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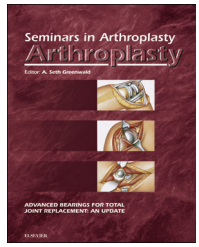

Clinical tests for subscapularis integrity: A "hole" in one?

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ABSTRACT

Thorough physical examination is especially important in the diagnosis of subscapularis tears; given that many tears are missed on MRI evaluation. The belly-press test may be the best test in cases where internal rotation is limited, while the belly-off sign is very sensitive for partial subscapularis tears as long as the external rotators are intact. The internal rotation lag sign, followed by the lift-off test, is the most sensitive test for predicting complete deficiency of the subscapularis when range of motion is not limited.

1. Introduction

The subscapularis muscle is one of the four rotator cuff muscles and it covers the anterior shoulder. The subscapularis is a large muscle and tendon with a superior rolled edge. In the normal shoulder, the function of the subscapularis muscle is to terminally internally rotate the humerus in the adducted position. The normal subscapularis also acts in coordination with other muscles to stabilize the shoulder in external rotation and in extension of the humerus [1].

Patients with subscapularis tears often report anterior shoulder pain and weakness but typically do not have overt shoulder instability [2]. Subscapularis dysfunction leads to weakness in internal rotation, but more importantly, it can lead to decentering of the humerus and altered biomechanics that manifest initially as anterior shoulder pain. Subscapularis function has a special relevance after total shoulder arthroplasty because it is cut during the deltopectoral approach to the shoulder.

Subscapularis tears are less common than other types of rotator cuff tears and often occur in conjunction with tears in the other rotator cuff muscles or lesions in the long head of the biceps tendon [3,4]. Making the diagnosis even more challenging is that tears of the subscapularis can be missed on MRI scans up to 40% of the time but are later confirmed on arthroscopic examination [3,5,6]. Thus, high suspicion and thorough physical examination are especially important in the diagnosis of subscapularis tears.

The clinical challenge of the physical examination of the subscapularis is to isolate subscapularis function from the surrounding muscles that work in a similar fashion, including the pectoralis major, the pectoralis minor, and the latissimus dorsi. Concomitant tears of other rotator cuff muscles can make isolated physical examination of the subscapularis difficult. Further, confounders for evaluation of the subscapularis include restricted internal rotation from glenohumeral arthritis, residual stiffness after total shoulder arthroplasty, or decreased anteversion after prosthetic replacement.

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There are several important physical examination maneuvers that should be done for the assessment of subscapularis integrity. The most common tests of the subscapularis are the belly-press test, the belly-off sign, the bear-hug sign, the lift-off test, and the internal rotation lag sign.

2. Clinical tests for subscapularis function

2.1. *Belly-press test*

The belly-press test is performed by having the patient place the palm of the hand onto the stomach, then asking the patient to keep the elbow forward while pressing the hand into the stomach. A belly-press test is abnormal if the elbow falls back, as the patient tries to put posterior pressure on their stomach (Fig. 1). The degree of hand movement can be subtle, so it is often helpful for the examiner to place a hand between the patient's stomach and hand while placing the other hand in front of the patient's elbow to feel any weakness present. A belly-press test is abnormal if the elbow falls back because the patient cannot generate sufficient internal rotation force to push the hand into the stomach, indicating rupture of the subscapularis.

The belly-press test has been validated and is specific for evaluation of the subscapularis muscle [7]. Using electromyographic evaluation, the belly-press test was found to activate the upper subscapularis muscle significantly more than the lift-off test ($P < 0.05$) [7]. The upper border of the subscapularis tendon is the most common location for a partial tear of the subscapularis, indicating that most complete tears often start in this location [4]. A different EMG test confirmed that the belly-press test successfully isolates both the upper and lower portions of the subscapularis muscle from the pectoralis major and latissimus dorsi in healthy volunteers [8]. In an arthroscopic correlation study, the belly-press test (or Napoleon test) predicted complete tears 89% of the time but could not reliably predict partial tears [9].

