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CASE REPORT

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A very rare case report: accessory head of the sartorius muscle

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The sartorius muscle belongs to the anterior compartment of the thigh. Morphological variations of this muscle are very rare, few cases being described in the literature. An 88-year-old female cadaver was dissected routinely for research and teaching purposes. However, an interesting variation was found during anatomical dissection. The proximal part of the sartorius muscle had the normal course, but the distal part bifurcated into two muscle bellies. The additional head passed medially to the standard head; thereafter, there was a muscular connection between them. This connection then passed into the tendinous distal attachment. It created a pes anserinus superficialis, which was located superficially to the distal attachments of the semitendinosus and gracilis muscles. This superficial layer was very wide and attached to the medial part of the tibial tuberosity and to the crural fascia. Importantly, two cutaneous branches of the saphenous nerve passed between the two heads. The two heads were innervated by separate muscular branches of the femoral nerve. Such morphological variability could be clinically important.
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Keywords: sartorius muscle, accessory head, morphological variation, case report, saphenous nerve entrapment syndrome, compression

INTRODUCTION

The sartorius muscle (SM) belongs to the anterior compartment of the thigh. It is proximally attached to the anterior superior iliac spine (ASIS) and distally attached on the medial side of the proximal part of the tibia at the pes anserine. Its blood supply is provided by muscular branches of the femoral artery. It is innervated by the femoral neve (L2–L4) [15]. Because of its specific attachment points, this muscle is responsible for movements in both the hip and knee joints: hip flexion, abduction, and external rotation, and knee flexion [15].

Morphological variations of the SM are very rare, and few instances have been described in the literature. However, absence of this muscle has been reported [12]. There are also descriptions of a doubled SM. When there is an additional head in the proximal attachment it can originate from the pectineal line,

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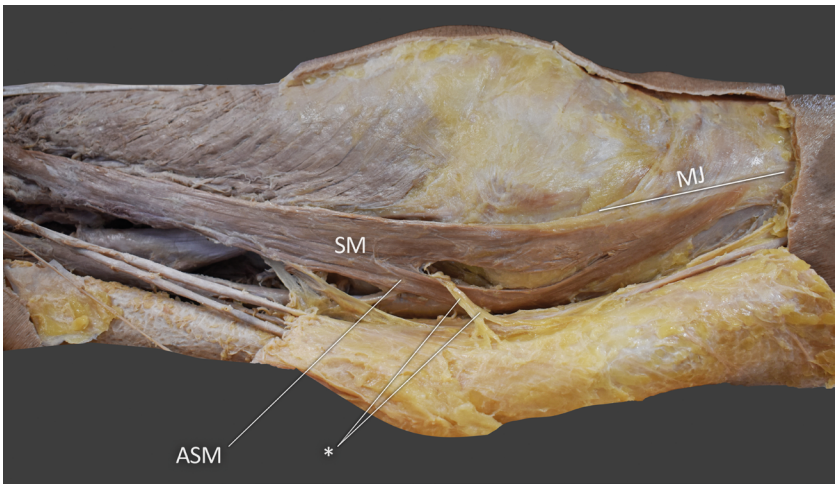

Figure 1. A very rare case of accessory part of the sartorius muscle; SM — sartorius muscle; ASM — accessory sartorius muscle; MJ — myotendinous junction; *cutaneous branches of the saphenous nerve.

the iliopectineal eminence, the femoral sheath, the inguinal ligament, or the pubic symphysis [2, 3]. The distal part of the SM can also bifurcate [10]. Its insertion can be located, for example, on the medial aspect of the patella [10].

Accessory structures can be associated with some kind of neurovascular compression [24]. If the additional head of the SM is located over the femoral nerve, then femoral nerve compression is a strong possibility [8]. For example, lateral femoral cutaneous entrapment could occur, also called meralgia paraesthetica, which can result in pain, paraesthesia, and sensory loss within the distribution of the lateral cutaneous nerve of the thigh [7].

During anatomical dissection, an interesting variant of the SM was found. Proximally, there was one short tendon attached to the ASIS. It then passed into the muscle belly, the distal part of which bifurcated into two muscular parts. The first had a normal course, the additional one passing medially to it; after that there was a muscular connection between the two, which passed into the tendinous distal attachment. This created a pes anserinus superficialis, located superficially to the distal attachment of the semitendinosus and gracilis muscles. This superficial layer was very wide and attached to the medial part of the tibial tuberosity and to the crural fascia. Importantly, cutaneous branches of the saphenous nerve passed between the two heads, which were innervated by separate muscular branches of the femoral nerve.

CASE REPORT

An 88-year-old female cadaver was dissected routinely for research and teaching purposes at the Department of Anatomical Dissection and Donation, Medical University of Lodz, Poland. The left lower limb was subjected to traditional anatomical dissection [17–20] and the skin, subcutaneous tissue, and deep fascia were dissected. Each muscle was then carefully examined and an anomalous SM was found.

