Subscapularis tendon tears: A narrative review

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Abstract

The subscapularis muscle, which is the strongest muscle of the rotator cuff, plays important roles in shoulder biomechanics and stability. The emergence of a significant percentage of subscapular tendon tears in rotator cuff tears with advancing arthroscopic techniques has brought the importance of subscapular repair to the agenda along with different dynamics to the arthroscopic perspective. Patient training will reduce postoperative patient morbidity in addition to physical examination, imaging, and medical and surgical approaches to the treatment.

Keywords: M. Subscapularis Tendon, Shoulder, Arthroscopic Repair.

INTRODUCTION

The shoulder is a complex joint that has a complex network of bones, ligaments, muscles, and neurovascular anatomy along with a wide range of motion and functional requirements (1). The subscapularis muscle, which is the largest and strongest muscle of the rotator cuff, plays important roles in shoulder stability and function (2).

The subscapular muscle fills the subscapular fossa providing 50% of the total strength of the rotator cuff. It also plays roles with its triangular shape in balancing the force couples of the glenohumeral joint and in internal rotation and abduction of the shoulder (3). Its upper two-thirds attaches to the minor tuberosity as a tendon after passing under the coracoid, and its lower third attaches to the metaphysis of the proximal humerus as a muscle (4). The superolateral part of the subscapularis is in close relationship with the superior glenohumeral and coracohumeral ligament (5). The nerve subscapular innervates the subscapular muscle (6).

Subscapular tears are frequently detected in forced external rotation with abduction or forced extension (7). Subscapularis tears are more frequent than expected with the development of modern arthroscopic techniques and greatly affect the quality of life (8). Although isolated subscapular tears are frequent in the young population (4%) (9), subscapular tears are detected in 40% of shoulder cuff tears (4). In the present study, the clinical characteristics, diagnostic methods, treatment options, and rehabilitation procedures of subscapularis muscle tears, which affect the comfort of life significantly, are explained comprehensively.

Subscapularis Tears and Classification

Classifying the subscapular tendon tears is of prognostic importance for preoperative preparation and planning appropriate treatment. Many suggestions were offered in the past for the classification of subscapular tendon tears, but no strong decision has been reached yet. Some of these classifications are diagnostic in physical examination, some in ultrasonography, and some in CT arthrography. Yoo and Rhee, Fox and Romeo’s, Martetschlager, Lyon, Toussaint, Dierckman classifications are the classifications used in the repair of subscapular tendon tears (10). According to a survey that was conducted among elbow and shoulder surgeons in America in 2023, it was reported that the Lafosse Classification is more appropriate for the most appropriate diagnosis and treatment (11).

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>Partial tear and erosion on the superior third of the subscapularis</td>
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<tr>
<td>2</td>
<td>Complete detachment of the superior third of the subscapularis</td>
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<tr>
<td>3</td>
<td>Complete detachment of the superior two-thirds of the subscapularis without involvement of the inferior one-third muscular part (limited tendon retraction)</td>
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<tr>
<td>4</td>
<td>Complete subscapularis tear from the humeral insertion (well-centered humeral head and fatty infiltration involving less than or equal to grade 3 tear)</td>
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<tr>
<td>5</td>
<td>Complete subscapularis tear from the humeral insertion with humeral head anterosuperior subluxation and contact with the coracoid (associated with fatty infiltration)</td>
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<tr>
<td>Plug</td>
<td>Isolated deep layer SC tendon tear (for visualization it is required to elevate the subscapularis tendon by the probe)</td>
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The Etiology of Subscapular Tendon Tears

Many subscapular tears occur as a result of a strong contraction in sudden accidents and traumas (13). Partial or complete tears might occur as a result of repetitive chronic overuse, especially in manual workers and athletes (14). Non-traumatic tears might occur as a result of decreased elasticity in muscle tissue with advancing age (15). Biomechanical abnormalities (16) and inadequate body alignment (17) cause potential tears over time and genetic predisposition (18) plays important roles in this respect. In the shoulder joint, inflammatory conditions (e.g., tendinitis and bursitis) can weaken the subscapular tendon and cause ruptures if not managed well (19).

