




# Supernumerary Muscles in the Hand and Wrist: Image and Clinical Presentation

## *Músculos supernumerarios en la mano y muñeca: Imagen y presentación clínica*

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### Abstract

The current descriptive study presents an extensive clinical experience in treating aberrant muscles around the hand, illustrated through 23 clinical cases. These cases are particularly noteworthy due to the rarity of such conditions. Each case was meticulously documented, providing valuable insights into specific clinical manifestations. The following supernumerary muscles were identified: extensor digitorum brevis manus (EDBM), extensor digiti medii proprius, aberrant palmar muscles, flexor carpi radialis brevis (FCRB), and aberrant abductor digiti minimi (aADM).

The EDBM was observed in 7 cases, with a bilateral occurrence in 30% of the cases. In two instances, it was concomitant with a dorsal ganglion. Surgical excision yielded complete resolution of the symptoms. The extensor digiti medii proprius, which is an exceedingly rare presentation, required excision due to activity-aggravated discomfort. Two cases of supernumerary palmar muscles were identified, and one was an aberrant lumbrical requiring surgical intervention for nerve irritation.

The FCRB manifested in three cases in males with strenuous occupations, and it was clinically detected due to their prominent volume; surgical removal led to the disappearance of the discomfort. Five cases of accessory palmaris minor muscle (palmaris longus profundus, PLP) were found to be incidentalomas during carpal tunnel release surgery. Excision of the PLP, which was performed concurrently with surgery, markedly relieved symptoms. The aADM, which was detected in five cases, induced ulnar nerve compression. In severe cases, surgery combined with opening of the Guyon canal resulted in substantial improvement.

The present compilation ranks among the largest published studies on supernumerary muscles. Its findings highlight the importance of considering supernumerary muscles in the differential diagnosis of other more prevalent clinical syndromes.

### Keywords

- ▶ supernumerary muscles
- ▶ musculotendinous abnormalities
- ▶ extensor digitorum brevis manus

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## Resumen

Este estudio descriptivo presenta una amplia experiencia clínica en el tratamiento de músculos aberrantes alrededor de la mano por medio de 23 casos clínicos con imágenes de enorme interés, dada la baja incidencia de estas afecciones. De todos ellos se registraron sus manifestaciones clínicas específicas. Los músculos supernumerarios que se hallaron fueron: *extensor digitorum brevis manus* (EDBM), extensor propio del dedo medio, músculos palmares aberrantes, *flexor carpi radialis brevis* (FCRB) y músculo *abductor digiti minimi* aberrante (ADMa).

El EDBM fue detectado en 7 casos, con una incidencia bilateral del 30%. En dos casos, se asociaba con un ganglión dorsal. La exéresis quirúrgica resultó en la resolución completa de los síntomas. El extensor propio del dedo medio, que es una presentación extremadamente rara, fue extirpado debido a molestias que se intensificaban con la actividad manual. Se observaron dos casos de músculos palmares supernumerarios, uno de los cuales resultó ser un lumbrical aberrante que requirió intervención quirúrgica por irritación nerviosa.

El FCRB se presentó en tres casos en varones con alta demanda laboral, detectados clínicamente por su notable volumen; la extirpación quirúrgica condujo a la desaparición de las molestias. Cinco casos de músculo palmar menor accesorio (*palmaris longus profundus*, PLP) se presentaron como incidentaloma en una cirugía de liberación del túnel carpiano. La extirpación del PLP, realizada durante la cirugía, resultó en una clara mejoría de la sintomatología. El ADMa, detectado en cinco casos, provocaba una compresión del nervio cubital. En los casos más graves, la cirugía combinada con la apertura del canal de Guyon condujo a una mejoría significativa.

Se trata de una de las mayores recopilaciones de músculos supernumerarios publicadas, y su revisión pone de manifiesto la necesidad de considerar los músculos supernumerarios en el diagnóstico diferencial de otros síndromes clínicos más frecuentes.

