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Subscapularis minor — an analogue of the Teres minor?

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KEYWORDS
Shoulder; Rotator cuff; Subscapularis; Pseudoparalysis; Teres Minor; Greasy infiltration; Function

Summary

Introduction: The purpose of this study was to determine the role of the subscapularis (SSC) in forward flexion. We hypothesized that the inferior part of the SSC has a main role in the ability to preserve forward flexion in cases of anterosuperior rotator cuff tears.

Material and methods: Active forward flexion of the shoulder was prospectively evaluated in patients presenting with Grade 3 or higher SSC fatty degeneration, with superior and inferior SSC tears being evaluated separately.

Results: Thirty-two patients were enrolled in this study. Pseudoparalytic shoulders were found in 80\% of cases when the inferior part of the SSC was torn, but never when only the superior part was torn.

Discussion: The inferior SSC or “Subscapularis minor” can be considered as an analogue to the teres minor in the posterior aspect of the shoulder. It must be preserved in cases of tears and fatty degeneration of the superior part, and repaired when possible.

Level of evidence: Level II.

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Introduction

Rotator cuff tears are a common problem [1]. One or more tendons can be torn. A supraspinatus (SSP) tear can be complicated by an associated subscapularis (SSC) tear [2,3]. These are called anterosuperior rotator cuff tears. The associated SSC tear can either be complete or involve only the superior half of the SSC.

The SSC has been classically described as the largest muscle in the rotator cuff [4]. Anatomy, neurophysiology and biomechanics studies have shown that the superior and inferior parts of the SSC are different [5–9]. The purpose of this study was to determine the role of the SSC in forward flexion. We hypothesized that the inferior part of the SSC has a main role in the ability to preserve forward flexion in cases of anterosuperior rotator cuff tear.
Material and methods

Study population

Between 2008 and 2011, a prospective clinical and radiological study was undertaken at two institutions. The study was approved by the local ethics committee. Inclusion criteria were all patients presenting with a torn SSP and SSC (superior or inferior part), with Grade 3 or higher fatty degeneration [10] on axial CT images. The insertion of the tendon onto bone does not determine its function. The rotator cuff tendons can be detached from the bone but still be functional because of the rotator cable [11]. Conversely, they can still be attached but not functional [12]. From a methodological perspective, to avoid any bias and to make sure that the tendons involved were no longer functional, the study only included patients with Grade 3 or higher fatty degeneration. Exclusion criteria consisted of glenohumeral OA above Stage 3 (Hamada classification) [13]; stiffness with a deficit in passive range of motion; history of surgical procedure on shoulder; previous deltoid muscle injury or isolated SSC tear (inferior and superior SSC) [14].

Data collection

Clinical follow-up included measurements of passive and active shoulder motion. Patients with active forward flexion of less than 90° were deemed as having a pseudoparalytic shoulder [15]. All patients were filmed by two orthopedic surgeons. The images were reviewed twice. The anterosuperior rotator cuff tears were separated into two groups:

- Group A: tears of the SSP and superior SSC (superior SSC) (Fig. 1);
- Group B: tears of the SSP and the entire SSC (superior and inferior) (Fig. 2).

Figure 1  Group A: tears of the SSP and upper part of the subscapularis (SSC) (superior SSC).

Figure 2  Group B: tears of the SSP and the entire subscapularis (SSC) (superior and inferior).

Statistical analysis

The descriptive analysis consisted of frequencies and percentages for discrete data. Means and standard deviations were used for continuous data. Differences between the two groups were explored statistically using Tukey–Kramer multiple comparison analysis.

Results

This study included 32 patients, 16 men and 16 women with an average age of $67.7 \pm 8.2$ years (range, 50 to 84). The results are summarized in Table 1 and Figs. 3 and 4. Group A consisted of 10 cases with tears of the SSP and the upper part of the SSC (superior SSC) with an average forward flexion of 172°. No cases of pseudoparalytic shoulder were observed in this group (Fig. 4). Group B consisted of 22 cases with tears of the SSP and the entire SSC with an average forward flexion of 100°. In this group, 80% of the shoulders were pseudoparalytic (Fig. 4). The difference between Groups A and B was statistically significant ($P < 0.05$).

Discussion

The hypothesis is confirmed. The inferior part of the SSC has a major role in preserving forward flexion in cases of anterosuperior rotator cuff tears and preventing pseudoparalytic shoulder. However, this study could not determine if a tear gets worse over time. The tear could either naturally

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progress toward the inferior part or stop at the inferior part of the SSC. Since we observed cases of hypertrophy in the inferior part of the SSC, the second scenario seems most likely.

Anatomy, biomechanics and electrophysiology data also seem to support this scenario. Anatomical and biomechanical differences between the superior and inferior part of the SSC have been reported [5–9]. The SSC is described as being the largest muscle in the rotator cuff and as being stronger than the SSP, infraspinatus and teres minor combined [4, 16]. Macroscopically, the superior two-thirds of the SSC ends as a tendon that inserts on the lesser tuberosity of the humerus. The inferior part has no tendon; the muscle attaches directly to the bone, as with the teres minor on the posterior aspect of the humerus. In addition, the superior and inferior SSC are innervated by two different nerves [5, 6]. The superior part is innervated by the upper SSC nerve that comes directly from the posterior cord. The inferior part is innervated by the lower SSC nerve arising from either the axillary nerve or the thoracodorsal nerve. Furthermore, electrophysiology studies confirm this division and have shown different activity in the superior and inferior parts of the SSC [5]. Finally, different activation patterns in the two parts of the SSC were found during a positron emission tomography (PET) study [8].

Based on these elements, the SSC muscle, usually perceived as a single muscle, should be considered as two different muscles — inferior and superior. This distinction is not theoretical. The present study has shown that extension of the SSC tear into its inferior half results in a significant loss of forward flexion. Given its important role in preserving forward flexion, the inferior part should be repaired when feasible [17].

Conclusion

The inferior SSC or ‘‘Subscapularis minor’’ can be considered as an analogue to the teres minor in the posterior aspect of the shoulder. It must be preserved in cases of tears and fatty degeneration of the superior part, and repaired when possible.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

References


