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ORIGINAL ARTICLE

Variants of latissimus dorsi with a perspective on tendon transfer surgery: an anatomic study

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Background: The latissimus dorsi (LD) is often used for tendon transfers to treat massive irreparable posterosuperior rotator cuff tears. The operation requires the LD tendon to be mobilized to reduce tension on the tendon. In that respect, any connection between the LD tendon and contiguous muscles may hamper tendon mobility and affect the surgical outcome. The goal of this study was to document the occurrence of connections between the LD and adjacent muscles and nerves.
Methods: We studied the scapular region on 48 embalmed cadavers. The skin and superficial fascia were removed according to Cunningham's manual of dissection, and the muscle was exposed.
Results: It was found that the LD and teres major (TM) muscles are connected by muscle fibers in 10% of the cadavers studied. Another vital discovery was that in some cadavers, the LD tendon was penetrated by a nerve.
Conclusion: Fascial connections between the LD and TM are well known, but these muscle links are comparatively unusual. From the results of this study, one should pay particular attention to muscle links between the LD and TM during dissection of the LD for transfer. It can also be suggested that during transfer surgery, the LD tendon should be cautiously examined for the possibility of a nerve penetrating it.
Level of evidence: Anatomy Study; Cadaver Dissection

Keywords: Latissimus dorsi; teres major; tendon transfer surgery; shoulder injury repair; rotator cuff tear; muscle link

The latissimus dorsi (LD) muscle has been the subject of frequent studies because of its potential applications in tendon transfer surgery.[18] It is a large muscle originating from T7 to T12 on the vertebral spine, the thoracolumbar fascia, the iliac crest, the lower 3 or 4 ribs, and the inferior angle of the scapula with a flat tendinous insertion to the floor of the bicipital groove as seen in Figure 1.[17] Because an LD graft is often used for tendon transfers in rotator cuff injuries or other shoulder injuries,[14] its relation to the adjacent nerves in the shoulder or scapular region becomes important. There are several reports of accessory muscle slips from the anterior aspect of the LD.[3,4,7,16] The transfer operation requires that the LD be released and mobilized to minimize tension.[11] Any connection between the LD tendon and adjacent muscles may limit tendon mobility. Furthermore, the relation of nearby neurovascular structures to the LD must be well understood before mobilization of the tendon for surgical procedures.[15] This study was performed on cadaver shoulders, looking at attachments

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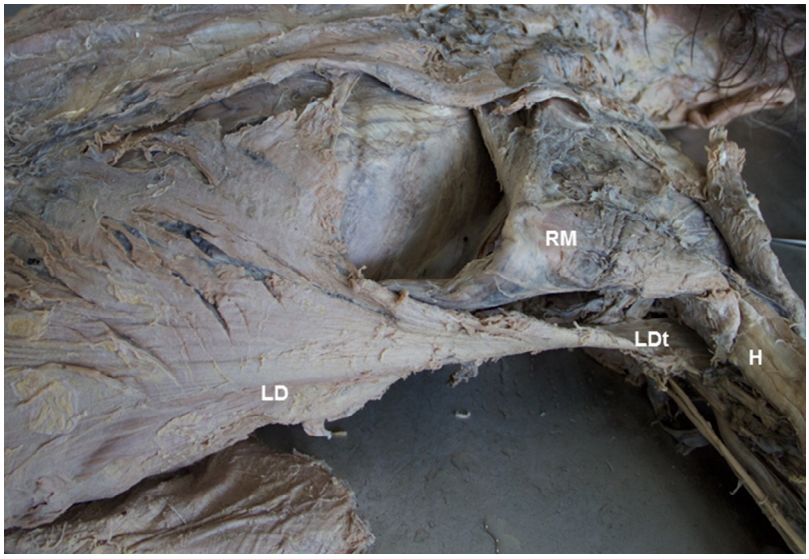

Figure 1 Posterior aspect of dissected right scapular region. *LD*, latissimus dorsi; *RM*, reflected rhomboid major; *LDt*, latissimus dorsi tendon; *H*, humerus.

of the LD and its relationship to adjacent neurovascular structures to document any variations from normal anatomy.

Materials and methods

This study was conducted on 48 embalmed cadavers. A skin incision was made, in the midline, from the level of the C7 vertebral spine to the level of the iliac crests. Two horizontal incisions were made at the upper and lower ends of the first incision. The skin was reflected from medial to lateral to expose the trapezius and LD. The upper border of the LD was defined, and the muscle was examined from medial to lateral toward its insertion for any variations.

Results

Muscle link between latissimus dorsi and teres major

Among the 48 cadavers studied, a muscle link between the LD and teres major (TM) was observed in 5 male cadavers (10%). It was on the left side in 3 cadavers and on the right side in 2 cadavers.

1. The muscle slip between the LD and TM in the right scapular region of 2 cadavers was about 5 cm long. It was a thick muscle link between the TM near its origin from the scapula and the musculotendinous junction of the LD (Fig. 2).
2. In one left scapular region, a thick muscle link between the LD and TM was observed. It originated from the scapula as well as from the proximal part of the TM and joined the upper border of the muscular part of the LD (Fig. 3).
3. In two left scapular regions, a thin muscle slip between the LD and TM was observed. This thin slip of muscle from the proximal TM joined the upper border of the muscular portion of the LD near the tendon origin (Fig. 4). It was about 4 cm longer.
4. In the remaining 43 cadavers, the typical attachment of the LD was found (Fig. 1). It originated from the inferior angle of the scapula, the spines of the lower thoracic vertebrae, the iliac crest, and the lower ribs. Subsequently, the muscle became flat and tendinous to insert into the floor of the bicipital groove in a spiral manner.

Nerve penetrating the latissimus dorsi tendon

Among the 48 cadavers studied, the LD tendon was penetrated by a nerve in 3 arms.

1. A communicating branch between the axillary and radial nerves was seen in the right axilla of a male cadaver. Here, a thick branch from the axillary nerve penetrated the upper part of the flat LD tendon, crossed the subscapular artery, and finally joined the radial nerve (Fig. 5).
2. A branch from the radial nerve penetrated a slip of the LD tendon and rejoined the radial nerve a little below the middle of the arm (Fig. 6).
3. In 1 cadaver, the LD tendon divided into 2 parts and inserted into the intertubercular area of the humerus with a gap in between. A branch of the radial nerve was near the upper slip, passed through the gap between the 2 slips, and rejoined the radial nerve at the inferior border of the lower tendon (Fig. 7).

Discussion

Both the LD and the TM are functionally related because they assist each other in adduction and internal rotation of the