



Case Report

Accessory muscle of the flexor digitorum superficialis and its clinical implications[☆]



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ARTICLE INFO

Article history:

Received 8 August 2016

Accepted 13 September 2016

Available online 21 October 2017

Keywords:

Muscle skeletal/abnormalities

Nerve compression syndromes

Cadaver

ABSTRACT

Anatomical variations of the flexor digitorum superficialis (FDS) muscle and tendon unit are frequently reported by anatomists and clinicians. Anatomical muscle variations of the FDS and its tendons may include variations of muscle belly, presence of accessory or duplicate tendons, abnormal tendon connections, and absence of muscle or tendon components. Such variations may or may not have clinical implications. This report presents a case not described previously: a unilateral accessory muscle of the flexor digitorum superficialis which was connected by a thick tendon to the flexor digitorum superficialis muscle; it was directed proximally to the insertion of the medial epicondyle of the humerus, next to the superficialis head of the pronator teres muscle. The belly of the accessory muscle was positioned anterior to the median and anterior interosseous nerve. This anatomical variation is known as type V in the classification of Elliot et al. The knowledge of these anatomical variations helps hand surgeons interpret the clinical examination, particularly in the evaluation of patients who have suffered tendon injuries or show signs of possible peripheral nerve entrapment.

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Músculo acessório do músculo flexor superficial e sua implicação clínica

RESUMO

Variações anatômicas (anomalias) da unidade musculotendínea do flexor superficial dos dedos (FSD) têm sido relatadas com frequência na literatura em tratados, artigos clínicos e anatômicos. Podem ocorrer variações do corpo muscular, presença de tendões acessórios ou duplicados, conexões musculotendinosas anormais e ausência do componente muscular ou tendinoso. Essas variações podem ou não ter implicações clínicas. Os autores apresentam

Palavras-chave:

Músculo esquelético/anormalidades

Síndromes de compressão nervosa

Cadáver

[☆] Paper developed at the Faculdade de Ciências Médicas e da Saúde, Pontifícia Universidade Católica de São Paulo, Sorocaba, SP, Brazil.

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<http://dx.doi.org/10.1016/j.rboe.2017.10.004>

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um caso não descrito previamente de um músculo acessório do músculo FSD unilateral que estava conectado através de um tendão espesso ao músculo FSD e dirigia-se proximalmente para inserir-se no epicôndilo medial do úmero ao lado da cabeça superficial do músculo pronador redondo. O músculo flexor superficial acessório posicionava anteriormente aos nervos mediano e interósseo anterior. Essa variação se enquadra no tipo V da classificação de Elliot *et al.* O conhecimento dessas variações anatômicas auxilia o cirurgião da mão a interpretar o exame clínico, em especial na avaliação de pacientes que sofreram lesões tendinosas ou apresentam sinais de possíveis compressão de algum nervo periférico.

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Introduction

The flexor digitorum superficialis (FDS) muscle is the largest muscle in the forearm. It forms an intermediate muscle layer between the superficial and deep muscle groups. The median nerve and the ulnar artery enter the forearm as it passes between its radial and humeral-ulnar heads. However, the relationship of the median nerve to the two heads of the flexor digitorum superficialis may show anatomical variations.

The upper limb may have duplicate and accessory muscles, as well as anomalous muscles. Anatomical variations of the flexor digitorum superficialis and its tendons are not uncommon: variations of the muscle belly, abnormal musculotendinous connections, absence of the tendinous component, particularly of the little finger, have been described in clinical and anatomical studies.^{1,2} These variations may or may not have clinical implications. The knowledge of these anatomical variations helps hand surgeons to interpret the clinical examination, especially in the evaluation of patients who experienced tendon lesions or show signs of possible compression of any peripheral nerve.

Elliot *et al.*³ discuss the development of flexor digitorum superficialis from amphibians to humans; they reviewed more than 30 articles, and classified the variations into five types. Type I: connection between the tendons of the muscle itself. Type II: connection between the FDS muscle tendons and the flexor retinaculum. Type III: digastric superficial flexor muscle. Type IV: distal extension of the muscle belly of the FDS. Type V: anatomical variations of the FDS muscle in the forearm.

Case report

We present a case that has not been previously reported of a unilateral superficial flexor accessory muscle identified during routine anatomical dissections made by residents and medical students of the Orthopedics and Traumatology Department. The study is registered in the Research Ethics Committee under no. 1.025.516. The purpose of a series of 100 dissections was to record anatomical variations in the upper limb focusing on the presence of anomalous nerve communications (e.g., Martin Gruber's anastomosis), anatomical variations of muscles and its tendons (e.g., Gantzer muscle), as well as the peripheral nerves, and to analyze the possibility of these variations being responsible for pathologies, especially for

