



The External Rotation Test in the Diagnosis of Adhesive Capsulitis

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abstract

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This article evaluates the effectiveness of the external rotation test in diagnosing capsulitis. The test is performed with the upper arm in a neutral position at the patient's side and the elbow in 90° of flexion. The test is positive when pain is produced with this maneuver. All patients (379) evaluated for atraumatic shoulder pain during 1 calendar year were studied. The patients were divided into external rotation positive (91 patients) and external rotation negative (311 patients) groups. Patients with atraumatic shoulder pain with a positive external rotation test were presumed to have adhesive capsulitis in the absence of glenohumeral arthritis. Patients diagnosed with adhesive capsulitis received an intra-articular steroid injection and a home therapy program. Patients were contacted 10 to 19 months following treatment to determine their status and need for any further care.

A diagnosis of adhesive capsulitis was made in 75% of external rotation positive patients (68 patients). Glenohumeral arthritis evidenced by radiographs was the only other diagnosis that produced a positive external rotation test (23 patients) in this group of atraumatic shoulders. Only 1 of 68 patients (1.4%) with a diagnosis of adhesive capsulitis (external rotation positive) had surgery during the follow-up period. However, 86 of 311 (27.7%) patients in the external rotation negative group underwent surgery ($P < .0001$). In the external rotation positive group, 3 patients (5%) sought second opinions, while 95% (55/58) sought no further care.

Our data suggest that patients with a history of atraumatic shoulder pain and a positive external rotation test on examination should be considered for adhesive capsulitis in the absence of glenohumeral arthritis.

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Adhesive capsulitis is frequently seen in orthopedic practice. Its prevalence has been reported to be approximately 2% in the general population and as high as 30% in patients with diabetes and other endocrinopathies.¹ The pain, limited motion, and subsequent functional limitations associated with the varying phases of adhesive capsulitis have been well described.¹⁻⁴ In its earliest phase (capsulitis), glenohumeral motion may be unaffected and symptoms are related primarily to pain, as opposed to stiffness. It is during this early inflammatory phase, when motion is normal or nearly normal, that a diagnosis of capsulitis could be easily overlooked by even the most experienced examiners.

While numerous clinical tests have been proposed for evaluation of shoulder pathology, none have been noted to be diagnostic of adhesive capsulitis.⁵ This article describes and evaluates the effectiveness of the external rotation test (painful external rotation with the upper arm in a neutral position at the patient's side and the elbow in 90° of flexion) as a means of diagnosing adhesive capsulitis, even in its early inflammatory stage when the range of motion (ROM) has yet to be significantly impacted.

MATERIALS AND METHODS

Patients

The charts of all new patients presenting to the senior author's (E.M.W.) practice with a chief report of shoulder pain during the calendar year 2007 were reviewed. Patients with a history of any significant trauma were excluded, as were patients seen at any time previously for shoulder pain. Three hundred seventy-nine patients met the inclusion criteria.

The average age of patients available for follow-up was 53 years (range, 18-84 years). The average age of patients diagnosed with adhesive capsulitis was 55 years (range, 33-71 years). Twenty-eight men and 30 women were diagnosed with capsulitis, and no appreciable differences

were seen with regard to hand dominance (29 dominant, 29 nondominant).

Clinical Evaluation

The history of these patients was non-traumatic shoulder pain of gradual or sudden onset. The physical examination of a new patient with shoulder pain was comprehensive. The glenohumeral joint was evaluated for rotator cuff pathology (impingement, weakness, tenderness, and transdeltoid palpation for cuff irregularity or defect [Rent test]), instability (apprehension, relocation, drawer, and sulcus signs), superior labral anterior-posterior (SLAP) lesions (O'Brien's test, abduction, and external rotation), and biceps pathology (Yergason's test).^{5,6}