## Palabras Clave

- ▶ músculos supernumerarios
- ▶ anomalías músculotendinosas
- ▶ *extensor digitorum brevis manus*

## Introduction

In the literature, we can find descriptions of a wide variety of aberrant muscles around the hand. These anomalies can be classified as follows: variations in the location, shape, or size of a muscle considered normal; existence of aberrant supernumerary muscles; and absence of one or more usually existing muscles.<sup>1</sup>

Musculotendinous anatomical variations are usually asymptomatic. If they manifest, they can give rise to neuropathies due to compression, pain due to the presence of tenosynovitis and/or of a ganglion associated with the anomaly, or, in the case of agenesis, absence of the function corresponding to said muscle.<sup>2</sup>

If we focus on supernumerary muscles, we could divide them into those found on the dorsal side, and those found on the volar side.

### Supernumerary muscles on the dorsal surface

There are multiple studies about the evolutionary development of the extensor muscles.<sup>3</sup> The precursor muscle mass in the forearm differentiates embryologically into three distinct parts:

1. A radial portion that differentiates into the brachioradialis muscle and the extensor carpi radialis longus and brevis muscles (ECRL and ECRB).

2. A superficial portion, which forms the extensor digitorum communis (EDC), the extensor carpi ulnaris (ECU), and the extensor digiti minimi (EDM) muscles.
3. And a deep portion, which gives rise to the abductor pollicis longus (APL) and the extensor pollicis brevis (EPB) muscles on the radial side, and the extensor pollicis longus (EPL) and extensor indicis proprius (EIP) muscles on the ulnar side.

Anatomical studies<sup>4,5</sup> suggest that the radial and superficial portions are more stable in different species, while the deep portion is highly unstable and has undergone considerable evolutionary change. Therefore, it is to be expected that most anomalies happen within this deeper portion.

### Supernumerary muscles in the volar aspect

The abnormal muscles in the volar aspect of the wrist can be divided into three groups. The first group is composed of those muscles that cross the carpal tunnel, while the second and third groups are made up of those that cross the Guyon canal. The muscles in the second group originate from the antebrachial fascia or from the tendons of the flexor carpi radialis (FCR), flexor carpi ulnaris (FCU), or palmaris longus (PL) muscles, and they insert themselves in the common origin of the flexor brevis and the abductor of the fifth finger. The muscles that form the third group share the same origin as the previous ones, but inserted themselves by fusing with the hypothenar musculature, so they could be considered

aberrant muscle bellies with a proximal origin of the muscles that make up the hypothenar musculature.<sup>6</sup>

Due to their location, the muscles in the first group can cause a compression syndrome of the median nerve, while those in the second and third groups usually cause compressive neuropathy of the ulnar nerve.

## Materials and Methods

We herein present a descriptive study in which we compiled surgical and radiographic images of 23 cases of supernumerary muscles, treated by the authors between 1990 and the present (33 years), associating them with different clinical presentations.

## Results

A summary of the cases is presented in ►Table 1.

## Discussion

The cases reviewed are of the following types of aberrant muscles:

- **Extensor digitorum brevis manus (EDBM):** we found seven cases (five men and two women) of EDBM, accompanied by a dorsal ganglion in two cases. The discomfort they caused led to their removal in five cases (four men and one woman), with resolution of the symptoms.

The EDBM is a rare aberrant muscle on the back of the hand that it was described for the first time by Albinus in 1734. The frequency of appearance ranges from 1 to 10%, and it is bilateral in 30% of the cases.<sup>7</sup>

It originates on the dorsum of the lunate and capitate bones, and can sometimes also originate in the scaphoid, the dorsal intermetacarpal ligaments, the distal radius or the ulna. From there, it is directed in the form of a fusiform muscle mass (with approximately 5 to 7 cm in length and 2 to 3 cm in diameter<sup>8</sup>) between the extensor tendons of the second and third fingers, inserting itself at the level of the metacarpophalangeal (MCP) joint of the second finger in the form of a single tendon, ulnar to

the EIP, although it can also give rise to several tendons and insert itself over the second to 4th fingers. The EDBM is vascularized by the posterior branch of the posterior interosseous artery, and it is innervated by branches that come from the posterior interosseous nerve.<sup>9</sup>

The differential diagnosis should also be made with extensor tenosynovitis.<sup>10</sup> It usually causes pain, especially in the dominant hand. In this case, the treatment is surgical and consists of excision of both the muscle and the ganglion if it is also present. The treatment does not cause significant functional sequelae, and complete disappearance of the symptoms is usually achieved (►Figures 1–2).

