

Unusual Topography of Posterior Antebrachial Musculature in the First Osseofibrous Compartment of Wrist - Clinicomorphological Appraisal

Topografía Inusual de la Musculatura Antebraquial Posterior en el Primer Compartimento
Osteofibroso de la Muñeca - Valoración Clínico-Morfológica

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SUMMARY: Anatomical variations of abductor pollicis longus and extensor pollicis brevis are important in clinical assessment of diseased and traumatized hand. The present case reports an unusual fusion of muscle bellies of abductor pollicis longus and extensor pollicis brevis with two separate tendons of insertion, the medial tendon inserted into the base of first metacarpal and the lateral tendon into the abductor pollicis brevis muscle. Knowledge of such anatomical variations is of utmost importance in the management of De Quervain's disease and reconstructive surgeries of hand.

KEY WORDS: Abductor pollicis longus; Extensor pollicis brevis; De Quervain's syndrome; Variations.

INTRODUCTION

Several studies have reported the anomalies of abductor pollicis longus muscle (APL). Much is known about the tendon of APL but reports on the muscle bellies of APL are few (van Oudenaarde, 1991). Anomalies of APL are of great clinical significance as anomalous pattern of APL may alter the mechanism for thumb movements. The present article reports the anomalous fusion of APL and extensor pollicis brevis muscle (EPB) to form a single well defined muscle belly. The latter exhibited insertion in the form of two tendons into the base of first metacarpal bone and the abductor pollicis brevis. Knowledge of such anatomical variations of muscles of hand may be important for tendon transfers, tendon translocation and interposition arthroplasty, where tendons of these muscles are harvested.

CASE REPORT

During routine educational dissection for first year medical students an unusual fusion of the abductor pollicis longus and extensor pollicis brevis were recorded on the

right side of an adult Indian male cadaver. The muscle was studied in detail and appropriate photographs taken. The APL took origin normally, from the posterior surface of radius and ulna whereas the EPB took origin from the posterior surface of radius, distal to APL and the adjacent interosseous membrane. The APL and EPB were fused to form a single muscle belly 8.6cms in length and 2.3 cm in width. The muscle displayed two tendons of insertion. The medial tendon was thicker, and measured 5.6cms in length and 0.6cms in width. It inserted into the base of the first metacarpal bone. The lateral tendon was thinner and measured 4.2cms in length and 0.2cms in width. It inserted into the abductor pollicis brevis muscle. The radial artery traversed medial to the medial tendon of insertion. Abnormal insertion of APL has often been reported, however, the abnormal insertion pattern of APL was also associated with abnormal fusion of APL and EPB. The present article highlights the morphological aspects, embryological basis and clinical significance of the muscular anomaly which may be of enormous significance to the present day anatomist, hand surgeon and radiologist.

