Case Report

Unilateral short rectus femoris muscle belly

Mark D. STRINGER +
Maiko KANO
Christina FAUSETT
Latika SAMALIA

Department of Anatomy, Otago School of Medical Sciences,
University of Otago, Dunedin, NEW ZEALAND.

Abstract

Two cadavers, one male and one female, with a short left-sided rectus femoris muscle belly are described. The variant muscle belly was foreshortened by approximately 30–40% compared to the contralateral normal muscle, with no evidence of scarring. Numerous anatomical variants of rectus femoris have been described but are rare. This particular variant has not been documented previously. Considering the widespread use of the pedicled rectus femoris muscle flap in reconstruction of complex groin wounds, this rare variant is of surgical significance.


Key words [variation] [quadriceps femoris] [cadaver] [rectus femoris flap]

Introduction

Rectus femoris is a spindle shaped muscle forming part of the quadriceps muscle group in the anterior compartment of the thigh. Traditionally, it is described as having two heads which arise as a straight tendon from the anterior inferior iliac spine and a reflected tendon from the ilium just above the acetabulum. Recent studies have shown that the anatomy of the muscle is more complex than previously understood [1–3]. The straight tendon covers the anterior aspect of the proximal third of the muscle, whilst the reflected tendon is deeper and extends intramuscularly for about two-thirds of the length of the muscle [1]. The distal tendon arises as a broad aponeurosis on the posterior surface of the distal two-thirds of the muscle, narrows to a thick flat tendon about two-thirds of the way down the thigh, and inserts into the base of the patella [3]. From here, fibers continue to the tibial tuberosity via the patellar ligament. The quadriceps femoris is a powerful knee extensor but rectus femoris also contributes to hip flexion since it crosses the hip joint anteriorly.

Despite its complexity, anatomical variants of rectus femoris are rare. To our knowledge, a short muscle belly has not been previously described.

Case Report

Two embalmed cadavers, a male aged 93 years at death and a female aged 92 years, donated to the Otago School of Medical Sciences in accordance with the New Zealand Human Tissue Act 2008, were found to have a similar anatomical variant. In both cadavers, the left rectus femoris muscle belly was markedly shorter than the right (Figure 1). The right-sided rectus femoris muscle and the vastus lateralis, medialis and intermedius muscles in both lower limbs appeared normal. In each cadaver the left-sided muscle belly narrowed to a tendon at mid-thigh level before...
merging with the quadriceps tendon; in the male cadaver it also merged with the fascia overlying vastus medialis and lateralis. Quantitative measurements showed that the normal right-sided muscle belly in the male ended 31 cm from the anterior superior iliac spine (8 cm proximal to the base of the patella) and had a maximum width of 4 cm, compared to a length of 22 cm (terminating 17.5 cm proximal to the patella) and maximum width of 3 cm for the variant left-sided muscle. In the female, the normal muscle belly ended 29 cm from the anterior superior iliac spine and had a maximum width of 4 cm compared to 18 cm and 3 cm, respectively for the variant muscle. Therefore, in both cases the variant muscle belly was foreshortened by about 30-40% of normal.

Discussion
The frequency of a short rectus femoris muscle belly is unknown but the two senior authors have not previously encountered this variant in several hundred cadaver dissections. A short rectus femoris muscle is not just of academic interest since the availability of a full-length muscle is extremely useful as a pedicled flap in reconstruction of complex groin wounds [4]. The muscle flap is well known for its consistent anatomy [5].

We were unable to determine whether this was a congenital or acquired variant but given the normal appearances of the other quadriceps muscles and the absence of macroscopic scarring, it is unlikely that the short rectus femoris muscle was the result of previous injury. Rectus femoris strains are nondisruptive and usually resolve without noticeable asymmetry of the muscle; complete muscle rupture is rare and causes proximal retraction of the entire muscle belly [1].

The functional sequelae, if any, of a short rectus femoris muscle belly are uncertain. Plastic and reconstructive surgeons have reported variable mid-term outcomes after harvesting rectus femoris. In a controlled study of 20 such patients investigated almost three years postoperatively, Sbitany et al. [6] found a 21% reduction in isometric knee extensor strength in the operated limb compared to the contralateral normal limb and a 17% difference between dominant and non-dominant lower limbs in controls. The authors concluded that there was little deficit in quadriceps strength after use of a pedicled rectus femoris muscle flap. In contrast, in a smaller uncontrolled study, Daigeler et al. [5] found that maximal voluntary contraction was reduced by 22% compared to the non-operated limb, although the range of motion in the knee and hip was not affected.

Other variants of the rectus femoris muscle are rare but several have been described and are summarized in Table 1.

Table 1. Reported anatomical variants of rectus femoris.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Variant</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Origin</td>
<td>Accessory muscle slip arising from a tendon at the edge of the acetabulum and inserting into anterior surface of vastus lateralis</td>
<td>Bergman et al. [7]</td>
</tr>
<tr>
<td></td>
<td>A femoral head arising from the intertrochanteric line on the femur</td>
<td>Tubbs et al. [8]</td>
</tr>
<tr>
<td></td>
<td>Two heads arising from anterior inferior iliac spine</td>
<td>Macalister [9]</td>
</tr>
<tr>
<td></td>
<td>An additional origin from the anterior superior iliac spine joining the straight head</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Continuity of the acetabular and spinous heads</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Absence of the reflected head</td>
<td></td>
</tr>
<tr>
<td>Muscle belly</td>
<td>Fusion of vastus lateralis with the lateral border of rectus femoris</td>
<td>Macalister [9], Becker et al. [10]</td>
</tr>
<tr>
<td>Insertion</td>
<td>Variable arrangement of rectus femoris layer within the quadriceps femoris tendon</td>
<td>Waligora et al. [3]</td>
</tr>
<tr>
<td>Other</td>
<td>Union of vastus medialis and lateralis over the rectus femoris tendon</td>
<td>Macalister [9]</td>
</tr>
</tbody>
</table>

Figure 1. Right and left thigh dissections in a 92-year-old female showing a unilateral short rectus femoris (arrows) muscle belly on the left side.
Conclusion

We describe two cadavers with a unilateral short rectus femoris muscle belly. Several anatomical variants of rectus femoris have been reported but this particular variant has not been documented before. Clinically, it could affect the outcome of reconstructive operations using the pedicled rectus femoris muscle flap.

References


