ANOMALOUS INSERTION OF THE PECTORALIS MINOR MUSCLE: ULTRASOUND FINDINGS

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INTRODUCTION

The pectoralis minor muscle originates from the third, fourth and fifth ribs near their costochondral junctions and inserts on the medial and superior margins of the anterior portion of the coracoid process. It contributes to abduction of the scapulothoracic joint and downward movement of the shoulder (1). Anatomists from the 19th century have described anomalous insertions of this muscle with fibers extending passed the coracoid process to insert on the coracoacromial ligament, superior glenoid margin, medial margin of the supraspinatus tendon, glenohumeral joint capsule, humeral tuberosities, etc. In 1897, Le Double (3) described three subtypes:

1. Most frequently, the pectoralis minor tendon runs over the superior margin of the coracoid process to insert distally on multiple possible sites: supraspinatus tendon, coracoacromial ligament, greater or lesser humeral tuberosity, glenoid (fig. 1).

2. Less frequently, most of the pectoralis minor tendon inserts on the coracoacromial ligament with only a few fibers extending distally to insert on the coracoacromial ligament, supraspinatus tendon, or glenohumeral joint capsule (fig. 2).

3. Rarely, the entire tendon inserts on the glenohumeral joint capsule or humeral tuberosities (fig. 3).
Fig. 1: Le Double’s type 1, based on Samuel and Blanchard (2).

Fig. 2: Le Double’s type 2, based on Samuel and Blanchard (2).

Fig. 3: Le Double’s type 3, based on Samuel and Blanchard (2).

Fig. 4: a) Sagittal oblique T1-weighted MR image: coracohumeral ligament (arrowheads), coracoid process (arrow). b) Transverse oblique ultrasound (US) scan: elongated coracohumeral ligament (arrowheads) and the coracoid process (arrow) during external rotation of the humerus. c) Transverse oblique US scan: curved coracohumeral ligament (arrowheads) and coracoid process (arrow) during internal rotation of the humerus.

Fig. 4: a) IRM, séquence écho de spin T1, plan sagittal oblique, ligament coraco-huméral (pointes de flèches), processus coracoïde (flèche longue). b) Échographie, plan axial oblique, ligament coraco-huméral rectiligne et allongé (pointes de flèche), processus coracoïde (flèche longue). Rotation latérale de l’épaule. c) Échographie, plan axial oblique, ligament coraco-huméral curviligne (pointes de flèche), processus coracoïde (flèche longue). Rotation médiale de l’épaule.
Fig. 5: Anomalous insertion of the pectoralis minor muscle. a) Transverse oblique US scan demonstrates musculotendinous fibers (arrowhead) over the coracoid process (long arrow) in continuity with the pectoralis minor muscle (short arrows). The dynamic examination shows the fibers slipping over the coracoid process during external and internal rotation of the humerus. b) Coronal oblique T1-weighted MR image demonstrates the coracoid process (long arrow), the pectoralis minor muscle (short arrows) and its fibers over the coracoid process (arrowhead). c and d) Transverse oblique US scan (c) and coronal oblique T1-weighted MR image (d). Distal fibers of the pectoralis minor (arrowheads) following a trajectory identical to that of the coracohumeral ligament (Fig. 4). Coracoid process (arrow). e and f) Sagittal US scans. Transversal sections of the fibers of the pectoralis minor (arrowheads) over the coracoid process (arrows) (e) and over the distal segment lateral to the coracoid process in (f). g and h) Coronal oblique T1-weighted MR image parallel to the longitudinal axis of the pectoralis minor muscle (g) and sagittal oblique T1-weighted MR image perpendicular to the longitudinal axis of the pectoralis minor muscle (h). Pectoralis minor muscle fibers (arrowheads) with extension to the rotator interval (Le Double’s type 3).
According to Rouvière (4), from a phylogenetic perspective, the coracohumeral ligament is the result of fibrous involution of the distal (post-coracoid) fibers of the pectoralis minor muscle. In 1986, Weinstabl et al. (5) demonstrated continuity between the coracoglenoidal ligament and pectoralis minor muscle with muscle fibers running on the coracoid process in 16% of the 126 evaluated anatomical preparations. In 2000, Koets et al. (6) observed continuity between the tendon fibers of the pectoralis minor and coracoglenoidal ligament in 27 of the 34 evaluated anatomical preparations. In 2000, Turgut et al. (7) reported a case of bilateral insertion abnormality of the pectoralis minor muscle. The varied muscle was lying under the pectoralis major muscle and was medial to the pectoralis minor muscle. The thicker part of the tendon, similar to the anomalous insertion of the pectoralis minor tendon, ran over the coracoid process and inserted on the upper surface of the acromion. Sonography (US) enables detection of an anomalous insertion of the pectoralis minor muscle when it was possible to identify fibers running over the superior surface of the coracoid process during medial and lateral rotation of the shoulder, contiguous with the pectoralis minor muscle fibers located more medially and along a trajectory similar to that of the coracohumeral ligament located more laterally (fig. 5a-d). A sagittal US image enabled evaluation in a transverse plane of the muscular and tendinous fibers at the level of the coracoid process, musculotendinous junction, and distal course (fig. 5e and f).

MRI correlation was available for 4 shoulders, including SE T1W sequences parallel and perpendicular to the axis of the anomalous insertion of the pectoralis minor muscle (fig. 5b, d, g and h).

RESULTS

The distribution of the presence of an anomalous insertion of the pectoralis minor muscle with regards to gender, involved side, equipment used, and presence or absence of symptoms was analyzed with the help of a distribution table (descriptive evaluation) and differences were evaluated using the log-linear model ($p > 0.8$) and odds-ratio model.

An anomalous insertion of the pectoralis minor muscle was detected at US in 9.57% (58/606) of examined shoulders for a total of 40 patients (bilateral in 18 patients, unilateral in 22 patients). There was a statistically significant predominance for the left side (12.2% – 37/303) compared to the right (6.9% – 21/303) and for females (12.2% – 42/392) compared to males (4.7% – 10/214). There was no statistically significant correlation between the presence of the anomaly and clinical symptoms.

CONCLUSION

Using a visual criterion (observation of fibers sliding over the coracoid process) during medial and lateral shoulder rotation, an anomalous insertion of the pectoralis minor muscle was detected at US in 9.57% of examined shoulders. There was a female and left sided predominance and no significant correlation with clinical symptoms.

Acknowledgements

The authors wish to thank Mr. Walther Y. Ishikawa for help with the illustrations.

References