Proximally, there was one short tendon attached to the ASIS. At the origin it was 15.86 mm wide and 3.41 mm thick. It then passed into the muscle belly. Distally, it bifurcated into two muscular parts. The distance from the origin to the bifurcation was 355.70 mm. The first part had normal course and was 83.68 mm long, and the additional muscle belly (92.36 mm long) passed medially to it. After that there was a muscular connection between these two structures, which was 67.03 mm long.

This connection passed into the tendinous distal attachment. At the myotendinous junction the width was 68.45 mm and the thickness 0.34 mm. It created a pes anserinus superficialis, which was located superficially to the distal attachment of the semitendinosus and gracilis muscles. This superficial layer was very wide and attached to the medial part of the tibial tuberosity and to the crural fascia. Its insertion was 36.16 wide and 0.41 mm thick (Fig. 1).

Importantly, two cutaneous branches of the saphenous nerve passed between the two heads. The

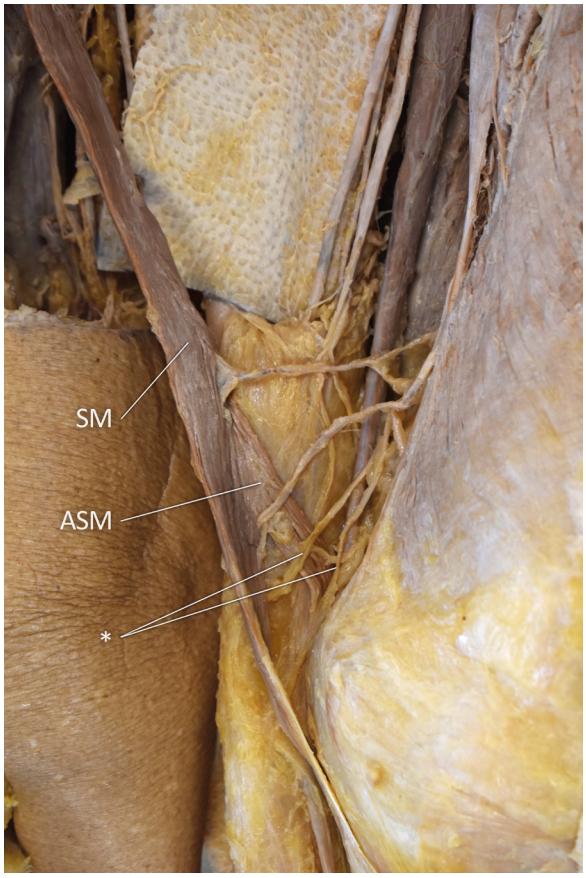

Figure 2. A very rare case of accessory part of the sartorius muscle and loop for the cutaneous branches of the saphenous nerve; SM — sartorius muscle; ASM — accessory sartorius muscle; *cutaneous branches of the saphenous nerve.

Figure 3. Excised sartorius muscle and loop for the cutaneous branches of the saphenous nerve; SM — sartorius muscle; ASM — accessory sartorius muscle; *cutaneous branches of the saphenous nerve.

Table 1. Morphometric measurements of the present case

ORIGIN	ASIS
Width	15.81 mm
Thickness	3.41 mm
LENGTH	
To the bifurcation	355.70 mm
To the connection	**The SM (normal):** 83.68 mm; **The accessory head:** 92.36 mm
To the MJ	67.03 mm
MJ	
Width	68.45 mm
Thickness	0.34 mm
INSERTION	To the medial part of the tibial tuberosity and to the crural fascia
Width	36.16 mm
Thickness	0.41 mm

ASIS — anterior superior iliac spine; MJ — myotendinous junction; SM — sartorius muscle

diameter of the first was 1.90 mm and that of the second was 2.19 mm (Figs. 2, 3).

An electronic calliper (Mitutoyo Corporation, Kawasaki-shi, Kanagawa, Japan) was used for the measurements. Each measurement was repeated twice with an accuracy of up to 0.1 mm. No other morphological variabilities were found during dissection of the lower limb. Table 1 shows the morphometric measurements.

DISCUSSION

There are some descriptions of morphological variations of the SM in the literature but these are very rare. One variation of the lower limb is absence of the SM [1]. The SM can also be doubled, with complete longitudinal division into two elements [1].

The proximal attachment of this muscle can have additional heads. Kumar et al. [11] found two heads of the SM, one following a normal course while the second (the accessory head) originated from the

inguinal ligament. This additional muscle belly was connected to the main SM between the upper one-third and lower two-thirds of the thigh. Importantly, the femoral nerve was located under the accessory head [11].

However, the inguinal ligament is not the only structure from which an accessory head of the SM can originate. Brock et al. [3] reported that it can also be attached to the pectineal line, or the iliopectineal eminence [3]. There are also cases in which an additional head originated from the ASIS, the femoral sheath, or the pubic symphysis [1].

The SM can also vary in its distal attachment. The tendinous attachment can bifurcate and insert to the anteromedial aspect of the patella, the medial condyle of the femur, the capsule of the knee joint, or the fascia of the leg [1]. However, this bifurcation can be more proximal and the muscular structure then ends in a tendon. Sometimes, a variation of this kind is called a musculus sartorius bicaudatus. Mailing and Zweymiillerb [11] found only one case of this variation in their study population (1.14%); this structure was attached to the medial meniscus anteromedially [18].