- **Extensor medii proprius:** we present an extremely rare case of extensor of the middle finger in a teenager, who required its removal due to discomfort that increased with hand activity.

The extensor of the third finger is an anomalous muscle, which originates on the dorsum of the forearm and runs ulnarly to the EIP, to insert itself into the extensor mechanism of the third finger. There are many anatomical variations<sup>11,12</sup> that may share a common origin with EIP. The vascularization, innervation, symptoms, and treatment are similar to those of the EDBM, and the treatment is surgical excision when it causes pain. (►Figure 3).

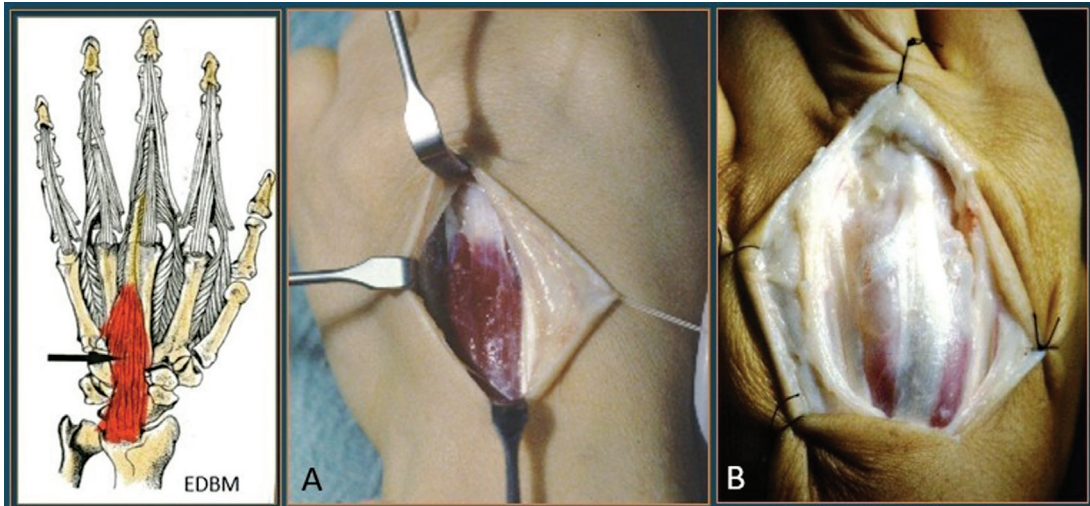
- **Aberrant palmar muscles:** their clinical expression depends on their size and location. In our series, we found two cases of aberrant palmar muscles, both detected by magnetic resonance imaging (MRI). One case (male) underwent surgery because he reported incapacitating discomfort in his manual work. The other case (female) was not operated on and was left undetermined, as the patient considered that her discomfort was tolerable.

The aberrant lumbrical muscle is shown, which causes irritation in the ulnar collateral branch of the second finger. The surgical approach led to the definitive diagnosis and treatment, after a long period of clinical evolution (►Figure 4).