A relative advantage of the belly-press test and the belly-off sign over other maneuvers is that internal range of motion is not required. In six cases (12%), the lift-off test and the internal rotation lag sign could not be performed due to a painful restricted range of motion [10]. In one study, the lift-off test could not be performed reliably 75% of the time due to pain and restrictions in function [9].

2.2. *Belly-off sign*

The belly-off sign is the inability of the patient to maintain the palm of the hand attached to the abdomen, while the arm is passively flexed. One study found that the belly-off sign was more reliable than any other diagnostic test or sign, including the belly-press test, internal rotation lag sign, and lift-off test, in detecting partial tears of the subscapularis tendon, even in combination with complete supraspinatus tendon tears, and in detecting postoperative subscapularis insufficiency manifested as mild atrophy of the upper aspect of the subscapularis muscle. In cases of complete subscapularis tears with or without concomitant rotator cuff tears, the belly-off sign was as reliable as the other tests. However, in cases of external rotator deficiency, the belly-off sign was non-diagnostic. The authors concluded that the belly-off sign is attributable to an unbalanced transverse force couple with overwhelming of the external rotators of the shoulder [11].

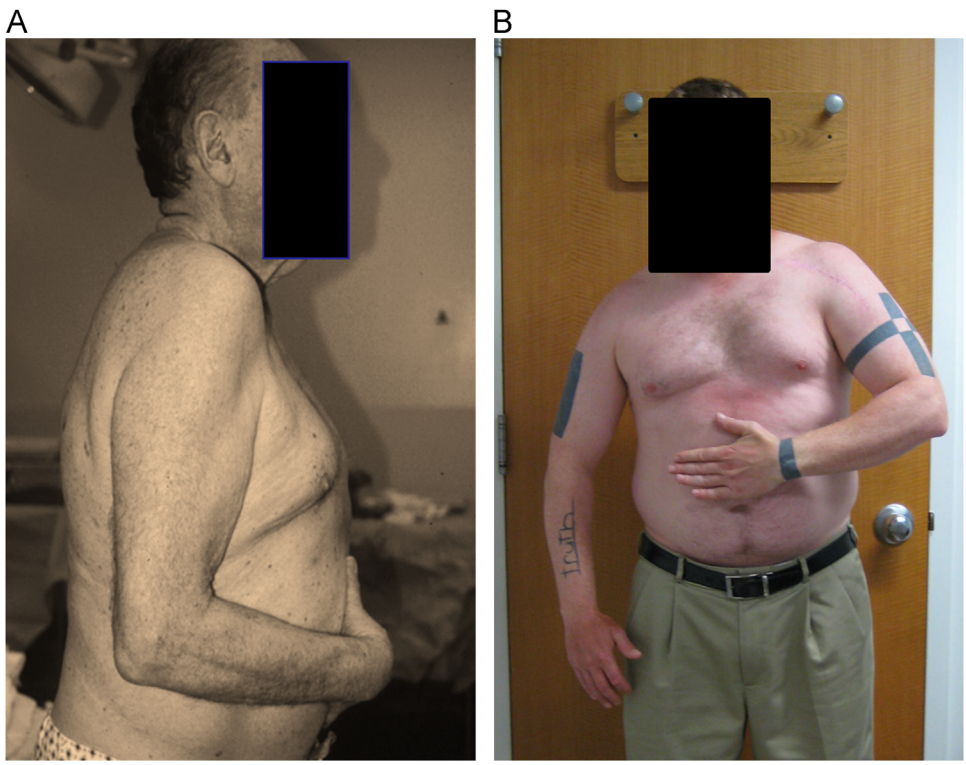

Figure 1 – (A) Clinical photo of a positive belly-press sign, indicating subscapularis dysfunction. In contrast, the second clinical photo (B) shows the appearance of a normal belly-press maneuver.