

Superficial Portion of Abductor Pollicis Brevis Muscle, Morphological Study and Literature Review. Case Report

Fascículo Superficial del Músculo Abductor Corto del Pulgar, Estudio Morfológico y Revisión de la Literatura. Reporte de Caso

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SUMMARY: Abductor pollicis brevis muscle (APB) belongs to the foreground of the subfascial muscle thenar region, which is of great importance in the movement of the thumb on its two-joint arrangement. In this article, we report the presence of a superficial portion of the APB muscle and its relationship and discuss the available literature and the clinical implications of the presence of this variation.

KEY WORDS: Abductor pollicis brevis muscle; Thenar eminence; Thumb; Movement of the thumb.

INTRODUCTION

The differentiation from prehomínids (*Australopithecus afarensis*) to homínids (*Homo habilis*) is due to the use of tools, which was only possible through the development of the brain and the opposition of the thumb (precision grip), being considered as evolutionary characteristics. Because of the significance of this fact, the structure and function of the brain and thumb are still currently widely investigated (Susman, 1994; Miralles & Miralles, 2005).

In relation to the human thumb, when we look at its constitution, strength, and fine motor control of their movements, we found six different muscles that are interrelated, prepared prior to the metacarpophalangeal joint: flexor pollicis longus (FPL), 1st interossei palmar (of Henle) (1st IP), deep fascicle of flexor pollicis brevis (FPBdeep), superficial fascicle of flexor pollicis brevis (FPBsup), adductor pollicis (ADP), and abductor pollicis brevis (APB) muscles. In these muscles, the APB and ADP muscles plus an extrinsic muscle of the hand, the abductor pollicis longus (APL), are responsible for the claim and thumb abduction (Llusá *et al.*, 2004; Miralles & Miralles). In particular, we distinguish the APB muscle, which also acts in the abduction

and medial rotation of the proximal phalanx during early stages of opposition (Moore & Dalley, 2006) and the extension of the latter on the distal phalanx through its expansion into the APL tendon (Napier, 1952; Kapandji, 2001; Llusá *et al.*). These actions are explained from the relationship and trajectory of the APB muscle on carpometacarpal and metacarpophalangeal joints of the thumb, which are traversed by that muscle.

The classic anatomy texts indicated as proximal attachment or origin of the APB muscle tubercle of the scaphoid bone, the flexor retinaculum, and an expansion of the APL tendon (Latarjet & Ruiz-Liard, 1999; Feneis & Dauber, 2000; Llusá *et al.*; Rouvière & Delmas, 2005), description to which some authors add the Trapezium tubercle (Drake *et al.*, 2005, Moore & Dalley). The distal attachment of the APB muscle is the lateral tubercle of the base of the proximal phalanx and an expansion to the tendon of the extensor pollicis brevis muscle (EPB) (Latarjet & Ruiz-Liard; Llusá *et al.*; Drake *et al.*) to the extensor pollicis longus muscle (EPL) (Rouvière & Delmas, 2005), as well as in the sesamoid bone of the thumb (Llusá *et al.*; Feneis & Dauber, 2000).

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With regard to form, the APB is a fusiform muscle; it is flat, thin, and triangular and located at the surface of the thenar eminence, which is characterized by a thick skin, adherent and hairless, adhering to thenar fascia (superficial) through fibrous layers circumscribing in adipose clusters. Radiopalmar artery, a branch of the radial artery, crosses the superficial or deep side of the APB muscle or crosses from the ventral to the dorsal region (Latarjet & Ruiz-Liard; Rouvière & Delmas).

This muscle is related in the background with the opponens pollicis muscle (OP), which lies below and laterally, and the FPBsup, which lies inferiorly and medially. The gap formed by these two muscles and the APB muscle enters the thenar branch of the median nerve (recurrent branch of median nerve C8-T1), to innervate these three muscles (Rouvière & Delmas). A third plane contains the FPBdeep, which, together with the FPBsup, form a concave groove medially, which glides the FPL tendon wrapped in its synovial sheath. The fourth plane, and deeper, consists of the AP muscle, consisting of a transverse and one oblique bundle.

The thenar branch of the median nerve is responsible for supplying the APB muscle innervations and the other thenar muscles (Olave *et al.*, 1995; Olave *et al.*, 1996; Ajmani, 1996). Both the APB and FPB muscles, as described, have a large number of small motor units, consistent with the observations of authors, such as Chan *et al.* (2001), Carvalho *et al.* (1988), and Neto *et al.* (2004), who emphasize this feature fine movement muscles, although Chan *et al.* warn that this condition can vary within the same muscle and between other muscles.

