

Accessory Fasciculus of Abductor Digiti Minimi

Dr. Sada Saraswathamma¹, Dr. D. Asha Latha²

¹Assistant Professor, Government Medical College, Ananthapuramu, India

²HOD of Anatomy, Andhra Medical College, Visakhapatnam, India

Abstract: *Aim and Objective: to study the variations of Abductor Digiti Minimi, whether absent, or present, and its presence or absence of one to three bellies, its variation in origin. Materials and methods: 48 upperlimbs from 24 cadavers were dissected to observe the variations. Results: During routine dissection of undergraduates we have come across the presence of this accessory muscle in the wrist when the carpal tunnel is opened. This presents with Abductor Digiti Minimi (ADM) muscle bilaterally, involving ulnar artery (UA) and ulnar nerve (UN) distribution.*

Keywords: Hypothenar, Accessory, Fasciculus, Abductor Digiti Minimi, ulnar artery, ulnar nerve

1. Introduction

Ontogenic interpretation of the anomaly: It is to be noted that original undifferentiated mesenchyme divides into 2 layers, superficial and deep. From superficial mesenchyme three primordia are developed radial, medial and ulnar. Medial - flexor digitorum superficialis (FDS), radial-abductor policis brevis (APB), ulnar- Abductor Digiti Minimi (ADM). The rest of the muscles develop from deep layer at a later stage. FDS then extends from its present position to fore arm and reaches its adult position. With this ontogenic origin of muscles it is considered that these accessory fascicles are due to defect in migration above and not a super numerary origin of antebrachial muscles. Although muscular, vascular and nervous variations of the hypothenar eminence are rare. The accessory fasciculus of ADM is the most common anomaly among all the accessory hypothenar muscles, with a prevalence of 24%, and present bilaterally in 50% of the cases

2. Materials and Methods

This study is done in Department of Anatomy, Andhra Medical College, Visakhapatnam; over a period of 3 yrs. This was carried out on 48 Upper limbs. When the antebrachial and hand dissection were being done by the students, the hypothenar area was carefully dissected following vascular and nervous structures neighbouring the ADM's accessory head. These findings were recorded and photographed (digital camera) UA vascular distribution and muscular variation are noted.

3. Observations

In one of the male cadaver aged 63 yrs the following observations were made. Both hands showed the accessory fasciculi. The Right hand (Figure1.) presented an accessory ADM head originating in antebrachial fascia. According to Murata et al., [7] classification resembles "variation 2", however without additional palmaris longus tendon origin. It passed obliquely through Guyon's canal, enclosing the UN and vessels.

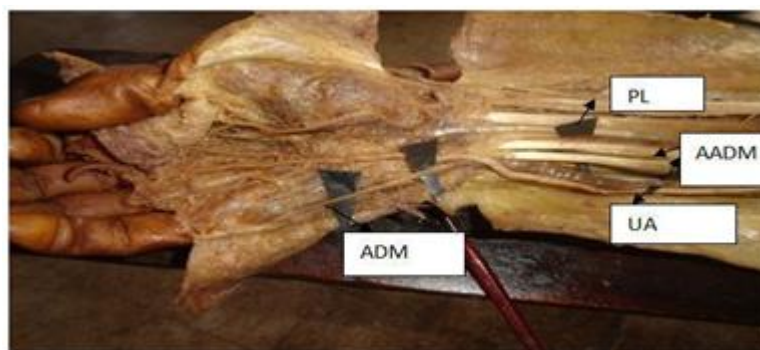


Figure 1

Rt hand: AADM: Accessory abductor Digiti Minimi, PL: Palmaris Longus, UA: Ulnar artery, ADM: Abductor Digiti Minimi. AADM originating from Antebrachial fascia

The accessory head made a late union in its distal trajectory to form a single pennate muscle with the ADM originating in pisiform bone. It was localized superficial to the flexor Digiti Minimi brevis muscle and lateral to OpponensDigiti Minimi muscle. Length was 10cms, 2mm and 2.43 mm thick compared to the ADM. The head was 5cms, 4mm wide and 7.09 mm thick. This right accessory ADM head had 34.3%

of the thickness of a usual ADM head. UA is seen crossing it at the level of Guyon's canal, and UA was covered by this ADM accessory head. Sensorial UN branches had both superficial and deep branches regarding muscular variation and were presented in relation to them. Sensory branch coming from the ulnar nerve's dorsal cutaneous branch and a deep sensory branch coming from the ulnar trunk. They

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were connected after coursing through the accessory ADM head. A third sensorial trajectory course was observed toward the fourth finger after passing Guyon's canal as the "fourth common digital nerve".

The left hand (Figure2) also presented an accessory ADM head originating in the ante brachial fascia.. It also passed obliquely through Guyon's canal, enclosing the UN. This accessory head also had a late union in its distal trajectory to form a single pennate with the ADM originating in pisiform bone. The origin was found to be at 2.5 cms from the flexor retinaculum. The Ulnar Artery was seen first passing above it in the tunnel and later became superficial and formed the superficial arch without joining with any of the branches of

radial artery as it is usual. The left hand muscle length was 10cms, 1.5mm wide and 1 mm thick compared to the usual ipsilateral. ADM head which was 5cms, and of same thickness as on other side. This accessory ADM head had 45.8% of the thickness of a usual ADM head. The UA adopted a superficial course above the accessory ADM head while the UN and all its sensorial branches were covered by this variation. These accessory ADM heads received deep UN branch motor innervations on both sides. Right -hand hypothenar zone. ADM: abductor Digiti Minimi muscle. AH: accessory head of abductor Digiti Minimi muscle. UA: ulnar artery. FR: flexor retinaculum. AF: antebrachial fascia.