The external rotation test was performed with the upper arm in a neutral position at the patient's side and the elbow at 90° of flexion. The examiner stood next the patient on the involved side and gently externally rotated the forearm while maintaining the neutral position of the upper arm. The external rotation test was considered positive if pain was produced with gentle passive external rotation (Figure). The degree of painful limitation of motion was recorded

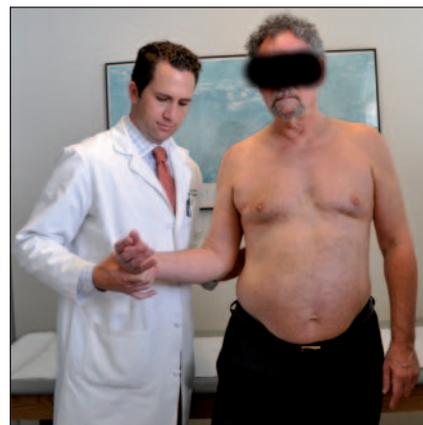


Figure: The external rotation test is performed with the upper arm adducted to the side and the elbow at 90° of flexion. The examiner stands next the patient on the involved side and gently externally rotates the flexed forearm while maintaining the upper arm adducted. The external rotation test is considered positive if pain is produced with gentle passive motion to its limit.

and compared with the uninvolved side. Internal rotation, external rotation, and forward elevation were also recorded.

In the absence of trauma, radiographs were obtained if the patient's age, history, or examination suggested a possibility of glenohumeral arthritis.

Diagnosis and Treatment

We believed the external rotation test was likely to be positive in patients with glenohumeral arthritis or adhesive capsulitis. The diagnosis of glenohumeral arthritis was confirmed by radiographic evidence of loss of joint space, spur formation, and subchondral cyst formation. In the absence of glenohumeral arthritis, a diagnosis of adhesive capsulitis was made in external rotation positive patients with no history of shoulder trauma.

Our initial treatment for adhesive capsulitis was an intra-articular injection of 1 cc (40 mg) of methylprednisolone acetate and 2 cc of 0.5% bupivacaine with epinephrine. The injection was given using an anterosuperior approach with a 22-gauge, 1.5-inch needle on a 3-cc syringe. A simple home stretching program was demonstrated to the patients, and they were given an informational handout regarding adhesive capsulitis that included instructions and schematics of the home exercise and stretching program. No formal physical therapy was prescribed.

Data Collection

Three hundred seventy-nine patients met the inclusion criteria for this study, and 91 of these had a positive external rotation test. Twenty-three of the external rotation positive patients were found to have glenohumeral arthritis confirmed by radiographs, leaving 68 external rotation positive patients with the presumed diagnosis of adhesive capsulitis; they were treated with intra-articular corticosteroids and a home stretching program.

After a diagnosis of adhesive capsulitis was made and the injection performed, patients were instructed to return to the clin-

ic if symptoms persisted for >4 weeks. As most patients obtained significant pain relief with the injection, many never needed to return. Therefore, to determine the accuracy of the external rotation test, we attempted to contact each of the 68 patients diagnosed with adhesive capsulitis. Fifty-eight of the 68 external rotation positive patients (85.3%) diagnosed with adhesive capsulitis were successfully contacted and comprise the capsulitis study group. Follow-up ranged from 10 to 19 months. When contacted, the patients were asked 3 standardized questions: Have you seen any other physician for the shoulder in question subsequent to our treatment? Have you received any treatment since being seen in our office? Are you satisfied the treatment we provided and with the current status of your shoulder?

RESULTS

External Rotation Positive Patients

Ninety-one (24%) of the 379 patients who met the inclusion criteria had a positive external rotation test. Of the 91 patients, a diagnosis of adhesive capsulitis was made in 68 (75% of external rotation positive patients, 18% of total). Of those diagnosed with adhesive capsulitis, 9 (15%) had a confirmed history of an endocrine disorder (4 hypothyroid, 1 hyperthyroid, 4 insulin-dependent diabetes, 1 noninsulin-dependent diabetes). The adhesive capsulitis group included 28 men and 30 women with an even distribution of hand dominance (29 dominant, 29 nondominant).