Another approach is that the subscapularis tendon increases the tensile loads on the joint surface, causing tension undersurface fiber failure at the subscapularis insertion. Subcoracoid stenosis and subcoracoid impingement contribute to the pathogenesis of subscapularis tendon tears by causing a “roller-wringer effect” on the subscapularis tendon (20).

The Symptoms of Subscapular Tendon Tears

The presence of pain increasing with internal rotation or overhead exercises is a characteristic indicator of
subscapularis tears (21). Subscapularis injuries might result in a limited range of motion in the abduction and internal rotation. Patients might also face difficulties in raising their arms above their heads or feel discomfort while doing certain actions. Determining the degree of mobility restriction facilitates determining the extent of the tear (13). Patients might encounter pain within a defined range of movement, commonly during the middle phase of moving the limb away from the body and rotating it outward. Identifying the specific range of movement that causes discomfort helps to determine the damaged structures and direct additional diagnostic investigations (22). Some persons experiencing subscapularis tears might have a perception of catching or clicking in the shoulder joint when performing specific movements. These sensations might suggest the presence of structural problems and can help direct additional diagnostic tests (23). Commonly, clinical examinations reveal tenderness in the anterior shoulder region, particularly localized over the subscapularis muscle. By palpating this region, the clinician can pinpoint the origin of pain and discomfort, hence enhancing the precision of the diagnosis (21). An indicative indication is the exacerbation of pain during nighttime, especially when reclining on the afflicted shoulder. Nocturnal pain can greatly affect the quality of sleep and is frequently an indication of an underlying subscapularis disease (24). Subscapularis rips can lead to muscular atrophy in circumstances that are persistent or severe. Measurable alterations in muscle size, specifically in the front region of the shoulder, can suggest the presence of long-lasting or significant injuries (25).

**Physical Examination Findings and Imaging Techniques**

Detailed anamnesis, physical examination, and imaging make up the pillars of diagnosis in patients presenting with shoulder complaints. Physical examination and imaging are a whole. It is argued that only imaging without physical examination might not be compatible with the actual treatment and might cause unnecessary and excessive treatment modalities to be applied (26). The functionality of the subscapularis is evaluated with the Dynamic Lift-Off Test, bear-hug test, and Belly Press Test performed during the physical examination (27). Among these tests, the bear-hug test can be considered the most likely clinical test to detect a tear in the upper part of the subscapularis tendon. Performing all subscapularis physical examination tests at the same visit is useful in estimating the size of the tear (28). Long biceps head tendon sheath effusion >2 mm on USI (29), subscapularis tendon tear from the lesser tuberosity in the axial plane on Magnetic Resonance Imaging (MRI), Long Head of the Biceps (LHB) tendon subluxation, subscapularis muscle belly atrophy in the sagittal plane, torn subscapularis fibers and bare lesser tuberosity are important findings in subscapular tendon ruptures (11). Bone marrow edema, cysts, and fat atrophy in the tuberculum minor are the symptoms of chronic tears (30). In addition, although no subscapular tear is seen in the MRI findings of patients whose surgery is planned due to rotator cuff tear, the presence of subcoracoid effusion should bring to mind intraoperative subscapular evaluation (31).

No doubt, the best imaging is Shoulder Arthroscopy, which serves both diagnosis and treatment simultaneously (32). When the Comma Sign is in the upward retraction of the superior glenohumeral ligament and coracohumeral ligament, it is an important symptom in full-thickness subscapular tears in arthroscopy (33).

Artificial intelligence and machine learning algorithms have attracted great attention in recent years as a promising, innovative approach to diagnosis (34). According to a machine learning study conducted for the diagnosis of subscapular tendon tears, it was found that MRI alone was successful in predicting subscapularis tears in 85% of patients, and this machine learning increased the accuracy and sensitivity in diagnosis (35). However, advanced and large-scale studies on machine learning are still needed.