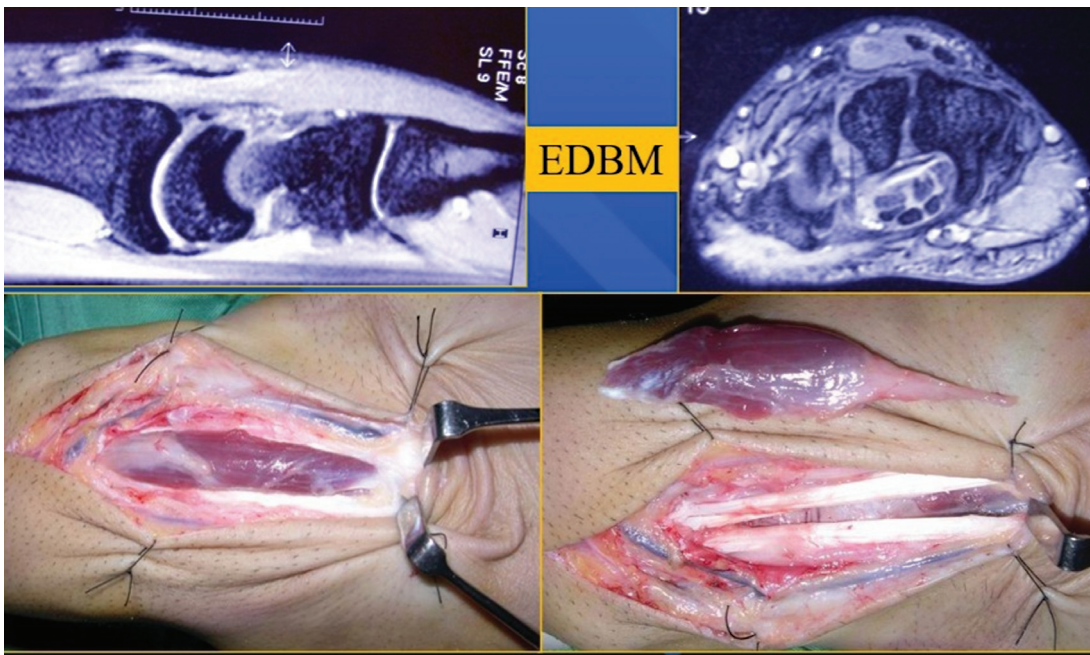
- **Flexor carpi radialis brevis (FCRB):** it may present a significant volume. We show three cases of FCRB, all in men with a high-demand work activity, which were

**Table 1** List of cases

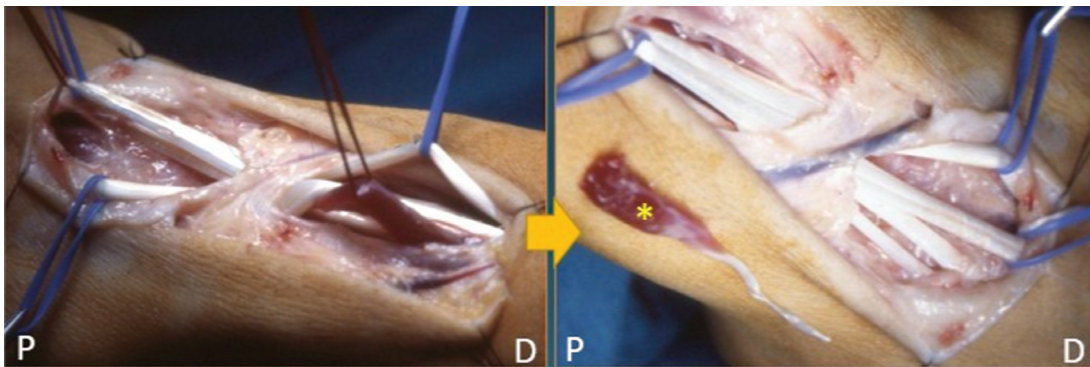
Aberrant muscle	n	Presentation
Extensor digitorum brevis manus (EDBM)	7 cases	2 asymptomatic; 3 with pain and claudication; 2 with dorsal ganglion
Palmaris longus profundus (PLP)	5 cases	5 with carpal tunnel syndrome
Supernumerary abductor of the 5th finger (aberrant abductor digiti minimi, aADM)	5 cases	5 with cubital tunnel syndrome
Flexor carpi radialis brevis (FCRB)	3 cases	3 with pain and claudication
Extensor of the 3rd finger (extensor medii proprius, EMP)	1 case	1 with pain and claudication
Aberrant palmar muscles	2 cases	1 with pain and claudication; 1 paucisymptomatic
	23	