In the clinical setting, the APB muscle was used for assessment, diagnosis, and treatment of various diseases and dysfunctions, such as dynamometry tests (Liu *et al.*, 2007), conduction velocity studies in carpal tunnel syndrome (Violante *et al.*, 2007), and surgical reconstruction of the thumb intrinsic structures (Horch *et al.*, 2006). The present study describes an anatomical variation of the APB muscle in a cadaver in the Department of Basic Biomedical Sciences, Universidad de Talca. The case reported describes the APB muscle and its relationship with neighboring anatomical structures.

CASE REPORT

In a male cadaver preserved through glycerin, belonging to the Morphology Laboratory, Department of Basic Biomedical Sciences, Universidad de Talca, during routine dissection of the left thenar region, we observed an unusual variation to APB muscle; therefore, the muscle was

carefully dissected, preserving the whole of it, as well as its attachments and surrounding anatomical structures.

The skin, subcutaneous layer, and subdermal adipose tissue were removed to make the APB muscle visible. In anatomical position, the APB muscle was found in close relation to the palmar fascia, surrounded by abundant adipose tissue in the superficial plane to the FPBsup and OP muscles. Of these, the first is located medially and deep enough to be visible almost in totality, as opposed to the OP muscle, which is covered in a lateral plane and located in a deep region, although it can still be observed from a sagittal view. The FPBdeep muscle is located in a third plane and medial to the anterior muscles, forming a concave canal for the FPL tendon with the aid of the FPBsup muscle.

Finally, the AP represents the fourth and deeper muscle levels of the thumb, conformed for an oblique fascicle and a transverse fascicle (Fig. 1).

The APB muscle, with its fusiform shape, shows two fascicles that are arranged one above the other, connected by a loose areola tissue for easy removal. The superficial portion of the APBsup muscle is closely linked to the adipose and dermal tissues, receiving aponeurotic expansions of the tendinous portion of the PL muscle, the palmar aponeurosis, and the APL tendon (Fig. 2). The APBdeep muscle passes medially to the superficial region. With its flattened appearance, the APBdeep muscle thins as it approaches the insertion site; this issue does not receive tendinous expansions.

The remaining inserts are part of the deep fascicle (APBdeep) of the APB muscle, which are directed to the APL tendon, scaphoid tuberosity, flexor retinaculum, and tubercle of the trapezium. Both the ABPsup and APBdeep muscles are inserted distally on the lateral tubercle of the base of the proximal phalanx of the thumb sesamoid bone and dorsal expansion (Fig. 1). The APBsup muscle fibers are oriented parallel and slightly lateral to the APBdeep muscle fibers with a lower volume relative to its counterpart, being separated by a thin connective tissue and easily removed.

DISCUSSION

The presence of variations in the arrangement of the thenar muscles is common in modern humans and higher primates. For Susman, the greater variability in these species is observed in the deep fascicles of the FPL and FPB muscles; these variations are probably greater specialization relationships that upper hominids acquired through the thumb

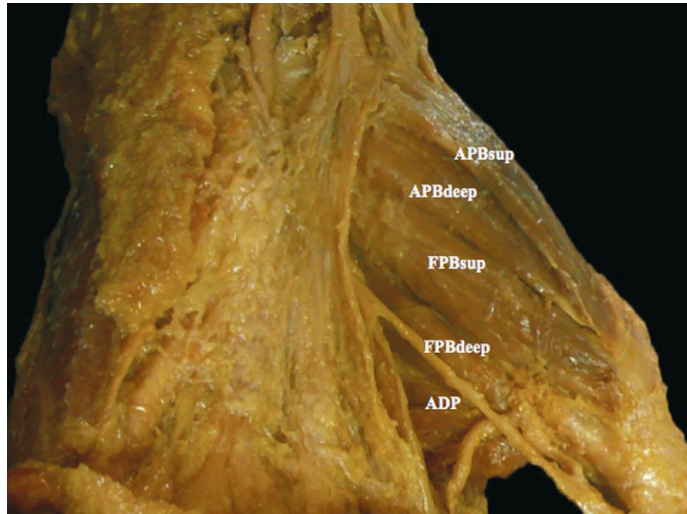


Fig. 1. Fascicles and relationships of abductor pollicis brevis muscle. Superficial abductor pollicis brevis muscle fascicle (APBsup); Deep abductor pollicis brevis muscle fascicle (APBdeep); Superficial flexor pollicis brevis muscle fascicle (FPBsup); Deep flexor pollicis brevis muscle fascicle (FPBdeep); Adductor pollicis muscle (ADP).

