

# Unusual Co-existence of Biaponeurotic Palmaris Longus and Accessory Abductor Digiti Minimi in Man

TEJASWI HIREMARALI LOKANATHAN<sup>1</sup>, MANJAPPA SURENDRA<sup>2</sup>, NINGAIAH AJAY<sup>3</sup>, RAJA RAO RAJENDRA<sup>4</sup>

## ABSTRACT

The present study describes a rarely reported co-existence of variant muscles in the right upper limb of a male cadaver of 57 years of age, observed during routine anatomical dissection. There was a presence of the biaponeurotic palmaris longus with a central muscle belly in the anterior forearm region which was closely related to the median nerve. In addition to this, an accessory abductor digiti minimi muscle was also reported in the corresponding hypothenar region, traversing the Guyon's canal, passing superficial to the ulnar vessels and nerves. Biaponeurotic palmaris longus and accessory abductor digiti minimi are important structural causes of the entrapment neuropathies of forearm and wrist. Diagnosis of these muscles as a cause of entrapment neuropathies requires the sound knowledge of variant muscles in the forearm and wrist region.

**Keywords:** Palmaris longus variations, Accessory palmaris longus, Variarnt hand muscles

## CASE REPORT

While performing the routine anatomical dissection on a formalin fixed, well-preserved male cadaver of about 57 years of age, we encountered an unusual co-existence of muscular variations in the right antebrachium. In the superficial flexor group of muscles, we observed a biaponeurotic PL muscle [Table/Fig-1]. All attachments, both proximal and distal were identified on careful observation. Photographs and measurements were taken through the course of dissection, so as to document all the relevant structures for their relations and morphology. The proximal attachment of the PL arising from medial epicondyle of humerus was aponeurotic and inverted 'y' shaped. Distally too, the muscle was aponeurotic and had an upright 'y' shape and inserted to the proximal border of flexor retinaculum [Table/Fig-1]. The proximal aponeurosis was 8.6 cm in length. The distal aponeurosis was 1.6 cm in length. The central muscle belly of PL measured 15.4 cm in length and revealed a definite myoarchitecture. The central muscle belly was observed with the help of a 4X hand lens to understand the direction of the muscle fibres. Over the superficial surface of PL, the muscle fibres from the proximal aponeurosis passed downwards, medially and joined the distal aponeurosis. The deep surface of the PL showed similar orientation of myofibres. The muscle belly was supplied by the branch from the median nerve. The median nerve was present

between the tendon of flexor carpi radialis and central belly of PL [Table/Fig-1]. There was no flattening of the median nerve along its course with the central myoaponeurotic belly of PL suggesting that there was no compression of the median nerve and this variation might have been an asymptomatic one.

In the same limb, an accessory ADM was observed [Table/Fig-2]. The proximal attachment of accessory ADM arising from distal aponeurosis of PL was fleshy. Distally, the accessory ADM was tendinous and inserted into the normal ADM. In Guyon's canal the muscle fasciculi measured 3.5 cm in length and 4mm in width and the ulnar vessels and nerve were deep to ADM [Table/Fig-2]. The total length of the muscle was 6.4 cm. This accessory ADM had its nerve supply through its deep surface by the ulnar nerve in the Guyon's canal. Flattening of the ulnar nerve or tortuosity of ulnar vessels was not evident.

No other major or significant variations were reported on careful observation in the same or the opposite upper limbs.

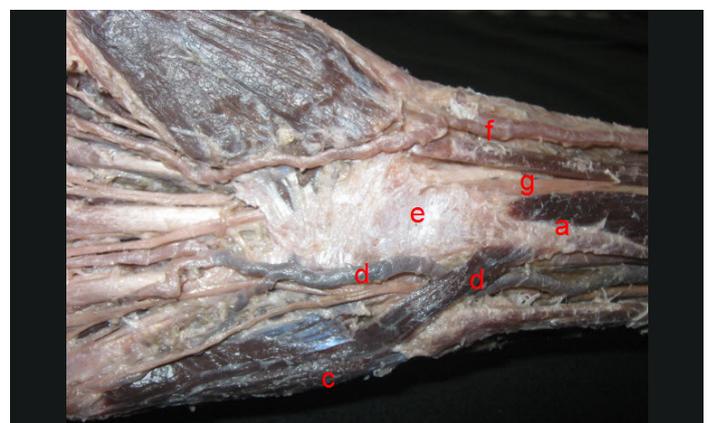
## DISCUSSION

The prevalence of variant muscles around the wrist related to the palmaris longus (PL) muscle and Guyon's canal is relatively high [1]. PL is a slender, fusiform muscle medial to flexor carpi radialis (FCR). It springs from the medial epicondyle by the common tendon and from



**[Table/Fig-1]:** Anterior compartment of right forearm region showing biaponeurotic Palmaris longus

a – Common flexor origin, b – Biaponeurotic Palmaris Longus  
c – Flexor carpi ulnaris, d – Ulnar artery and nerve  
e – Accessory abductor digiti minimi, f – Flexor retinaculum  
g – Median nerve, h – Flexor carpi radialis