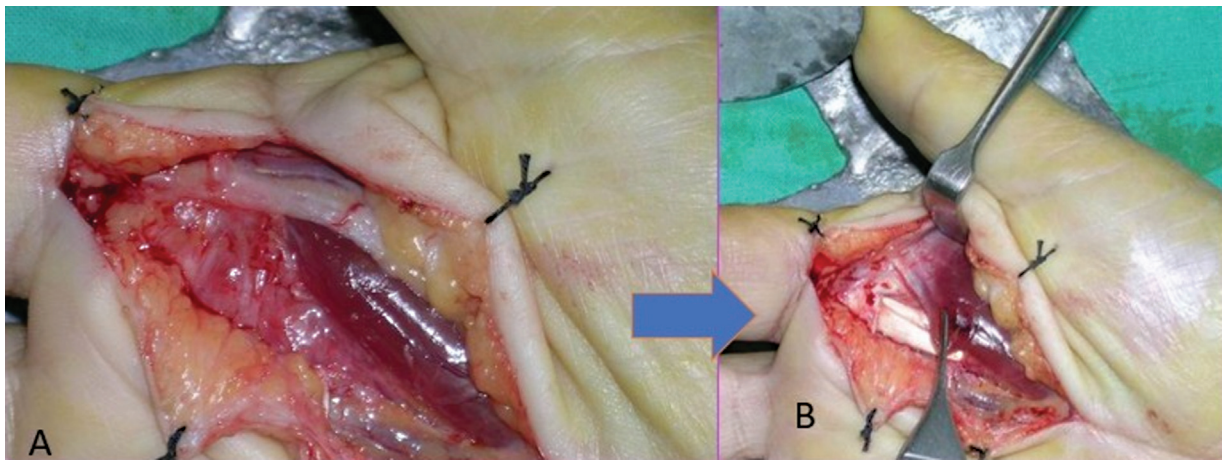
**Fig. 1** Anatomical diagram and appearance of the extensor digitorum brevis manus (EDBM) muscle without a ganglion (A) and with an associated ganglion (B).



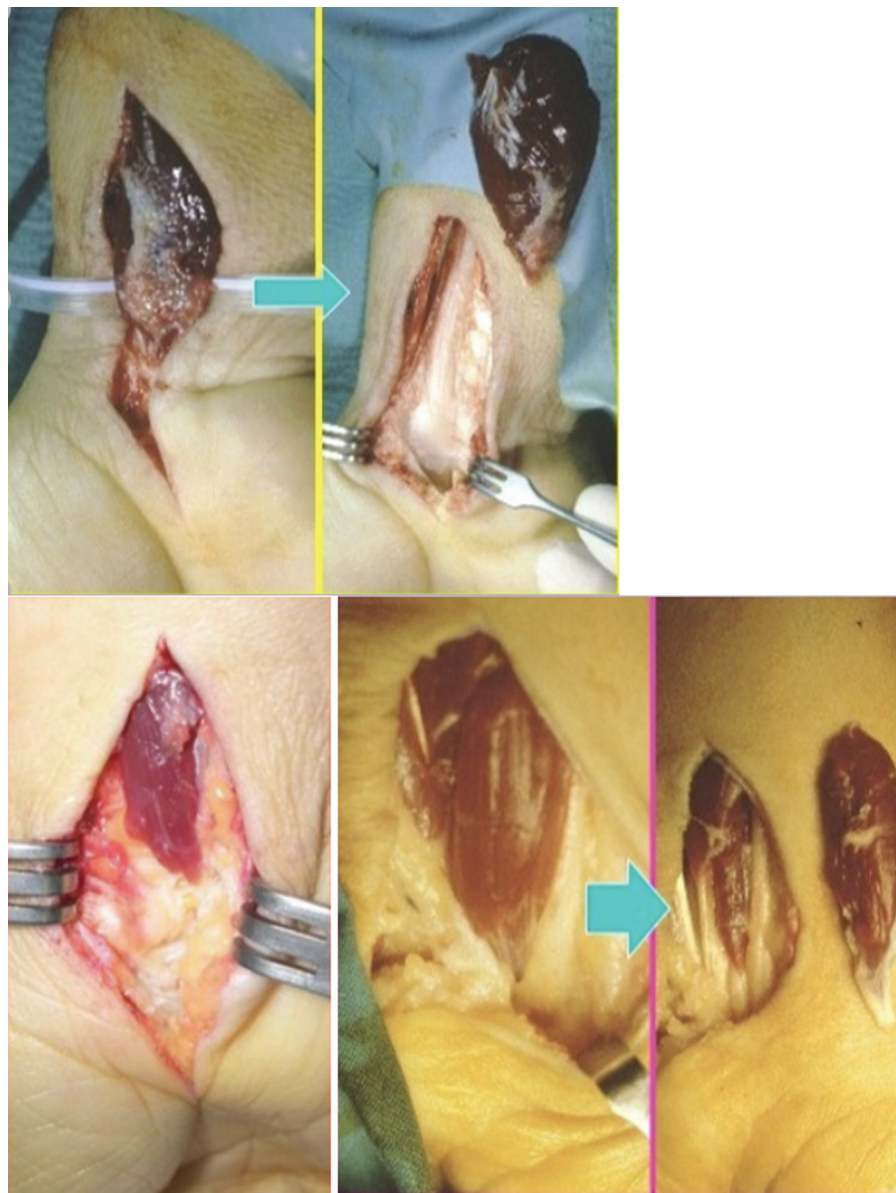
**Fig. 2** Appearance of the EDBM on MRI images, during surgery and after removal.



