

Previously unreported variant of the rectus femoris muscle

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Although uncommon, variant muscular variations can occur related to the quadriceps femoris. Such variations might be encountered in the clinical setting so these should be documented. Here, we report three additional heads related to the rectus femoris muscle identified during routine dissection of the right thigh. To our knowledge, such a variation has not been previously reported. (Folia Morphol 2023; 82, 1: 221–224)

Key words: anatomy, lower limb, quadriceps femoris, anatomical variations, rectus femoris

INTRODUCTION

The anterior compartment of the thigh contains the iliacus, psoas major, sartorius, and the quadriceps femoris. The quadriceps femoris is typically described as being formed by the rectus femoris and the three vastus muscles: vastus medialis, vastus lateralis, and vastus intermedius which all converge and connect to the common quadriceps tendon, which continues as the patellar ligament, which attaches to the tibial tuberosity [1, 9]. Each of the four muscles of the quadriceps femoris are innervated by branches of the femoral nerve [3, 7].

The rectus femoris crosses the hip and thus assists with flexion of the thigh as well as extension of the knee along with the other three parts of the quadri-

ceps femoris. Specifically, the straight head of the rectus femoris originates from the anterior inferior iliac spine and its reflected head from the ilium just superior to the acetabulum [6]. The vastus medialis and vastus lateralis begin at the intertrochanteric line and greater trochanter, respectively and both continue their attachment down the medial and lateral lips of the linea aspera, while the vastus intermedius originates from the anterior and lateral surfaces of the femur [6]. In general, anatomical variations of the quadriceps femoris is uncommon. Here, we report the details of a cadaver found to have a, to our knowledge, previously unreported variant of the rectus femoris muscle.

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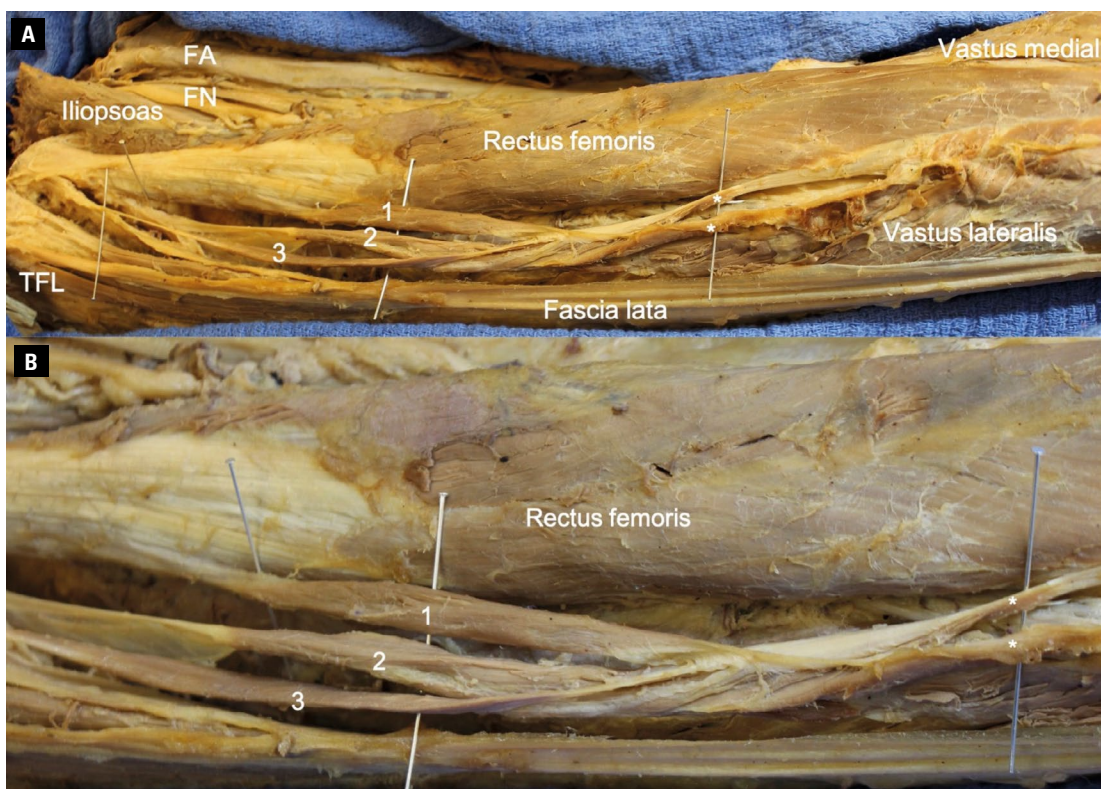


Figure 1. Right anterior thigh in the cadaver presented herein; **A.** Note the three additional heads (1–3) related to the rectus femoris. Also, note the tensor fasciae latae (TFL), femoral nerve (FN), and femoral artery (FA); **B.** Zoomed in view of Figure 1 noting the three additional heads (1–3).

The quadriceps femoris is important in, for example, sports owing to its potential for injury, which can be painful and debilitating. Tears, strains, and contusions are not uncommon and require recovery time. The quadriceps femoris can also be weakened by anterior cruciate ligament ruptures and reconstructions, resulting in atrophy of the vastus medialis and vastus intermedius. Therefore, knowledge of its anatomical variations is important.

