

Transdeltoid palpation (the rent test) in the diagnosis of rotator cuff tears

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The purpose of this study was to assess the diagnostic accuracy of transdeltoid palpation (the rent test) for the diagnosis of full thickness rotator cuff tear. Clinical and arthroscopic findings were documented prospectively for 109 consecutive patients undergoing shoulder arthroscopy by the senior author. A retrospective analysis was then performed on these data to assess the accuracy of transdeltoid palpation in the diagnosis of full thickness rotator cuff tear. Transdeltoid palpation was found to have a sensitivity of 95.7% and a specificity of 96.8% for the diagnosis of full thickness rotator cuff tear. The positive and negative predictive values for transdeltoid palpation were 95.7% and 96.8%, respectively. Overall, the diagnostic accuracy of transdeltoid palpation was 96.3%. We conclude that transdeltoid palpation is highly accurate for the clinical diagnosis of full thickness rotator cuff tear. (J Shoulder Elbow Surg 2001;10:470-3.)

INTRODUCTION

Codman^{3,4} first described the palpation of full thickness rotator cuff tears. He described the ability to palpate a "sulcus" produced by a rent in the supraspinatus tendon. Subsequently, McLaughlin¹¹ noted that a cuff rupture could be palpated with reasonable certainty in a great majority of cases. Lyons and Tomlinson⁹ attempted to correlate clinical palpation of the rent with the size of tear found at surgery. They found the sensitivity and specificity to be 91% and 75%, respectively, in a population of 42 patients. They also confirmed, as previously noted by Codman,⁴ that the estimate of the size of the tear based on clinical palpation is not completely accurate. The senior author (E.M.W.) has used transdeltoid palpation in his practice since 1992 with great reliability. We studied a group of consecutive patients undergoing shoulder arthroscopy to assess the accuracy of transdeltoid pal-

pation in the clinical diagnosis of full thickness rotator cuff tears.

MATERIALS AND METHODS

Technique of transdeltoid palpation

The technique of transdeltoid palpation as originally described by Codman⁴ (Figures 1 and 2) requires a relaxed patient. Palpation is performed anterior to the anterior margin of the acromion through the deltoid. The patient is asked to relax, allowing the arm to dangle freely. While positioned behind the patient, the examiner holds the patient's forearm with the elbow flexed to allow rotational control in order to maneuver the arm while the examiner's other hand is used for palpation. The arm is gently maneuvered into full extension. Internal and external rotation is used to palpate the rotator cuff tendons. In the presence of a tear, both an eminence and a rent are palpable. The tear is palpated as the arm is brought in and out of full extension and internally and externally rotated. The eminence represents the prominent greater tuberosity in the presence of a full thickness rotator cuff tear. The rent is the soft tissue defect created by the rotator cuff that avulsed from the tuberosity. The size of the tear is appreciated by palpating the anterior and posterior margins of the cuff tear and the presence of an avulsed edge. Failure to palpate an avulsed edge is indicative of significant retraction.⁴ The examination should be performed bilaterally to appreciate the anatomy of the uninvolved shoulder and to compare it with the symptomatic side.

Methods

One hundred nine consecutive patients undergoing shoulder arthroscopy for diagnoses related to shoulder pain and weakness (eg, impingement and rotator cuff tear) were evaluated during the period of August 1999 to September 2000. The study group consisted of 42 women and 67 men. All examinations and procedures were performed by a single surgeon. All patients were examined before review of accompanying diagnostic studies in order to remove bias. A retrospective chart review was carried out documenting the clinical, surgical, and magnetic resonance imaging (MRI) (if available) findings. These data were tabulated, and sensitivity, specificity, positive and negative predictive values, and diagnostic accuracy were calculated for each criterion.

RESULTS

The patients' ages ranged from 29 to 86 years (mean, 51.2 years). There were 42 female patients and 67 male patients. The sensitivity, specificity, posi-

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Figure 1 Position of hands for examination of shoulder. (Reprinted from Codman EA. *The shoulder: rupture of the supraspinatus tendon and other lesions in or about the subacromial bursa*. Chapter V. Original edition. Boston: Thomas Todd; 1934. p. 123-77. Reprint edition. Melbourne [FL]: Krieger; 1984. With permission.)

