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CASE REPORT

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Bilateral accessory head of the adductor longus muscle: an anatomical case study

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The adductor longus muscle, with its proximal origin at the pubic bone and distal at the linea aspera, is reported to be one of the most frequently injured groin muscles in contact sports, namely football or ice hockey. Notwithstanding, there is a scarcity of published works regarding the accessory heads of the adductor longus muscle in the existing literature, let alone the clinical significance of the said variant.

The following study is a case report describing bilateral accessory heads of the adductor longus muscle in a 97-year-old female cadaver. A routine cadaveric dissection revealed two accessory heads on the right thigh and one on the left thigh of a donor with no known structural or pathological abnormalities of the proximal lower extremity. The anterior division of the obturator nerve provided nerve supply to the variants on both sides. The deep femoral, superficial external pudendal, femoral vessels were responsible for the vascular supply to the accessory heads of the adductor longus.

Undoubtedly, extensive knowledge regarding the variant anatomy of the hip adductor muscles is of immense importance to physiotherapists and orthopaedists treating patients for their injury or complete tears. Nonetheless, there is little information regarding the accessory heads of the adductor longus in the existing literature (originating mostly from cadaveric studies) that requires further evaluation in vivo to assess whether this variant might have an impact on a patient's everyday life. (Folia Morphol 2023; 82, 2: 416–421)

Key words: adductor longus, anatomical variation, anatomy, orthopaedics, physiotherapy

INTRODUCTION

There are six distinct adductor muscles of the hip, found at the proximal end of the lower extremity in humans that include the adductor longus, adductor magnus, adductor brevis, gracilis, pectineus and obturator externus muscles. The adductor longus muscle has been found to be the most common muscle to be injured, occurring in approximately 62% in a study of 55 cases of groin injuries [15]. The said muscle has its proximal attachment at the pubic bone, inferiorly to the pubic tubercle, travels anteriorly as a fan-shaped muscle covering the adductor brevis and the middle part of the adductor magnus to its distal attachment at the middle third of the linea aspera of the femur [9]. Moreover, the adductor longus forms the posterior wall of the adductor canal (alongside the

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adductor magnus) through which the femoral artery, femoral vein, and saphenous nerve pass towards the popliteal fossa, as well as nerve to vastus medialis [9]. A branch from the anterior division of the obturator nerve (originating from the L2-L4 levels of the spinal cord) is said to be responsible for its innervation [9].

The obvious function of the adductor longus is to provide adduction of the thigh. Nonetheless, the aforementioned muscle has also been found to play an important role in hip flexion, as well as internal and external rotation on limited flexion angles [12]. A study by Hides et al. [3] has found the adductor magnus muscle to be involved to a greater extent in weight-bearing closed chain exercises compared to the adductor longus. Henceforth, the aforementioned types of exercise would not be beneficial in training the latter muscle. The adductor longus action is best noticeable during flexion of the hip in the hip extension position, whereas the adductor magnus works indifferently to the position of the hip [5].

Injuries to the groin, and especially the hip adductor muscles, occur frequently in athletes and contact sports. Extensive knowledge regarding these muscles and their variant anatomy and function is of immense importance to medical professionals and physiotherapists worldwide, as it may help devise a prevention programme (with appropriately directed exercises to strengthen these muscles) or provide adequate treatment upon injuries [3]. Henceforth, the purpose of this case report was to provide a thorough description of bilateral accessory heads of the adductor longus muscle, encountered during a routine cadaver dissection and to provide an up-to-date overview of the clinical implications pertaining to this muscle.

CASE REPORT

A routine cadaver dissection of a 97-year-old Polish female formalin fixed donor was undertaken at the Department of Anatomy, Jagiellonian University Medical College in Krakow, Poland in November 2021. The procedure was performed on previously untouched lower extremities. Three prosectors (T.K., M.P.Z., J.A.W.) were responsible for the specimen preparation. No visible trauma or other pathology were noted upon their inspection, nor were they found in the available medical records of the patient. Having removed the skin, the subcutaneous tissue and muscular fascia were carefully removed to individually expose the muscles of the thigh. Upon closer inspection of the adductor group of both right and left lower extremities, there were bilateral variations noted regarding the adductor longus muscle. Measurements of the vascular length were obtained with the help of a digital calliper, averaged from three separate measurements.