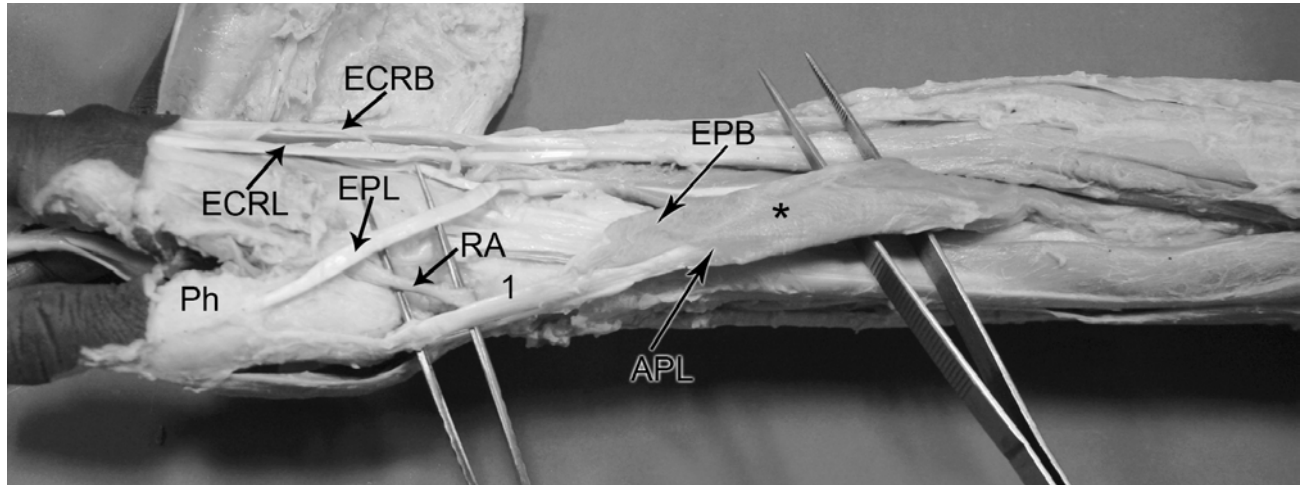


Fig. 1. Photograph of right forearm and hand showing fused abductor pollicis longus and extensor pollicis brevis with two tendons of insertion. ECRB-extensor carpi radialis brevis ,ECRL-extensor carpi radialis longus ,EPL-extensor pollicis longus ,APL-abductor pollicis longus ,EPB-extensor pollicis brevis ,RA-radial artery ,Ph-proximal phalanx of thumb ,1-first tendon of insertion of fused muscle belly formed by APL and EPB.

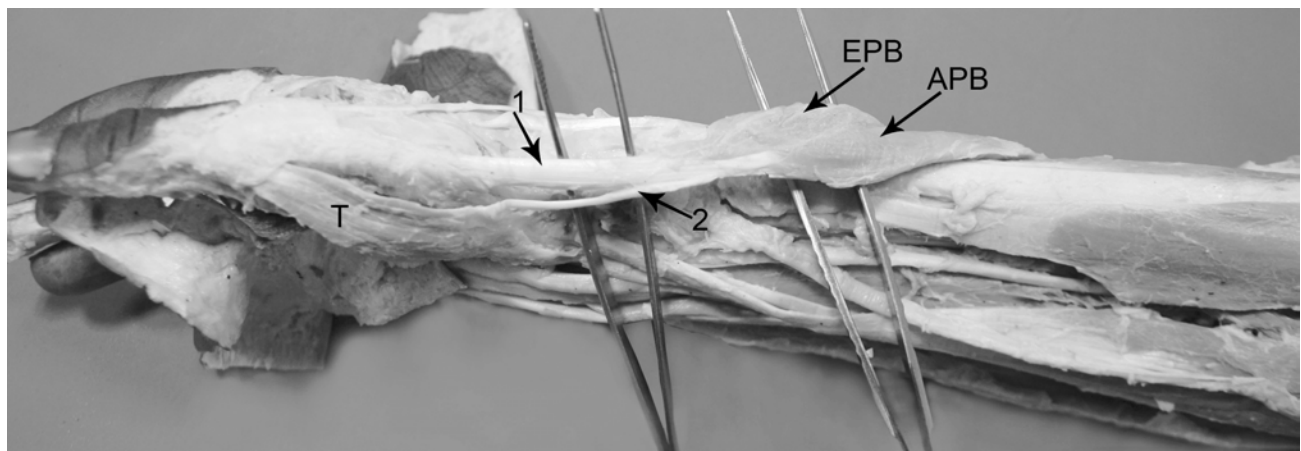


Fig. 2. Photograph of lateral aspect of right forearm and hand showing fused abductor pollicis longus and extensor pollicis brevis with two tendons of insertion. APL-abductor pollicis longus ,EPB-extensor pollicis brevis o , T-thenar eminence with abductor pollicis brevis. 1-first tendon of insertion of fused muscle belly into the base of first metacarpal bone., 2- second tendon of insertion of fused muscle belly into the abductor pollicis brevis.