**Treatments**

Less active, older patients with smaller atraumatic tears should first enter a conservative treatment plan consisting of physical therapy, anti-inflammatories, and activity modifications (36). Shoulder joint strengthening exercises and electrical stimulation help increase range of motion and NSAIDs can provide both physiopathological and symptomatological relief for inflammation (37, 38). The patient must be shown which movements to avoid (21). Corticosteroid injections might be utilized because of their anti-inflammatory characteristics. Injected directly into the subacromial region or shoulder joint, these injections offer brief alleviation of discomfort and inflammation. It should be kept in mind that there may be atrophy in the muscle, and it should not be forgotten that it may pave the way for new tears in the tendon (39, 40). Platelet-Rich Plasma (PRP) and Stem Cell Therapy are widely
preferred in biological interventions today. PRP injections entail the utilization of concentrated platelets from the patient’s own blood to promote the process of healing. This regenerative method has the potential to enhance tissue healing in instances of subscapularis rips (41, 42). Stem cell therapy investigates the regenerative capacity of stem cells to assist in the restoration of damaged tissues. Ongoing research in this field shows promise for treating subscapularis injuries (43, 44). While symptomatic relief is observed in conservative treatments, it should be kept in mind that complete recovery may not occur and the patient should be informed about this. In addition, conservative treatments have a lower success rate and are not cost effective compared to the surgical approach (45).

Patients unresponsive to conservative treatment may be candidates for surgical intervention. Early surgical intervention in patients with traumatic tears will likely yield better outcomes (46). Arthroscopic repair is performed in the surgical approach by suturing the subscapular tear under the guidance of an arthroscope (44). Open repair can be performed for specific anatomical factors with a large incision, but postoperative recovery time might be prolonged (47). In arthroscopic repair, the typical posterior portal is necessary in addition to the anterosuperior and anterior portals for arthroscopic surgery to repair the subscapularis. First, a portal is established on the anterolateral side. The ideal position and alignment of the portal should be parallel to the subscapularis fibers at a certain angle, enabling access to the tuberculum minus of the humerus for suturing purposes (48). Through examination of the biceps tendon is necessary during surgery. If it is determined to be required, pathological tendons can be treated with either total tenotomy or tenodesis. Medial subluxation should be assessed in non-pathological tendons (49). Due to the subscapularis tendon’s attachment site providing anterior support to the biceps long head groove, dislocation of the biceps long head tendon can exert pressure on the subscapularis tendon, resulting in repair failure. If faced with such a circumstance, biceps tenotomy or tenodesis may be suitable options (50).

The coracoid prominence is readily identifiable since it is positioned just at the center of the anterior portal entry and directly above the subscapularis tendon (51). The axillary artery and vein, long thoracic nerve, and brachial plexus are located nearby (52). Furthermore, one may see the presence of compound tendons originating from the short head of the biceps and coracobrachialis, together with the attachment of the pectoralis minor muscle (53). Burkhart suggests that in cases of partial tear of the subscapularis muscle, coracoplasty can be performed by establishing a window in the rotator interval. It is important to maintain the integrity of the biceps’ medial tether and the superior glenohumeral ligament (SGHL) throughout this treatment (54).

The objective of coracoplasty is to establish a coracohumeral spacing of 7-10 mm, hence reducing friction during the subscapularis healing process (55). Following complete tears, the subscapularis muscle will progressively retract over a period of time. In instances of severe retraction, it is possible for it to have shifted medially to the extent of the glenoid labrum (21). This adds complexity to the process of selecting the allocation for tenodesis during subscapularis repair. In such instances, the “comma sign,” as elucidated (32). The comma sign denotes the superolateral surface where the subscapularis tendon is distinguished from the humeral head. In essence, it is a leftover part of the middle connection of the biceps muscle (56).

Postoperative physical rehabilitation must be planned according to the type of the subscapularis tear and individual characteristics for the regeneration of strength, flexibility, and functional movements (57). For proactive prevention in physical rehabilitation, shoulder conditioning, effective preparatory exercises and flexibility training, and gradual progressive activities will improve shoulder multifaceted function (58). Periodic checks along with pain management will optimize patient outcomes.

Declarations
The authors have no conflicts of interest to declare. The authors declared that this study has received no financial support. Ethics committee approval is not required

REFERENCES