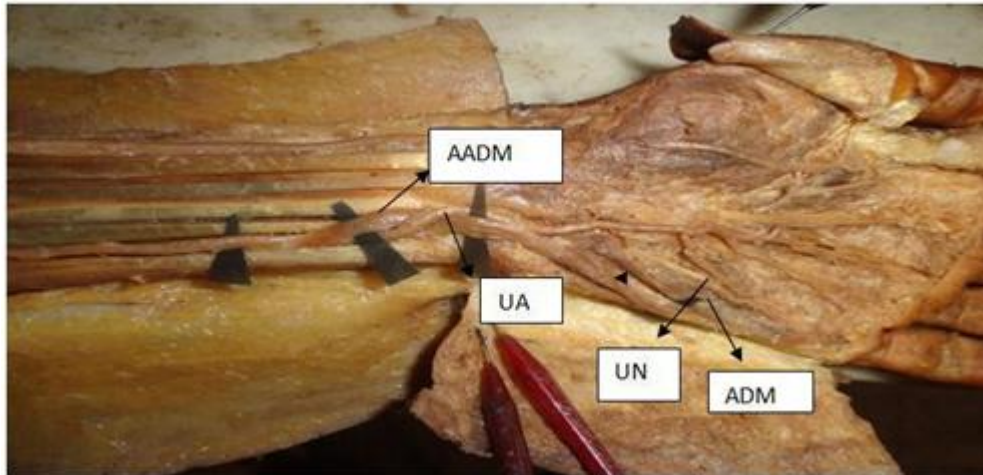


Figure 2

Left Hand: AADM: Accessory Abductor Digiti Minimi, ADM: Abductor Digiti Minimi; UA: Ulnar Artery, UN: Ulnar Nerve. Here too originates from AnteBrachial Fascia

4. Discussion

According to Sheppard, three cases of accessory ADM were first reported by Wood in 1868. Most authors call such additional ADM head as an "accessory" component which can be unilaterally or bilaterally presented, producing compression in Guyon's canal. Harvie et al., found an accessory ADM in 41% of 116 volunteers' asymptomatic ultrasound examinations, greater prevalence being found in males and bilateral presentation in 50% of cases for both genders. The flexor Digiti Minimi brevis muscle can also be present in this area; Madhavi et al., have stated that it relates to the common phylogeny of these muscles from the same muscle mass. Murata [7] found an accessory ADM in 35 hands, having one (17%), two (80%) and three fascicles (3%). Furthermore, Wulle [8] presented eleven cases of accessory ADM, but having "longus" presentation. This kind of muscular variation causes entrapment of neuro-vascular bundles causing sensorial and/or muscular implications in a range of compression neuropathies [5,6]. Entrapment neuropathies produce heterotopic projected pain, symptomatic consequences arising from mechanical nerve injury passing through a narrow anatomical space or under a muscular structure as seen here which may potentially compress the neuro-vascular package. We think that muscle size, tightness and course may be important factors in considering whether such variations are able to produce

compression, radiological guidance is a must to rule out these clinical symptoms.[11]

This scenario can cause nerve oedema and ischemia by muscle structure friction over the peryneuroma which can cause neuritis and raise endoneural pressure. In addition to traumatic neuropathic pain, symptoms in distal nerve distribution (dysesthesia, paresthesia and anaesthesia), paresis, hyporeflex, hypotonicity and atrophy, such as inferior motor neuron lesion, may be equally feasible. The deep UN motor branch may be compressed by this ADM accessory head and compromise palmar and dorsal interosseous muscles, hypothenar eminence muscles, lumbricals III and IV and hallux adductor, thereby producing a clinical "claw hand" appearance or resembling Guyon's canal syndrome.

Having dealt with this variation's possible sensorial and motor effects, vascular effects must also be considered. UA compression (left hand) may produce peripheral vascular disease from two possible events depending on the type of compression (i.e. constant or intermittent muscular compression). Muscular hyperfunction can reduce these arterial branches' distal irrigation, causing hypoesthesia or hyperesthesia in the hand. Likewise, muscular spasm can produce anaerobic metabolism and consequent nerve irritation by anoxic acidified setting with neurogenic inflammation and peripheral hyperalgesia. Permanent loss

of vascular supply during muscular spasm can lead to vascular claudication and pain.

We believe (from a functional perspective) that precipitating factors (gender, occupation, side dominance, traumatic history, anatomical characteristics) may develop neurovascular compression and symptoms in an anomalous muscle; we thus present this anatomical case. The morphological characteristics led to all the above explained symptomatic possibilities; however, lacking clinical judgment, further statements lose their functional value and become merely speculative.

5. Conclusion

In the above case both the AADM of RT and Lt hands originated from ante brachial fascia. But in the previous reports, the accessory ADM muscles originated either from the deep antebrachial fascia or from aponeurosis or Palmaris longus. (Wood, 1868; Roberts, 1972; Tubiana, 1981. Muscular variations compromising neurovascular bundles may produce clinical symptoms such as dysaesthetic pain, sensory loss, wakefulness and paresis, highlighting these anatomical discrepancies' importance when they are presented. However, the existence of an accessory ADM is usually asymptomatic and only rarely results in nerve compression. It does appear that muscle size, tightness and course may be an important factor in considering whether such variation is able to produce UN compression at Guyon's canal or UA compression resulting in a poor relationship between blood-flow and artery diameter. A larger sample of cadaver specimens is needed. Also, further clinical studies are required to confirm the existence of these variations' clinical effects

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