Figure 2 Tip of finger palpating eminence and rent. (Reprinted from Codman EA. *The shoulder: rupture of the supraspinatus tendon and other lesions in or about the subacromial bursa*. Chapter V. Original edition. Boston: Thomas Todd; 1934. p. 123-77. Reprint edition. Melbourne [FL]: Krieger; 1984. With permission.)

tive and negative predictive values, and diagnostic accuracy were calculated for transdeltoid palpation (Table I). The sensitivity, specificity, positive and negative predictive values, and diagnostic accuracy of MRI in the diagnosis of full thickness rotator cuff tear was also evaluated in those patients who had an MRI performed (Table II).

Of the 109 patients, 46 had full thickness rotator cuff tears documented at arthroscopy. Transdeltoid palpation identified 44 full thickness tears, for a sensitivity of 95.7%. Sixty-three patients had diagnoses (eg, partial thickness tear, impingement, or acromioclavicular arthritis) other than full thickness rotator cuff tear documented at arthroscopy. The results of 61 of these patients were negative for full thickness tear per transdeltoid palpation, for a specificity of 96.8%. Transdeltoid palpation failed to identify 2 patients who had a full thickness tear at arthroscopy and also falsely identified 2 patients who had other diagnoses at arthroscopy, giving positive and negative predictive values of 95.7% and 96.8%, respectively. Diagnostic accuracy (True positive + True negative/Total patients) for transdeltoid palpation was 96.3% (Table I). Seventy-one patients had an MRI scan performed. Results of the MRI were evaluated independently of the clinical examination to remove bias. Of these 71 patients, 33 had a full thickness tear documented at arthroscopy. Thirty-four patients had MRI results that were positive for the diagnosis of full thickness tear. Thirty-seven patients had MRI results that were negative for full thick-

ness tear. Three patients with MRI findings other than full thickness tear had a full thickness tear at arthroscopy. Four patients with MRI findings consistent with full thickness tear had other findings at arthroscopy. The sensitivity of the MRI for full thickness tear in this group was 90.9%, and the specificity was 89.5%. The positive and negative predictive values were 88.2% and 91.9%, respectively. The diagnostic accuracy of the MRI for full thickness tear was 90.1% (Table II).

DISCUSSION

Many tests are available today for the diagnosis of full thickness tear of the rotator cuff. These include both imaging modalities and physical examination. Imaging modalities include plain radiography, ultrasonography, contrast arthrography, computed tomography, and MRI. In a study of patients with proven rotator cuff tears, plain radiographs were found to have good sensitivity but poor specificity for rotator cuff tear.⁵ Ultrasound, arthrography, and computed tomography have largely been replaced by MRI. MRI has become an increasingly popular imaging modality and is highly accurate in making the diagnosis of full thickness tear of the rotator cuff.^{1,6,8} MRI in this group was performed at multiple locations with a variety of protocols, examiners, and equipment. Nevertheless, a survey of the diagnostic accuracy for MRI in this group of patients demonstrated results consistent with those previously reported.^{1,6,8}

Table I Transdeltoid palpation data

	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Diagnostic accuracy
Transdeltoid palpation	95.7%	96.8%	95.7%	96.8%	96.3%

Table II MRI data

	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Diagnostic accuracy
MRI	90.9%	89.5%	88.2%	91.9%	90.1%

Several signs and symptoms have been described for the clinical diagnosis of full thickness rotator cuff tear. These include the Hawkins and Neer impingement signs, the dropping and hornblower's signs, the lag signs of Hertel, weakness, and loss of active motion. Although the Hawkins and Neer impingement signs had a sensitivity of 88% and 85%, respectively, for rotator cuff tear, they had low specificity and low positive predictive values.¹⁰ The dropping and hornblower's signs were evaluated by Walch et al¹³ and were found to be highly sensitive and specific for fatty degeneration of the infraspinatus and teres minor, respectively, as diagnosed with computed tomography. However, no surgical correlation with regard to the status of the tendons was available.¹³ Hertel et al⁷ evaluated the diagnostic accuracy of Jobe's sign and the lag signs for rupture of the rotator cuff. The diagnostic accuracy for complete rupture of the rotator cuff was 77% for Jobe's sign, 42.5% for the external rotation lag sign, and 78.1% for the drop sign. Ben-Yishay et al² found no significant differences in testing range of motion or strength based on presence or absence of rotator cuff tear.