On the left lower extremity, the adductor longus comprised two distinct heads. The proximal insertion point of both heads was located close to the pubic tubercle at the inferior pubic ramus, with the typical head attached more medially than the lateral head. The typical head appeared more muscular in its form, with tendinous attachments visible in the close proximity of the inferior pubic ramus, whereas the lateral head had a more tendinous proximal attachment. The distal insertion point for both heads was at the linea aspera of the femur, with the lateral head attached superiorly to the typical head. The saphenous vein crossed both of the heads anteriorly. The lateral head was located posteriorly and laterally from the typical head.

Both of the aforementioned heads of adductor longus muscle were innervated by the anterior division of the left obturator nerve. The vascular supply to both the typical and lateral heads was derived from the deep femoral artery (a single branch for both of them), with its length to the lateral head being 18.87 mm on average, and 25.69 mm to the typical head. The average length of the femoral artery (measured from the femoral canal to the branching off point of the deep femoral artery) was 72.65 mm (Figs. 1, 2).

On the right lower extremity, the adductor longus comprised three distinct heads. All of them had a common origin at the inferior pubic ramus, close to the pubic tubercle. The lateral accessory head had a more tendinous proximal attachment, located most laterally of the three, whereas the middle accessory head, also with a tendinous attachment, was positioned in between the lateral head and the typical head of the accessory longus muscle. The proximal attachment of the typical head appeared to be more muscular in its form, with tendinous attachments visible in the close proximity of the inferior pubic ramus. The distal attachment of all three heads was at the middle 2/3 of the linea aspera of the femur, with the lateral head located most superiorly, and the typical head most inferiorly. The typical and lateral heads were crossed by the saphenous vein anteriorly, whereas the middle head was located deep in between the two other heads. The lateral head was positioned posteriorly and laterally from the typical

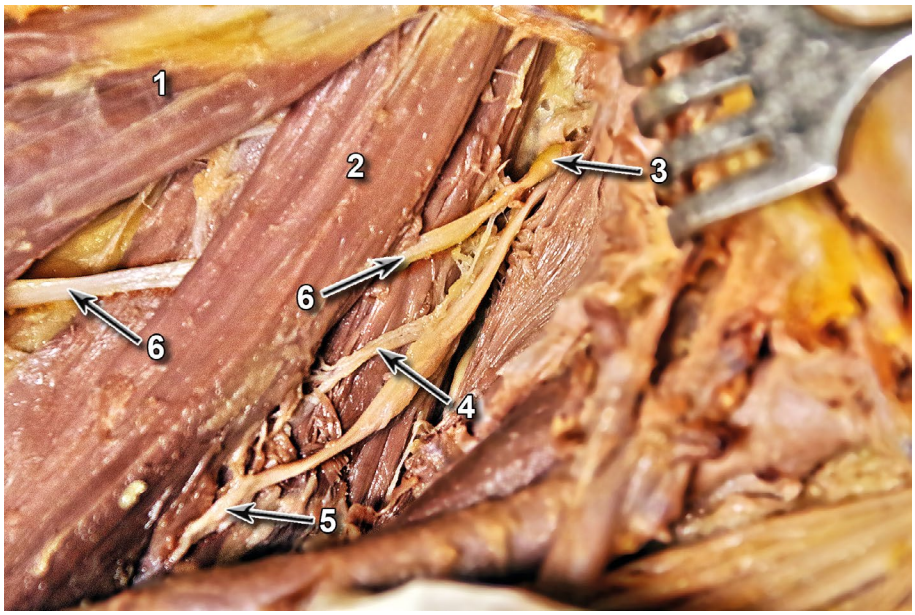

Figure 1. A left accessory adductor longus head with its neural supply; 1 — adductor longus; 2 — adductor longus accessory head; 3 — obturator nerve (anterior division); 4 — branch of the obturator nerve to adductor brevis; 5 — branch of the obturator nerve to the adductor longus accessory head; 6 — branch of the obturator nerve to the adductor longus.