Glenohumeral arthritis was diagnosed in 25 patients, 23 (92%) with a positive external rotation test. All patients diagnosed with glenohumeral arthritis had crepitus on examination and commensurate radiographic findings. Other than adhesive capsulitis, glenohumeral arthritis was the only diagnosis with a positive external rotation test in this cohort. Specifically, no patients with documented labral tears, glenohumeral instability, acromioclavicular arthritis, or biceps pathology had a positive external rotation test. One

patient with a partial thickness rotator cuff tear had a positive external rotation test.

External Rotation Negative Patients

The most common diagnoses in 288 external rotation negative patients were rotator cuff pathology in 51 (17.7%), labral tears in 40 (13.8%), instability in 17 (5.9%), and acromioclavicular joint arthritis in 28 (5.9%).

Range of Motion at Presentation

At presentation, the average forward flexion was 145° (range, 20°-180°). Thirty of 58 patients (52%) had forward elevation within 15° of the contralateral shoulder. The average external rotation with the arm in adduction was 43.4° (range, 0°-90°). Nineteen of 58 patients (33%) had external rotation within 15° of the contralateral shoulder. Twenty-two of 58 patients (38%) had internal rotation within 4 vertebral levels of the contralateral shoulder.

Treatment and Patient Satisfaction

Eighty-six (28%) of the 311 patients in the external rotation negative group required surgical treatment, while only 1 patient (1.7%) in the external rotation positive group with a diagnosis of adhesive capsulitis group underwent surgery. This was statistically significant ($P < .0001$). On presentation, this patient had symmetric full ROM, but with a markedly positive external rotation test, positive impingement tests, and positive tests for superior labral tear. An intra-articular injection was given. The patient returned to clinic after 4 weeks of a home therapy program with significantly improved pain and a negative external rotation test, but examination findings were still positive for impingement. This patient ultimately required arthroscopic subacromial decompression and debridement of a partial thickness supraspinatus tear that was seen on magnetic resonance imaging (MRI) at the initial visit. Fourteen (56%) of the 25 patients diagnosed with glenohumeral arthritis underwent glenohumeral arthroplasty.

Of the 58 adhesive capsulitis patients available for follow-up, 4 received 2 injections, and 3 received 3 injections. Five patients required a procedure (manipulation). No capsular releases were performed.

Three (5.2%) of 58 patients sought treatment by another physician. One had her diagnosis of adhesive capsulitis confirmed and ultimately underwent manipulation under anesthesia. Two were diagnosed as having partial thickness rotator cuff tears on MRI; both had resolution of symptoms with continued physical therapy and neither required surgical intervention.

When surveyed, 49 (84%) of 58 patients reported they were “satisfied with treatment provided and the current status of their shoulder.” Nine (15%) of 58 patients reported they were “dissatisfied with the current status of their shoulder.” Six of the 9 dissatisfied patients had been improved by the treatment and reported their shoulders did not bother them enough to seek further care. Two of the patients requiring manipulation under anesthesia were among those dissatisfied.

Only 2 patients (4%) with no history of an endocrine disorder required repeat injections, and both of these patients ultimately required manipulation under general anesthesia. However, 5 (56%) of the 9 patients with either diabetes or thyroid dysfunction required multiple injections, and 2 of these patients required manipulation as well. Of note, 1 patient with insulin-dependent diabetes was among those dissatisfied. The remaining patients with endocrine disorders were satisfied.

DISCUSSION

While the earliest description of what is now commonly referred to as adhesive capsulitis was presented in 1872 by Duplay,⁷ our modern definition wasn't formally described until Codman⁸ did so in 1934. He noted, “[it is] a class of cases which are difficult to define, difficult to treat, and difficult to explain from the point of pathology.”⁸ Because of its inconsistent patterns and varying course,

adhesive capsulitis is often considered a diagnosis of exclusion. While surgeons have invested extraordinary efforts into the explanation of the disease process and its appropriate treatment, we have been unable to accurately diagnose the condition in its earliest phase.