CASE REPORT

During the routine dissection of the right anterior thigh in an 82-year-old at death male cadaver, a muscular variation of the quadriceps femoris was observed. Three additional heads were found related to the rectus femoris muscle (Fig. 1). The more medial of these extra heads travelled from the distal part of the proximal tendon of origin of the rectus femoris (near the musculotendinous junction) and coursed distally to attach to a second and more laterally placed variant head that arose from the deep layer of fascia lata (Fig. 2). This intermediate head had two tendons of origin from the deep layer of fascia lata and dis-

tally, prior to fusing with the other two additional muscular heads, split into two more or less equal muscle bellies that took on an oval shape (see Fig. 2). A most lateral variant head of the rectus femoris that was slightly posteriorly rotated fused with the other two variant heads arose from the deep surface of the deep layer of the fascia lata via a broad tendon that also attached into the proximal tendon of origin of the rectus femoris at about the level of the inguinal ligament. The three additional heads came together distally to form a roughly chiasmatic structure that then sent a tendinous band to end in the medial surface of the distal vastus lateralis muscle just proximal to the junction between the rectus femoris and vastus lateralis muscles and a tendinous band that ended in lateral aspect of the distal rectus femoris just proximal to its fusion with the vastus lateralis. Each additional muscle belly was approximately 6 cm in length and 1 cm in width. The contralateral rectus femoris and anterior thigh, in general, was found to be normal with no muscular or other obvious anatomical variations. No distinct nerve or arterial supply was found for any of the additional heads of the rectus femoris

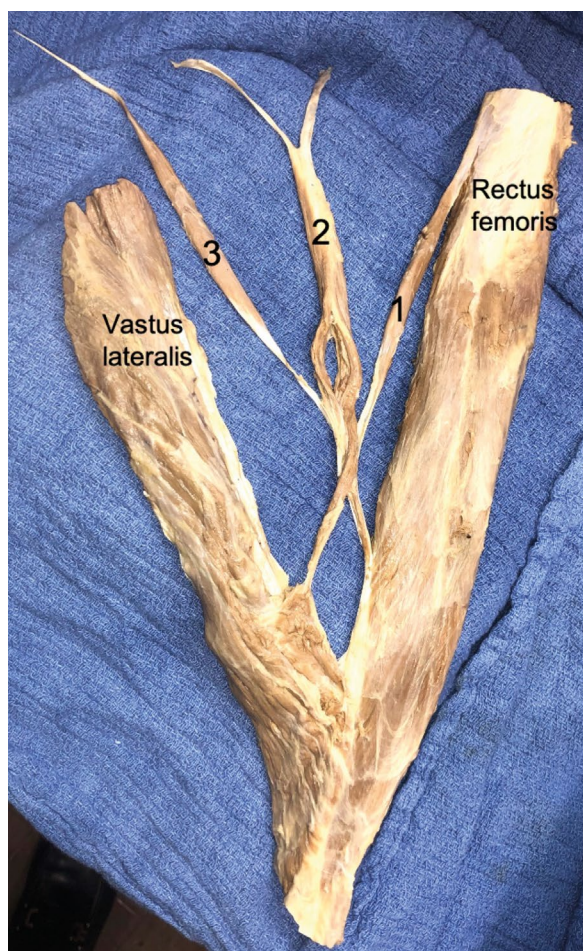


Figure 2. Variant muscle arrangement of the cadaver shown in Figure 1 after removal. The medial (1), intermediate (2), and lateral (3) variant muscles.

muscle. No medical or surgical history of the cadaver was available.

DISCUSSION

Although uncommon, variants to the quadriceps femoris have been identified in previous studies highlighting the complexity of this muscle group. Embryologically, the lower extremity develops opposite to the fifth lumbar and first sacral somites and as the bud develops, it lengthens and extends towards the sacral myotomes. The quadriceps femoris, developed from the myotomic portions of the somites, originally appears as a single mass that later differentiates into the four parts of the quadriceps femoris.

In 2020, Ruzik et al. [9] reported variants of the quadriceps femoris including accessory muscle bellies around the knee. Golland et al. [2] found an accessory head of the quadriceps femoris in 29%

of thighs and identified a fifth head in 36% of thighs. Olewnik et al. [8] reported that in several previous studies there were additional heads in the quadriceps femoris ranging from three to possibly 8 additional heads. Bonnechère et al. [1] identified three to 5 muscle heads in the quadriceps femoris raising the question of nomenclature for the quadriceps femoris.

While there have been several anatomical variants to the quadriceps femoris heads, 2020 Murdock et al. [5] reported the rectus femoris has previously been reported to have variations in the origin, ranging from upper anterior iliac spine to the lower anterior iliac spine or not having any acetabular origin and a muscle slip from the acetabulum directly into the vastus lateralis has been observed. We previously reported a femoral head of the rectus femoris that attached to the femur anteriorly at about the mid length of the rectus femoris muscle [10]. The case presented herein revealed 3 additional heads of the rectus femoris that attached into the distal vastus lateralis and rectus femoris.

CONCLUSIONS

Knowledge of the possibility of additional heads of the rectus femoris as reported here is important to not only anatomists but also clinicians who might observe such a variant on imaging or during surgical procedures.

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Conflict of interest: None declared

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