Figure 2. A left accessory adductor longus head with its vascular supply; 1 — adductor longus; 2 — adductor longus accessory head; 3 — femoral artery; 4 — branch from the deep femoral artery to the adductor longus and its accessory head.

head, whereas the middle head was located the most posteriorly and in between the two said structures.

All three aforementioned heads were innervated independently by the anterior division of the obturator nerve. The average length of the femoral artery (measured from the femoral canal to the branching off point of the deep femoral artery) was 73.44 mm. The typical head had a dual vascular supply. A branch of the deep femoral artery to the typical head was 31.48 mm in length and reached the middle part of the muscle, whereas a small branch from the femoral artery 14.69 mm in length supplied the inferior part of the muscle. The middle head obtained its vascular supply also from the deep femoral artery that was 27.67 mm in length. The vascular supply for the typical and middle head originated from the same

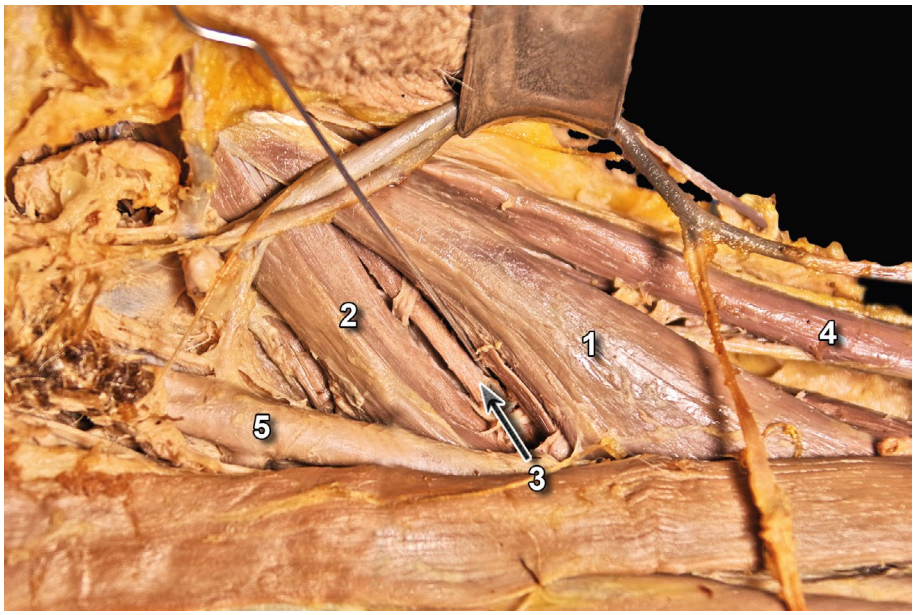

Figure 3. Two right accessory adductor longus heads; 1 — adductor longus; 2 — adductor longus lateral accessory head; 3 — adductor longus middle accessory head; 4 — gracilis muscle; 5 — femoral artery.

branch. The lateral head also had a dual supply. Its superior part was derived from the superficial external pudendal artery and veins that were 40.07 mm in length from their origin point at the external pudendal vessels. The inferior part was supplied by a branch from the deep femoral artery that was 16.59 mm in length, and originated separately from the branch that supplied the typical and middle head (Fig. 3).

Unfortunately, the average lengths of the respective heads on both sides were not measured, as that would require for the surrounding muscles to be excised in order to obtain wide access and reliable measurements from their proximal to their distal insertion points.

DISCUSSION

The current study reports a case of bilateral accessory heads of the adductor longus muscle, two on the right and one on the left. Their vascular supply was chiefly derived from the deep femoral artery, but also from the superficial external pudendal artery and the femoral artery. The available literature of the subject suggests that the adductor longus may also be vascularised by the obturator arteries [13, 14], but the authors have not found any of the said branches in the current study.

There is scarcity of research regarding the accessory heads of the adductor longus muscle in the available literature. Tuite et al. [17] are the only authors that made a brief mention about bicephalic adductor longus. The study was based on 37 cadaveric observations and investigated variations in the proximal tendinous origin and the typical muscle's length. Most of the described cases had tendinous attachments on the anterior surface, but on the posterior side it was usually muscular in origin [17]. The aforementioned authors also reported other types of anomalies, such as adductor longus muscular origin on the anterior surface or fused proximal tendons of the adductor longus and the gracilis muscles [17].