DISCUSSION

The APL is considered to be the most variable muscle in the forearm (Dawson & Barton, 1986). Split insertion of APL is often found in chimpanzees, gorillas and gibbons (Lacey *et al.*, 1951). APL is attached to the radial side of shaft of first metacarpal but in gorilla it is also attached to the trapezium. In chimpanzee it has a double insertion onto the dorsal surface of the base of the proximal phalanx and lateral aspect of base of first metacarpal. EPB separates completely only in man and gorilla and is much smaller in size (Giles, 1960). It may sometimes be absent or united with extensor Pollicis

Longus. Several studies report accessory tendon slips ranging from 3 to 9 (Backhouse, 1981; Bergman *et al.*, 1988; Schimdt, 1987) hence, the clinical importance of APL is evident. However, reports about abnormal morphology of muscle belly of APL and EPB are very few in literature. Anomalies of APL and EPB are important to understand the etiology and surgical decompression of De Quervain's disease (Giles; Jackson *et al.*, 1986; Stein, 1951). In a wider perspective variations of APL and EPB may be significant for anthropological correlation and academic studies.

Phylogenetically, the APL and EPB are differentiated from a common muscle mass (Aydinlioglu *et al.*, 1998). The EPB separates completely from the APL only in humans and gorillas. Thus, a gradation in the extent of differentiation of this common muscle is seen in different species. The phylogenetic infancy of this muscle could be the reason for the anomalies detected in humans (Giles).

The APL is an important muscle of dexterity. We as anatomists speculate that abnormal morphology of APL and EPB may alter the power of grip, as the thumb forms one half of the functional unit while holding or gripping an object (Paul & Das, 2006). The mechanics of abduction of thumb may be altered with fused APL and EPB associated with two separate bony and muscular insertions. Fused muscle belly of APL and EPB may alter the force component, thereby affecting mechanics of the thumb. The knowledge of such a variation may be significant in understanding the proper functioning of the thumb movements and helpful during any interposition arthroplasty where the APL and EPB tendon are used. Multiplicity of APL tendons can be viewed as a functional advantage, since injuries in one tendon can be compensated by the remaining tendons (Mehta *et al.*, 2009).

Studies report abnormal insertion of APL into the thenar muscle (Rayan & Mustafa, 1989). In one case the APL split into two bellies and gave off two tendons. One tendon inserted into the thenar muscle and the other inserted into the base of first metacarpal bone, which is considered the normal site of insertion of APL (Yuksel *et al.*, 1992). APL consisting of seven tendons has also been reported. The medial two inserted into the Abductor pollicis brevis, the other five inserted into the base of the first metacarpal bone. In the right side of the same case the APL consisted of three bellies (Sarickcioglu & Yildirim, 2004). APL with triple tendon has also been reported. However, the anatomical characteristics of the APL and EPB were normal in this case (Kocabiyik *et al.*, 2009). The present case report is unique as it brings to light unusual fusion of APL with EPB at their origin and the fused muscle belly splits into two tendons for insertion, into the abductor pollicis brevis and the base of first metacarpal bone.

Classically, the EPB muscle is described as originating from the posterior surface of the radius, distal to APL, and from the adjacent interosseous membrane. The tendon is inserted into the base of the proximal phalanx of the thumb, and commonly has an additional attachment to the base of the distal phalanx, usually through a fasciculus which joins the tendon of the EPL. The EPB may be absent or fused completely with the APL (Standring *et al.*, 2005). In a study conducted, asymmetry of EPB was recorded in 3 out of 16 arms in 8 cadavers dissected. This highlights the

rarity of unusual fusion of APL and EPB as reported in our case (Dawson & Barton, 1986).