**[Table/Fig-2]:** Dissected right wrist and hand region showing accessory abductor digiti minimi

a – Biaponeurotic Palmaris Longus, b – Accessory abductor digiti minimi  
c – Abductor digiti minimi, d – Ulnar artery and nerve  
e – Flexor retinaculum, f – Radial artery  
g – Median nerve

the adjacent intermuscular septa and the deep fascia. It converges on a long tendon, which passes anterior to flexor retinaculum; as the tendon crosses the retinaculum it broadens out to become a flat sheet which becomes incorporated into the palmar aponeurosis [2]. PL is the most variable muscle in the body. Its variations include complete absence, occasional division of the distal tendon or reduction of the muscle to a single tendon. The muscle belly may be digastric or fleshy throughout or it might be tendinous proximally and fleshy distally known as reversed PL or PL inversus [3]. The tendon of PL is the first choice donor tendon as it fulfills the necessary requirements of length, diameter and availability and can be used without producing any functional deformity [4]. Hence, the practice of surgery on upper limbs requires optimum familiarity with its related variations.

The abductor digiti minimi (ADM) muscle generally arises from the pisiform bone, flexor carpi ulnaris (FCU) tendon and pisohamate ligament. It ends in a flat tendon which divides into two slips; one is attached to the ulnar side of the base of proximal phalanx of the little finger, other to the ulnar border of dorsal digital expansion of extensor digiti minimi muscle [2].

Anatomical literature describes cases of ulnar nerve compression in the wrist caused by variant hypothenar muscles. ADM frequently presents anatomical variations in its morphology [5]. The commonest accessory muscle associated with hypothenar muscles is the accessory ADM [6]. Accessory belly of ADM can present various proximal attachments. It can arise from antebrachial fascia, flexor retinaculum, PL tendon, FCU FCR, the ulna and the radius. Commonest accessory slip of ADM arises from PL tendon and inserts into hypothenar muscles. Hence, this accessory ADM is also described by few authors as accessory PL [6].

Accessory ADM passing through Guyon's canal can produce compression of deep branch of ulnar nerve and ulnar vessels and is an important structural cause of Guyon's canal syndrome [7]. Hence, knowledge of anatomical variation of hypothenar muscles is essential in diagnosing Guyon's canal syndrome.

The present case report highlights an unusual co-existence of the biaponeurotic PL and an accessory ADM observed during routine dissection of cadaver of 57-year-old male with special emphasis on its clinical significance.

The present case describes the rarely reported biaponeurotic variant of PL. Reimann et al., characterized the anatomical variations of PL including muscle agenesis, duplications, accessory slips, and variations in attachment and variation in form. Following agenesis, variation in form was the most common anomaly with an incidence of 4% in the study sample. This variation included 3 main configurations – a distal muscle belly, a central muscle belly and digastrics like configuration with a central tendon connecting the two [8]. Mackerson describes a case with the central belly variant causing the median nerve compression but the muscle had a dual tendon [9]. Like other skeletal muscles, atypical PL has the potential for hypertrophy as a result of repetitive exercise, leading to an effort-related compartment syndrome [10]. Physical examination findings, including Tinel's sign and Phalen tests, have been unreliable in eliciting carpal tunnel syndrome in these patients. Full wrist extension followed by resisted flexion may cause pain and paresthesia in nerve distribution [10].

Recognizing the existence of atypical PL is essential to all surgeons

performing hand surgeries as PL is very useful in various reconstructive surgeries. Also, this variant can contribute to various pathologic processes such as nerve compression and compartment syndrome.

The ADM muscle, like the PL, is considered to exhibit most variability among the hypothenar muscles. The commonest accessory muscle belly associated with the hypothenar muscle is an ADM [6]. Accessory ADM was first reported by Wood in 1868 [10]. According to Dodds et al., incidence rate of accessory ADM in a cadaveric study was 22% with 46.2% of cases occurring bilaterally. Ziess et al., reported accessory ADM with incidence rate of 25% from their radiologic study, 67% of cases occurring bilaterally [11-13].

The class of accessory ADM variation described in this case report can cause entrapment of ulnar neurovascular bundles and may have sensorial and/or muscular implications in a range of compression neuropathies. The deep branch of ulnar nerve may be compressed by this accessory ADM and compromise palmar and dorsal interossei, hypothenar muscles, lumbricals III and IV thereby producing a clinical claw hand appearance or Guyon's canal syndrome [7].

## CONCLUSION

We conclude that even though MRI has been found to reliably identify variants of PL or accessory ADM muscles, awareness of muscle variations at the wrist remains essential, as MRI findings can be easily missed initially and may be recognized retrospectively only after surgical exploration is done. These variations must be kept in mind by an Orthopedic surgeon dealing with the surgical interventions and release operations related to the entrapment neuropathies of the upper extremities.

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### PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of Anatomy, AIMS, BG Nagar, Karnataka, India.
2. Professor, Department of Anatomy, AIMS, BG Nagar, Karnataka, India.
3. Post graduate, Department of Anatomy, AIMS, BG Nagar, Karnataka, India.
4. Professor, Department of Anatomy, AIMS, BG Nagar, Karnataka, India.

### NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Tejaswi H.L.,  
#167, Krishnanagar 3rd Stage, Pandavapura, Mandya District, Karnataka-571434, India.  
Phone: 9986322186, E-mail: drtejaswih@gmail.com

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