There are works [11, 14] that noticed the possibility of adductor longus having two distinct parts, however access to the primary source of this information turned out impossible. The second variation also mentioned in several sources is the muscle's length [11, 14]. In some uncommon cases, the adductor longus may even reach as far as the knee and fuse with the adductor magnus tendon [11]. Du Plessis et al. [11] reported that in this situation the tendons of the adductor longus and the adductor magnus can be fused together.

The clinical significance of the adductor longus muscle has been described only in a few case reports. The most frequent condition involving the aforementioned anatomical entity is its total rupture, which occurs mostly in football players [8, 10]. Incomplete tears or strains happen frequently at the more susceptible parts of the muscle, i.e. at its proximal part on

the junction point of muscular and tendinous fibres or else at its insertion on the pubic bone. However, complete muscle tears occur more often at the distal attachment to the femur [15]. Injury to the adductor longus is also common in sports such as ice hockey, horseback riding, skating and hurdling [17].

Nonetheless, sport injuries are not the only disorders associated with the adductor longus muscle. Alimehmeti et al. [1] described an unusual case of saphenous neuropathy due to a hydatid cyst located in the adductor longus, that caused swelling, numbness and pain in the medial part of the right tight. The cyst was excised and the patient walked independently the next day after the procedure. Another example of a non-traumatic disorder is urinary bladder cancer metastasis to the adductor longus [7]. The 62-year-old male patient in question presented with unusual symptoms in the right thigh, namely pain, swelling of the extremity and struggled with mobility. Unfortunately, the patient died during treatment, hence there is not enough information to estimate how the metastasis would have impacted his gait and muscle activation.

Accessory muscles are usually asymptomatic, but sometimes they may present clinical symptoms [16, 18]. Various cases of supernumerary muscles have previously been reported in the thigh and knee area, e.g. the tensor vastus intermedius [2], accessory sartorius muscle [6], tensor fasciae suralis, accessory semimembranosus muscle or accessory popliteus muscle [16, 18]. Accessory muscles can cause nerve entrapment syndromes, vascular compressions or may mimic other pathologies, namely soft tissue tumour or the Baker's cyst [18]. Truly, the clinical symptoms associated with presence of a supernumerary muscle depend on its location and the neighbouring neurovascular entities involved. Clinical deduction derived from cadaveric studies is extremely difficult and poses a high risk of bias, as most often encountering some of the anatomical variations occurs incidentally, without the previous knowledge of the patient or their family of their existence. Therefore, lack of medical history with the description of potential symptoms makes it impossible for cadaveric studies to truly discern the clinical meaning of the finding, hence it remains only as an assumption.

Generally speaking, the adductor longus muscle does not have an extensive description of its anatomy and clinical considerations in the available literature. Most of the publications describe its traumatology, biomechanics and therapeutic management in injuries. The reason behind it may potentially be low clinical importance of anatomical variations in this area. More research, and on a larger scale, regarding the anatomy of the adductor longus is still needed to estimate the prevalence of its accessory heads. The authors in their dissection experience have not encountered the described here variation in the past, regardless of its laterality, hence presume that its prevalence is rare. Both clinical and biomechanical properties of the accessory heads of the adductor longus would be beneficial to ascertain its potential role in the human organism. Nonetheless, the authors would like to acknowledge Żytkowski et al. [19] in saying that although the so-called 'anatomical norm' proves beneficial in everyday medical practice by presenting the most common anatomy of a structure, it is also a double-edged sword as it may also present an overly idealised view.

CONCLUSIONS

Anatomical variations of the adductor longus muscle play a crucial role whilst assessing a groin injury in contact sports, but also in case of cysts and casuistic neoplastic metastasis to the muscle. Undoubtedly, a thorough knowledge is required from medical professionals to adequately diagnose and treat such patients. This is most probably the first study to report bilateral accessory heads of the adductor longus muscle (with two accessory heads on the right thigh) thus adding to the existing literature and pointing to the yet still needed further scientific exploration of the said muscular variation in vivo.

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Conflict of interest: None declared

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