compressive syndromes. The dissection of each limb was made through a median incision throughout the forearm, middle and lower third of the arm; two flaps, including the skin and the subcutaneous tissue, were reflected to the radial and ulnar sides, respectively; the same was done in relation to the forearm fascia, with the entire musculature thus being exposed. In one of these limbs we identified this rare variation described. It was from a 57-year-old male cadaver. We do not have any significant individual clinical history. There was no evidence of any surgical procedure in the arm and forearm. The long palmaris muscle was lacking bilaterally. All other forearm muscles were present and showed no variation. The contralateral forearm was anatomically normal, except for the absence of the long palmaris muscle. The anomalous muscle was connected to the flexor digitorum superficialis. It consisted of two muscle bellies separated by an intermediate tendon, directed proximally to insert itself on to the medial humerus epicondyle next to the superficial head of the pronator teres muscle. The accessory superficial flexor muscle was positioned anterior to the medial and anterior interosseous nerves. The anomalous muscle was dissected away from the other structures and studied in detail. The muscle measurements were made and the forearm was photographed (Figs. 1 and 2). The maximum thickness of the accessory muscle was 2.5 cm and the length 9 cm. The muscle (FDS) and its accessory muscle received innervation from the median nerve.

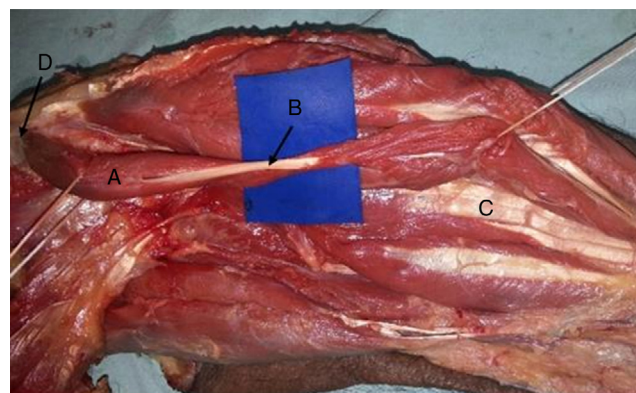


Fig. 1 – (A) Accessory flexor digitorum superficialis (anatomical variation). (B) Intermediate tendon. (C) Flexor digitorum superficialis. (D) Humerus medial epicondyle.

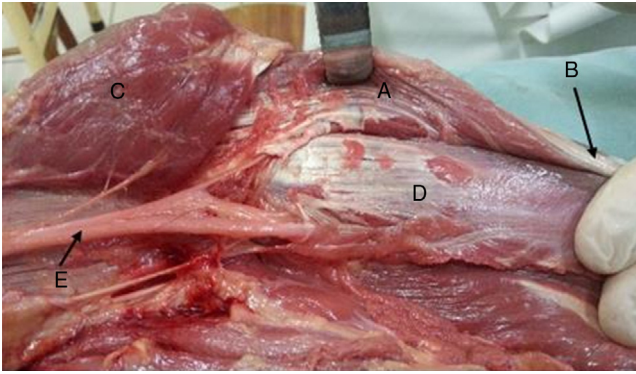


Fig. 2 – (A) Accessory flexor digitorum superficialis (anatomical variation), medially reflected. (B) Intermediate tendon. (C) Superficial head of the pronator teres (medially reflected). (D) Flexor digitorum superficialis. (E) Median nerve.

Discussion

Anatomical variations of the flexor digitorum superficialis muscles are not uncommon; they may mimic soft tissue tumors or cause nerve compression. The anatomical variations that have been described most frequently occur in the palm of the hand.^{4,5} In amphibians, the superficial flexors arise from the palm of the hand and during the course of evolution these muscles move to the forearm.⁶ It is possible that the presence of the muscle belly in the hand represents the persistence of an intermediate stage of evolution.^{7,8}

The muscle component of the flexor digitorum superficialis may occasionally extend into the carpal tunnel and may be identified during surgery for decompression of the median nerve in the carpal tunnel. During the finger flexion-extension movement the tendons move within the carpal tunnel and may frequently cause intermittent symptoms during digital flexion.^{9,10}

Elliot et al.³ reported a case of anatomical variation type V, stating that this was a rare variation. During the surgical procedure, they identified a small muscle attached by a tendon to the flexor digitorum superficialis muscle of the middle finger, 8 cm proximal to the wrist fold; this small muscle crossed the median nerve anteriorly, and was attached to the deep surface of the transverse carpus ligament; it was superficial to the normal superficial flexor tendons and to the median nerve; this variation is considered unlikely as being the cause of median nerve compression. They described another surgical case (type I) in which there was a small anomalous muscle attached to the tendon of the flexor digitorum superficialis proximally and distally to the index finger in the palm of the hand; during digital flexion, this anomalous muscle penetrated the carpal tunnel thus increasing the content of the tunnel, which can cause intermittent symptoms. They described a third case of type IV in which the flexor muscle belly of the index finger extended to the interior of the carpal tunnel and increased its content.