Our goal was to determine the diagnostic accuracy of transdeltoid palpation as originally described by Codman,^{3,4} correlated with the findings at shoulder arthroscopy. To date, this is the largest study evaluating the utility of transdeltoid palpation with arthroscopic correlation. Lyons and Tomlinson⁹ reported their results with clinical palpation with respect to size of cuff tear. They found clinical palpation to have a sensitivity, specificity, and diagnostic accuracy of 91%, 75%, and 88%, respectively. However, they evaluated 42 patients, with only 6 who had negative findings for full thickness tear in the group. The relatively small group of patients evaluated without a rotator cuff tear may explain the reduced specificity and accuracy in their study. As echoed by Codman,⁴ McLaughlin,¹¹ and Lyons and Tomlinson,⁹ transdeltoid palpation does

require some experience to utilize reliably. Codman provides an elegant and detailed description of the clinical signs and symptoms associated with rotator cuff tears.⁴ Our own clinical experience echoes his description.

Given the nature of our practice referral patterns, only a few of the patients were seen acutely after an injury. However, we noted no increased difficulty with palpation in these patients. We have found the technique a bit more challenging in patients with a thick adipose layer surrounding the acromion. They require careful bilateral palpation with constant passive motion for the technique to be reliable. We have found that a relaxed patient is the most important criterion for successful palpation. Palpation is performed at the anterior margin of the acromion, making successful palpation possible even in heavily muscled patients. A standing position with a relaxed posture allows easier manipulation of the arm for successful transdeltoid palpation. In addition, successful palpation requires full hyperextension of the glenohumeral joint with control of the arm to allow passive internal and external rotation. Although synovial fluid collection in the subacromial bursa has often been discussed, we have only found it to be present in patients with a clinical picture consistent with rotator cuff arthropathy. Consistent with the findings of Codman⁴ and Lyons and Tomlinson,⁹ we found that transdeltoid palpation provides only a reasonable indication of tear size (ie, small vs large). Patients with chronic impingement and atrophied, yet continuous, cuffs can also present a challenge. With experience, this situation can be readily differentiated from both a full thickness tear and an alternate source of pathology such as calcific tendinopathy. Full thickness tears have not only a prominent eminence (the greater tuberosity) but also the rent and the tender, avulsed edge of the tendon. In the partially torn or atrophic cuff, tenderness and an eminence may be palpated but the rent is less

prominent. In the case of calcific tendinopathy, the calcific deposit in the cuff is tender. However, the rent is again absent. Codman referred to the palpable defect as a sulcus in the cuff. Because the term sulcus has been used to describe abnormal inferior translation of the glenohumeral joint in multidirectional instability,¹² we have referred to the transdeltoid palpation of rotator cuff tears as the rent test.

Small, nonretracted full thickness defects in the rotator cuff and partial tears with predominantly articular surface involvement are more difficult to detect with the rent test. Significant bursal surface tears lack continuity, are more superficial, and are thus more readily palpable. As noted previously, full extension and rotation are necessary for successful palpation. We have not noted any significant learning curve for the rent test when introduced to residents and fellows. We found that bilateral evaluation and routine evaluation of all shoulder patients allowed us to formulate a better sense of the intact cuff, making palpation of diseased cuffs more reliable. Patients with a limited range of motion and extensive deltoid scarring due to multiple prior procedures can be difficult to assess. Despite these limitations, we have found the rent test to be of great clinical value, and it compares favorably with imaging modalities. The rent test is non-invasive, cost free, and highly accurate in the diagnosis of full thickness rotator cuff tears.

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