**Fig. 3** Appearance of an extensor muscle of the middle finger, which was removed. \*EMP muscle once removed. Abbreviations: P, proximal; D, distal.



**Fig. 4** Aberrant lumbrical muscle, irritating the radial branch of the index finger.



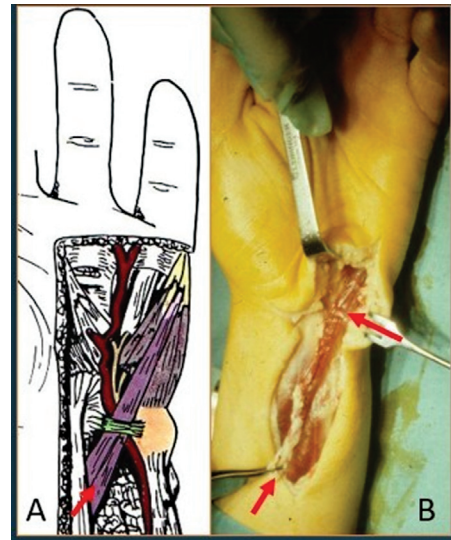
**Figs. 5, 6, and 7** Intraoperative images of three cases of flexor carpi radialis brevis (FCRB).

detected in the clinical examination as they presented a significant volume. The discomfort that existed before surgery disappeared after its removal (→ **Figures 5–7**).

- **Palmaris minor accessory muscle (palmaris longus profundus, PLP)**: we present five cases of PLP, in three men and two women. All five were operated on for carpal tunnel syndrome, and we were unaware of the presence of PLP, whose removal was associated with the section of the anterior annular ligament of the carpus. In all five cases, a clear improvement in the symptoms was achieved. This muscle is normally not detected before surgery, due to the lack of imaging tests required for the diagnosis and treatment of carpal tunnel syndrome.

