

Bilateral absence of the tendinous intersections of the rectus abdominis muscle

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Abstract

The rectus abdominis muscle is well known to be segmented by tendinous intersections into a certain number of serially arranged compartments. The tendinous intersections are present only on the anterior aspect and fused with anterior sheath of the muscle. Since the rectus abdominis is used as a graft, there are lots of studies in the literature about the rectus abdominis muscle and its intersections. In the dissection of a 64-year-old man at the Department of Anatomy of Ege University Medicine Faculty, an anatomical form of the rectus abdominis muscle not described in the available literature was encountered. Both rectus muscles, right and left, were symmetrical but there were not any tendinous intersections on them. The total length of the muscle was 30 cm for both sides. The width at the umbilical level was 5.7 cm on the right side and 5.4 cm on the left side. The thickness of the muscle at the umbilical level was 0.5 cm for both sides. This previously unreported variation is very interesting for clinical approaches since the transverse rectus abdominis flap is an important reconstructive tool, particularly in reconstruction of the breast following mastectomy.

Key words: tendinous intersections; rectus abdominis muscle; rectus abdominis flap; breast reconstruction

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Introduction

The rectus abdominis muscle is well known to be segmented by tendinous intersections into a certain number of serially arranged compartments.¹⁻⁴ The tendinous intersections are present only on the anterior aspect and fused with anterior sheath of the muscle.² Since the rectus abdominis is used as a graft muscle, there are lots of studies in the literature about the rectus abdominis muscle and its intersections. The transverse rectus abdominis musculocutaneous (TRAM) flap has been developed and improved since its first description by Hartrampf et al. and Gandolfo in 1982.⁵ For this reason, anatomic variations of the rectus abdominis muscle may be interesting for surgical approaches especially in breast reconstruction.

Case Report

In the dissection of a 64-year-old man at the Department of Anatomy of Ege University Medicine Faculty in İzmir, an anatomical form of the rectus abdominis muscle not described in the available literature was encountered. This cadaver had no trace of scars and no adhesions or signs of trauma or operation. Both rectus muscles, right and left, were symmetric but there were not any tendinous intersections on them (**Figure 1**). The total length of the muscle was 30 cm for both sides. The width at the umbilical level was 5.7 cm on the right side and 5.4 cm on the left side. The thickness of the muscle at the umbilical level was 0.5 cm for both sides.

After this examination, the abdominal cavity was opened. The tendinous intersections were not observed

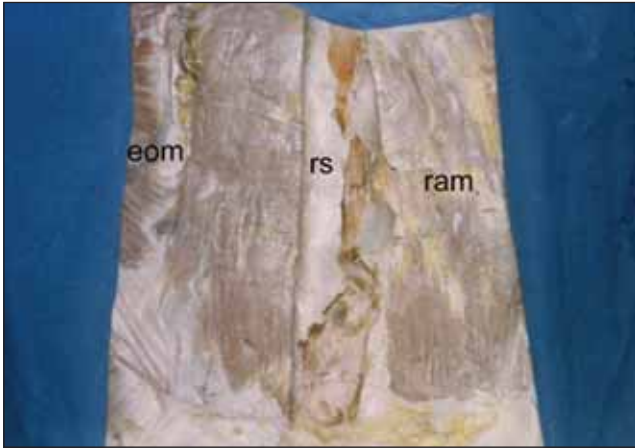


Figure 1. Bilateral absence of the tendinous intersections. eom: external oblique muscle; rs: rectus sheath; ram: rectus abdominis muscle)

on the posterior surface of the muscle also as usual. The courses of the intercostal nerves and blood vessels were normal. The origo and insertio of the muscle were expectedly also.

Discussion

This previously unreported case is very interesting for clinical approaches since the area of the rectus abdominis muscle is a frequent site of medical interventions of various kinds. The transverse rectus abdominis flap is an important reconstructive tool, particularly in reconstruction of the breast following mastectomy.^{4,6} Beside this, the pedicled rectus abdominis muscle flap is used in the treatment of complicated stress urinary incontinence.⁷ The other usages of the muscle are in reconstruction of chronic fascial palsy² and fecal abdominal stomas.⁸ Parrett et al. used the rectus abdominis musculocutaneous (RAM) flap as a treatment of lymphedema.⁹ The rectus abdominis muscle is advantageous in that¹ it is supplied by long nerves and long and large vessels,¹⁰ distance of contraction are appropriate,⁴ the tendinous intersections are suitable for anchoring sutures and¹¹ it is flat and consists of segments with appropriate lengths.² Since the rectus abdominis muscle is used as flap especially in plastic surgery, its anatomic variations have great importance for clinicians.

The anatomic variations of the rectus abdominis muscles in the available literature are related to their insertions, the composition of the human rectus sheath

and number and character of the tendinous intersections.^{1,11} The absence of the tendinous intersections described herein our cadaver was not reported before.

Drever reported a 39-year-old woman with Poland syndrome had total absence of external oblique muscle and hypoplasia of the rectus abdominis muscle on the left side. In place of the external oblique muscle, a thin-fascia like tissue continued around her flank with no evidence of muscle fibers. Also, the ipsilateral rectus abdominis muscle was close to half the width of that on the opposite side.¹²

Gryzybiak observed a tendinous portion of the rectus abdominis muscle. There were three tendinous intersections of the left rectus muscle in that case: the superior one was entire, irregular and oblique from the side toward the linea alba. Two incomplete intersections were visible only on the lateral side.¹

Three to four tendinous intersections are identified in each rectus abdominis muscle normally. Whetzel et al. studied the vascular anatomy of the tendinous intersections of the rectus abdominis muscle. The rectus abdominis muscle and intersections have been divided into separate numbered zones in that study. Zones 1, 3, 5 and 7 are muscle zones. Zones 2, 4 and 6 are the superior, middle and inferior tendinous intersections.^{2,4} They found lots of perforators for each tendinous intersections. The tendinous intersections in zones 4 and 6 had significantly greater perforator density than any muscle segment.⁴ Because of this reason, the tendinous intersections are important regions in approach to abdominal surgery.

Boyd et al. suggested that the transverse rectus abdominis flap would be more reliable if the skin paddle was based in the paraumbilical area because of the greater density of perforators in this region. The study of Whetzel et al. suggested that the perforators within the tendinous intersections were important to the blood supply of the anterior abdominal wall and to obtain optimal arterial supply, the design of TRAM flaps may be based on intersections location as well as paraumbilical location.⁴ But of course in such a case of us, it would be better to prefer the paraumbilical region because of the absence of the tendinous intersections.

Up to the 17th week of the prenatal life, rectus abdominis muscles of human fetuses have no tendinous intersections. They appear as late as between the 17th and 20th week of the fetal life.¹⁰ Since the tendinous intersections were found to appear as late as in the 17th week of the fetal life, mechanical factors in fetal life may have played a role for this variation during this period.

The tendinous intersections grow into the muscle from the anterior wall of the sheath.¹⁰ For this reason we did not expect to see them on the posterior surface of the muscle or in the muscle as well, when it was noticed that our cadaver had no tendinous intersections on the anterior surface of the rectus abdominis muscle.

Brown and McGill examined the deformations of the abdominal wall connective tissues, with a special focus on both the internal oblique aponeurosis and tendinous intersections of the rectus abdominis. The tendinous intersections were thought to function, at least in part, to provide strength to the rectus abdominis muscle by giving it anchor points along its length.¹³

According to our opinion although we did not observe any hernia in our cadaver, the absence of the tendinous intersections may be a possible predisposing factor for abdominal wall herniation because this anomaly may have weakened the anterior abdominal wall.

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