The literature reports other cases with type V anatomical variation. The first was reported by Mainland.¹ In cadaveric dissection, he observed a variation of the flexor digitorum

superficialis, in which the tendons of the ring and small fingers were connected to three muscles; two were in the forearm, the long palmaris muscle was absent. The second case of type V was reported by Figueiredo and Hooper¹¹; in this case they found, during a surgical procedure, an anomalous muscle in the forearm, which caused the flexion of the proximal interphalangeal joint of the index finger when pulled; the median nerve was situated superficially to this muscle in the forearm and wrist; they stated that the limited surgical incision did not allow better exploration. The most emblematic case of type (V) was described by Fromont.¹² During dissection of the hand of a cadaver, the presence of four anomalous flexor digitorum superficialis muscles was identified, which arose in the retinaculum of the flexors and were inserted in the base of the middle phalanx of the four fingers and acted as flexors of the proximal interphalangeal joint; the normal flexor digitorum superficialis muscle located in the forearm had only two tendons, one for the middle finger and the other for the ring finger. In the contralateral limb, the flexor digitorum superficialis muscle had only two tendons for the middle and ring fingers, which were inserted into the flexor retinaculum. Yesilada et al.¹³ reported that during the surgical procedure they observed a case of type V anomaly; there was a single, well developed muscle extending to the palm of the hand without the presence of tendons; traction in the muscle caused the flexion of the proximal interphalangeal joint of the index, middle, ring and small fingers; the palmar long muscle was absent.

Still and Kleinert⁸ identified, during surgical procedures, two cases (type IV) in which the muscle component extended distally to the carpal tunnel and were described as “aberrant muscles”; they reported that during the flexion-extension movements of the fingers these muscles enter and exit the carpal tunnel and may cause symptoms of median nerve compression.

Elias and Schuller-Ellis¹⁴ reported the surgical case of an 18 year old male patient in which they recorded the existence of digastric muscle (type III) that was inserted at the base of the middle phalanx of the index finger, had a proximal path and passed under the carpal tunnel; however, as it was a surgical case, it could not be explored proximally. They reported a second surgical case in which the muscle inserted into the site of the flexor digitorum superficialis of the index finger, and the muscle component passed through the carpal tunnel toward the forearm.

Still and Kleinert⁸ reported similar cases of Type II anomaly in which the anomalous muscle arose in the flexor retinaculum and was attached to the tendon of the flexor digitorum superficialis in the distal part of the palm. Hammer-Villar¹⁴ reported a similar case (Type II) in which the anomalous muscle arose in the thenar region, and was attached at the base of the middle phalanx of the index finger. Wesser et al.⁷ described the presence of an atavistic FDS muscle originating in the palmar aponeurosis and the transverse carpal ligament, and inserted into the base of the middle phalanx of the index and middle fingers. All these authors agree that these anatomical variations are atavistic, occur as a consequence of the interruption of some stage of development as in the amphibians.

In the case that we described, this is an anatomical variation (type V) that is not registered in the literature. We



Fig. 3 – By analogy with Gantzer (A) muscle, also called accessory to the flexor pollicis longus (B), which is frequent because it occurs in 68% of the limbs, we call this rare muscle as accessory of the flexor digitorum superficialis. (C) Median nerve. (D) Anterior interosseous nerve.

considered that most of the described anatomical variations were identified in the palm of the hand, and on the distal third of the forearm during surgical procedures of decompression of the carpal tunnel, and in these cases the incision was limited. We had doubts about the denomination of this anatomical variation we reported. We could call it “digastric flexor digitorum superficialis muscle”, because the anatomical nomina considers that two muscle bellies joined by a tendon should be called this way. The Gantzer muscle (Fig. 3) present in 68% of the forearms is also called accessory muscle of the flexor pollicis longus muscle because it is a small muscle that joins the flexor pollicis longus muscle to the medial epicondyle of the humerus or to the coronoid process of the ulna and adjacencies; thus, due to the similarity and analogy, it was termed “accessory muscle of the flexor digitorum superficialis”. It could even be considered as a variation of the humeral insertion of the “proximally expanded flexor superficialis muscle” with the presence of an intermediate tendon. In any case, we did not record the anatomical variation that we have described in the main classical manuals of anatomy and in our research. We do not have the clinical history of this cadaver, but we identified that the accessory flexor muscle of the FDS was anteriorly situated to the anterior median and interosseous nerves, and could potentially be the cause of the compressive syndrome of the anterior interosseous nerve or of the pronator teres syndrome.

The excision of these anomalous muscles is controversial and each case should be analyzed individually. Wesser et al.⁷ consider that surgery is not necessary, because these anatomical variations may be part of the functional unit that makes the

digital flexion, and may cause some functional impairment. Vichare⁴ also does not resect these anomalous muscles if there are no painful symptoms or nerve compression. Elias and Schulter-Ellis¹⁴ recorded the presence of these variations in nine cases and all were operated on. Kostakoglu et al.² prefer surgery because they consider that these abnormalities are potentially painful or cause compression syndromes.

Conflicts of interest

The authors declare no conflicts of interest.

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