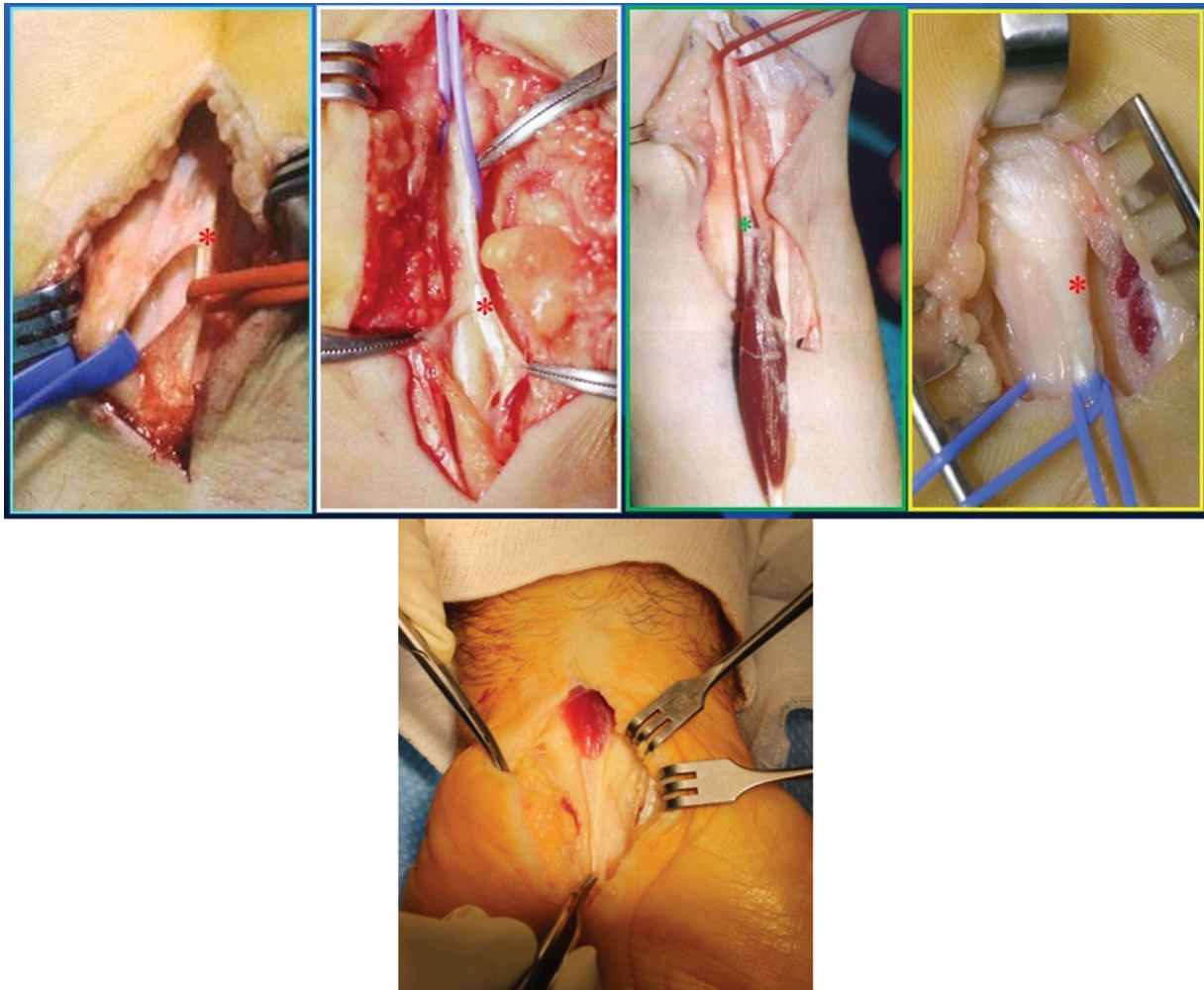
It is a muscle that originates from the epitrochlea, runs parallel to the palmaris longus, and inserts itself into the palmar aponeurosis, on its deep surface.<sup>13,14</sup> It can cause symptoms of compression of the median nerve at the level of the carpal tunnel because it takes up space. Muscle resection resolves the symptoms (→ **Figures 8–9**).

- **Aberrant abductor digiti minimi muscle (aADM)**: it can cause compression of the ulnar nerve. Its presence was confirmed in five cases in our (two men and three