An interesting case was found by Kim and Lee [10]. The proximal attachment of the SM was normal, but in the proximal one third of this muscle there was a bifurcation into medial and lateral parts. The lateral part was distally attached by a tendon on to the medial aspect of the patella. We found the course of the medial part more interesting because it gave off a small muscular structure to the vastus medialis, and below this it connected with an accessory SM. This additional muscle was proximally attached to the inguinal ligament. The common junction inserted on the medial aspect of the proximal tibia (pes anserinus) [10].

Another anomalous presentation of the SM was described by el-Badawi [6]. The SM was distally divided into two parts. The first one located laterally had an insertion into the medial epicondyle of the femur. The medial part was distally attached to the medial surface of the tibia [6]. Mailing and Zweymiillerb [14] also found a distal division of the SM. The larger part (posteromedial) presented normal course. The smaller part (anterolateral) was attached to the medial meniscus and was pushing the synovial membrane into the joint [14].

Dziedzic et al. [5] carried out a study about anatomy of this muscle. It turned out that in most cases the initial part of the SM was represented by the shortest width. In turn, the widest part was variable — in 10% it was the proximal part of the belly, in 30% it was the middle one, and in 50% the distal part. There was also a situation in which middle and distal parts were bigger than the proximal part, and its frequency was 10% [5].

Dudek et al. [4] carried out a study on human fetuses. It turned out that there was a statistically significant sexual dimorphism of thigh length and the SM's length — smaller sizes were observed in male fetuses. In turn, there were no significant differences in crown-rump length and total length. The SM's length rate was constant and amounted to 1.2 mm per week. They also distinguished two types of the SM — the rectangular and cone-shaped. Other observed morphological variations were: an accessory tendon, the start of muscle duplication in the form of a hollow, partial duplication of the distal part of the SM and discontinuous muscle [4].

In the present case, the normal proximal part originated from the ASIS by a short tendon, which passed into the muscular part. The additional muscular structure arising from the muscle belly of the SM was then observed. The first muscle belly had a normal course and the additional muscle belly passed medially to it. After that there was a muscular connection between these two structures, which passed into the tendinous distal attachment. This created a pes anserinus superficialis, which was located superficially to the distal attachment of the semitendinosus and gracilis muscles. This superficial layer was very wide and was attached to the medial part of the tibial tuberosity and to the crural fascia.

Analysing this course, we thought it could an example of the musculus sartorius bicaudatus, but in the present case there was an additional connection between the muscle bellies. However, the most interesting feature of our case was the specific course of saphenous nerve branches. Two cutaneous neural branches passed between the normal and additional bellies. Next to these there were small arteries arising from the femoral artery.

Additional structures are usually associated with some kind of neurovascular compression [25]. In the present case, the cutaneous branches of the saphenous nerve could have been trapped between the two heads of the SM and saphenous nerve entrapment syndrome could have resulted [21]. Patients with this pathology usually complain of pain along the

saphenous nerve. The pain can be located at the knee joint level, radiating superiorly to the medial aspect of thigh and inferiorly to the medial part of the foot. Symptoms can be aggravated when the knee is extended [15].

Sometimes, neuropathy in the foot can result from such a syndrome. Because of the pain, the knee is usually kept in a protective position (slight flexion). This results in shortening of the limb and there can be compensatory hypertrophy of the phalangeal muscles in the foot region, resulting in compression or nerve irritation.

Unrecognized saphenous neuritis can confuse the patient's clinical picture. For example, permanent pain in the knee region, without warming and reddening, can give a suspicion of rheumatoid arthritis, a long-term autoimmune disorder [23]. It can also be confused with injury or osteoarthritis of the knee. Permanent pain in one area should also draw attention to the possibility of bone metastases [13].

After diagnosis of saphenous nerve entrapment syndrome, appropriate treatment should be instituted. Treatment can be surgical or non-surgical. Non-surgical treatment involves different physiotherapy techniques and corticosteroid injections. If this does not succeed, invasive methods could help [22]. These depend on debridement of any fibrous tissue surrounding the compressed part of the nerve; so in the present case, removing part or all of the additional head of the SM could have been the best solution.

Good knowledge of morphological variations in various regions of the human body can help during diagnosis, especially when there is permanent paraesthesia or pain in one region with no apparent reason.

CONCLUSIONS

Morphological variations of the SM are very rare. An additional muscular band can be associated with some kind of neurovascular compression. Knowledge of the possibility of such variants can be important for clinicians, especially for orthopaedists, neurologists and rheumatologists, when entrapment syndrome and its symptoms need to be differentiated from other diseases.

Ethical approval and consent to participate

The study protocol was accepted by the Bioethics Committee of the Medical University of Lodz. The cadavers were the property of the Department of Anatomical Dissection and Donation, Medical University of Lodz. Informed consents were obtained from all participants before they died.

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Conflict of interest: None declared

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