A detailed study in fifty upper limbs reported 80% cases of multiple tendons of APL, absent EPB in 2% and in 18% cases, anomalous insertion of EPB with EPL. However, no case of fusion of APL and EPB was recorded. Sufficient improvement in De Quervain's syndrome is not always achieved even by tenosynovectomy, and the reason for this appears to be anatomical variations in the first extensor compartment of hand. In a study of first extensor compartment in 159 hands of 80 cadavers, accessory tendons of EPB and APL were recorded, however, abnormal morphological fusion of extensor muscles was not reported (Shiraishi & Matsumure 2005). Our case presents rare occurrence of abnormal morphology of both muscles and hence is of immense clinical value. These aberrant tendons are clinically important because their presence can cause persistent pain after surgical division of the first compartment of the extensor retinaculum to treat thumb inflammation (Rai *et al.*, 2010).

Bilateral subluxation of the trapeziometacarpal joint has been attributed to abnormal insertion of APL tendon and an atrophic EPB tendon (Yuasa & Kiyoshige, 1996). It is our humble assumption that such abnormal fusion of APL and EPB may lead to unexplained instability of the trapeziometacarpal joint with subluxation as an eventual event.

The presence of such variations may be a result of atavism. Awareness of variations may be important for surgeons performing grafting operations in the dorsolateral compartment of hand (Mansur *et al.*, 2010). The variations in the anatomy of the first extensor compartment have been associated with De Quervain's disease (Gonzalez *et al.*, 1995). Number, thickness and length of accessory tendons of APL and EPB might have an important function in the development of this disease (Melling *et al.*, 1996; Ippolito *et al.*, 1985). This disease is caused by stenosing tenosynovitis of the first dorsal compartment of the wrist, which includes tendon of APL and EPB.

We as anatomists opine that the knowledge of the present variation may contribute significantly in the management of undiagnosed pain at dorsolateral aspect of wrist radiating to thumb or lateral forearm. Successful tenosynovectomy in the treatment of De Quervain's disease requires paying special attention to accessory tendons of APL and EPB, branching of the tendons and the presence of an atypical septum in the first compartment (Kocabiyik *et al.*).

Awareness of such variations is important during surgical management of chronic compartmental syndrome

due to intensive use of APL and EPB. During decompression of the muscle bellies by longitudinal incision in the fascial sheath, the surgeon needs to be aware of the anomalous fusion of EPB and APL as reported in our case (Solheim & Hagen, 1979).

Knowledge of such anatomical variations is also of importance for the radiologist for accuracy in ultrasonographic evaluation of anatomic variations in the first extensor compartment of the wrist (Rousset *et al.*, 2010).

Presence of fused bellies may be a contributing factor in the etiology of intersection syndrome. Surgical treatment of intersection syndrome usually involves

decompression of the typical muscle bellies of APL and EPB (Williams, 1977). The variations in the number of APL tendons and the corresponding osseofibrous canals have been reported to be involved in the etiology and subsequent decompression of De Quervain's syndrome (Lacey *et al.*).

In conclusion, the present day physician and surgeon should be aware of such anatomical variations to avoid inadvertent injury to accessory tendons in the vicinity of wrist and dorsal surface of hand. We conclude that anatomical knowledge of abnormal fusion of muscle bellies of APL and EPB with accessory tendons of insertion are essentially imperative in reconstructive surgeries of hand and also of academic interest.

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RESUMEN: Las variaciones anatómicas de los músculos abductor largo del pulgar y extensor corto del pulgar son importantes en la evaluación clínica de la mano enferma y traumatizada. El presente caso informa una inusual fusión de los vientres musculares de los Mm. abductor largo del pulgar y extensor corto del pulgar con dos tendones de inserción separados, el tendón medial se insertó en la base del primer metacarpiano y el tendón lateral en el músculo abductor corto del pulgar. El conocimiento de estas variaciones anatómicas es de importancia en el manejo de la enfermedad de De Quervain y cirugía reconstructiva de la mano.

PALABRAS CLAVE: Músculo abductor largo del pulgar; Músculo extensor corto del pulgar; Síndrome de De Quervain; Variaciones.

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