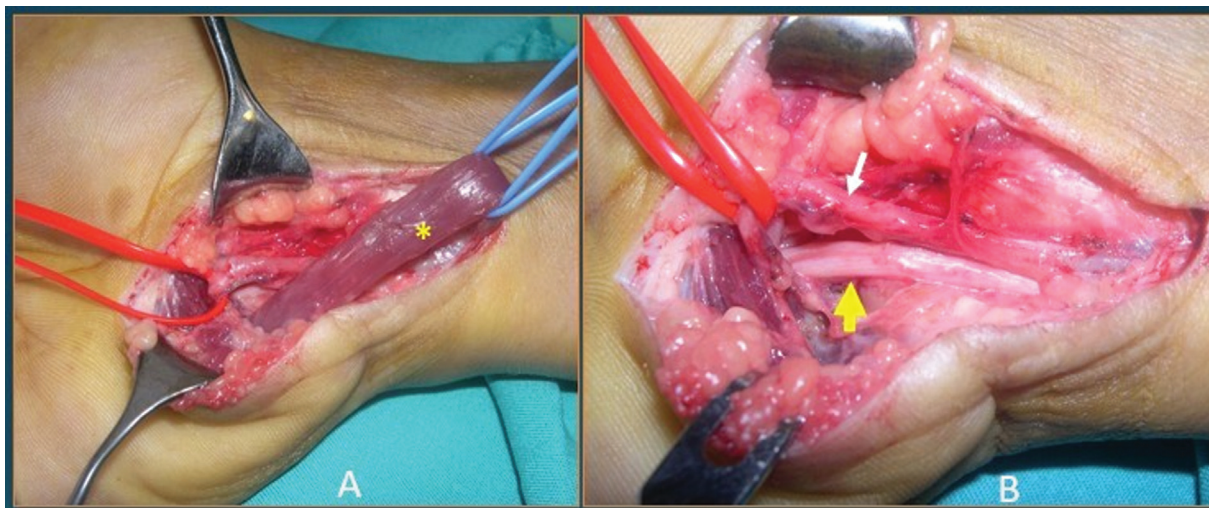


**Fig. 10** . Aberrant abductor muscle of the little finger.

women). In the three oldest cases, surgery was performed without obtaining a prior ultrasound or MRI. In two more recent cases with a clinical picture of severe compression of the ulnar nerve proven by nerve



**Figs. 8 and 9** Cases of *palmaris longus profundus* (PLP) muscle, all of them detected intraoperatively.



**Fig. 11** Aberrant abductor muscle of the little finger.

conduction studies, MRIs were obtained that confirmed the presence of the aberrant muscle. Its removal and opening of the Guyon canal resulted in a progressive improvement in the clinical condition, which enabled both patients to return to work.

The ADM usually inserts itself into the ulnar aspect of the base of the proximal phalanx and into the extensor aponeurosis, collaborating in the flexion and abduction of the metacarpophalangeal joint and in the extension of the proximal interphalangeal joint of the fifth finger.<sup>15</sup>

The aADM usually originates in the antebrachial fascia, although both its origin and insertion are very variable, and it crosses the Guyon canal to insert itself next to the ADM in the proximal phalanx (→ **Figures 10–11**).

Apart from Dr. Cantero's series of 58 cases,<sup>1</sup> we have not found any such extensive published series in the literature on this type of pathology, since most publications are series of cases.

Since asymptomatic patients with supernumerary muscles do not schedule consultations, it is difficult to know what their real incidence is, so we focus on associating certain clinical presentations with a specific supernumerary muscle.

Hand claudication with intense or repetitive activities could be associated with aberrant muscles on the dorsal or volar aspects of the forearm, although it implies a diagnostic challenge due to the low reproducibility of the clinical symptoms in consultations and the broad differential diagnosis.

The cases of EDBM, PLP, and aADM are those that have a direct association with common clinical syndromes; therefore, their recognition is especially interesting.

In cases of dorsal ganglion, it is advisable to check the possible presence of an EDBM on an MRI or ultrasound, since its non-removal may be a cause of recurrence. It is reasonable to expect that the presence of the EDBM would be less likely to cause compressive symptoms because its muscular belly lies distal to the edge of the extensor retinaculum. Symptoms

related to these abnormal muscles have been attributed to mechanical problems, namely an increase in volume within a small, rigid compartment that can cause pain due to muscle ischemia or inflammatory synovitis.

The presence of a PLP can be a cause of compression at the level of the median nerve before it exits through the carpal tunnel, and its intraoperative recognition is important, since unroofing the median nerve could be an insufficient treatment for these patients.

The presence of a supernumerary ADM is one of the known causes, which must be ruled out in cases of compression of the ulnar nerve or of its branches as they pass through the Guyon canal. This suspicion should arise even in cases of unremarkable imaging studies if there are clinical symptoms and/or electromyography findings consistent with it.

## Conclusion

- The possibility that a ganglion is associated with the presence of a supernumerary aberrant dorsal muscle should be considered, especially in refractory cases.
- Compression syndromes of the median and ulnar nerves, or of their branches, at the level of the palm may be caused by the presence of supernumerary palmar muscles, and their excision is often necessary for symptom resolution.
- Another clinical variant, with a more difficult to differential diagnosis, presents with discomfort that progressively increases with manual activities.
- Sometimes, their size enable us to suspect their presence during the clinical examination, but, in most cases, diagnostic tests such as ultrasound or MRI are necessary, and always recommended before resorting to surgery.
- Surgical excision of supernumerary muscles, if performed correctly, can definitively resolve the problem.

## Conflict of Interests

The authors have no conflict of interests to declare.

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