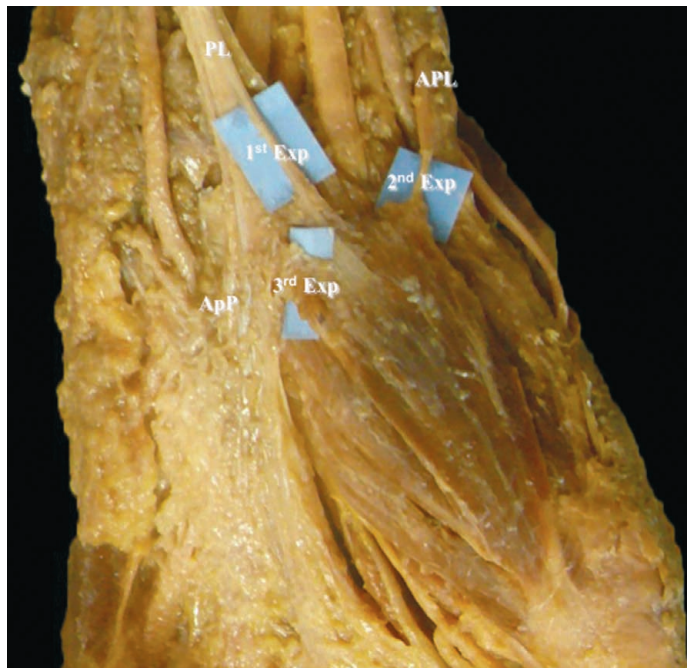


Fig. 2. Connective tissue expansions of APB muscle: Palmaris Longus (PL), abductor pollicis longus (APL), 1st connective tissue expansion (1st Exp), 2nd connective tissue expansion (2nd Exp), Palmar aponeurosis (ApP), 3rd connective tissue expansion (3rd Exp).

and the hand. In our study, we reported a change in the structure of the APB muscle, which has a bifascicular structure. This reflects what was reported by Napier, who analyzed the variations of the APB muscle, indicating that the presence of the two muscle bellies, with different backgrounds but a common insertion, is the most prevalent variation, with 38%. For him, when you have this

variation, the fibers form a superficial portion that is oriented above the deep fascicle of the ABS (APBdeep), and the latter by about the FPBsup muscle. Thus, the functional contribution varies in both cases. Napier said that the provision of the APB muscle, longitudinal along the axis, allows the separation of the metacarpal or proximal phalanx abduction and medial rotation addition because of its insertion into the dorsal expansion.

This study describes the presence of an insertion into the APL tendon, which is also indicated in the work of van Oudenaarde & Oostendorp (1995). These authors measured the electromyographic activity of the APB muscle and deep fascicle of the APL muscle in various positions of the thumb and hand, obtaining the conclusion that the ABS muscle is activated by the movements of the hand to maintain tension deep fascicle of APL and the movements of the thumb to prevent undesired movements of the hand and forearm. In addition, there is an insertion into the PL tendon, as described in previous cases (Napier; Fahrer & Tubiana, 1974), which would contribute to the preemption and medial rotation of the thumb (Simard & Roberge, 1974).

In this case, an APB muscle with two fascicles, one superficial establishing close relation with the tegument of the thenar region and other deep subfascial location and morphology similar to the APB muscle in its classic description, was presented. The influence that this disposition is on the clinical behavior of the APB muscle is unclear, so it is necessary to develop biomechanical and electromyographic studies to elucidate the functional aspects of these two muscle fascicles.

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RESUMEN: El músculo abductor corto del pulgar (ACP) pertenece al primer plano muscular subfascial de la región tenar de gran importancia en los movimientos del pulgar por su disposición biarticular. En el presente artículo reportamos la presencia de un fascículo superficial del músculo ACP y sus relaciones, se analiza la literatura disponible y se discuten las implicancias clínicas de la presencia de esta variación.

PALABRAS CLAVE: Abductor pollicis brevis; Eminencia tenar; Pulgar; Movimientos del pulgar.

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