Considering that the restoration of normal ROM is often a lengthy and painful process, and that several studies have shown that many patients never regain full motion, it is essential to accurately diagnose adhesive capsulitis in its earliest phase.¹⁻⁴ In so doing, it may be possible to lessen or even prevent the longstanding pain and limited motion associated with the natural history of adhesive capsulitis.

With the glenohumeral joint relying predominantly on complex soft tissue interactions for stability and function, it is often difficult to isolate individual structures around the shoulder with physical examination. Clark and Harryman⁹ described the confluent insertions of the cuff musculature and the intimacy of the capsule and glenohumeral ligaments. Their work was essentially a detailed look into the tenets illustrated previously by Neviaser¹⁰ in 1945, when he discussed the microanatomy of the cuff musculature and dynamic support structures of the shoulder girdle.

The work of Depalma et al^{11,12} broadened our understanding of the dynamic role of the rotator interval and glenohumeral ligaments as checkreins and defined their roles with varying abduction. Secondary to these studies and others that followed, it is now accepted that little other than the rotator interval, including the coracohumeral and superior glenohumeral ligaments, are placed under tension when the arm is in a neutral position and external rotation is applied. We consider the external rotation test to be an essential part of the clinical examination and a means to specifically evaluate the rotator interval capsule, including the coracohumeral and superior glenohumeral ligaments.

Ozaki et al¹³ eloquently described the role of the rotator interval and coraco-

humeral ligament in the pathogenesis of adhesive capsulitis. Warner et al¹⁴ reaffirmed these findings in 1996. Additionally, both Ozaki et al¹³ and Warner et al¹⁴ demonstrated the ability to provide pain relief and restore motion with the release of the rotator interval and coracohumeral ligaments, again demonstrating the rotator interval's role in capsulitis.

Since 1962, when Neviaser¹⁵ first described using arthrography to diagnose adhesive capsulitis, few advances have been made in this diagnostic arena. Although MRI findings of a thickened inferior capsule, synovitis in the rotator interval, and an abbreviated axillary pouch are frequently seen in adhesive capsulitis, they are too often relegated to the bottom of the list of conclusions or impressions, while labral pathology including SLAP tears, impingement, and cuff pathology are at the top of the list. This often poses a diagnostic dilemma, as many patients present with an increasingly painful shoulder, with or without specific injury, and an MRI suggestive of rotator cuff or labral pathology. This is a difficult problem for the surgeon, as it is common for patients to have multiple abnormal findings on MRI, some of which may have little or no role in their symptomatology. One thing is certain: surgery in the presence of capsulitis will risk heightening the inflammatory process, worsen the stiffness, and yield a long and difficult recovery.

This study confirms the clinical value of the external rotation test and its ability to effectively diagnose adhesive capsulitis. Glenohumeral arthritis, which is easily diagnosed, was the only diagnosis other than adhesive capsulitis with a positive external rotation test in this study group. Perhaps most surprising was the fact that while 27% of those in the external rotation negative group ultimately required surgery, only 1 patient diagnosed with adhesive capsulitis based solely on the positive external rotation test required surgery ($P < .0001$). Furthermore, 85% of those diagnosed with capsulitis on their initial visit reported they

were satisfied with their treatment from a pain and ROM standpoint, and 95% of them (55/58) felt no need to seek further treatment for their shoulder.

Adhesive capsulitis is, above all, a clinical diagnosis. In its earliest stage, when ROM is minimally impacted, we believe that in the absence of glenohumeral arthritis one must consider the external rotation positive patient with atraumatic shoulder pain to have capsulitis until proven otherwise. It has been definitively shown that the rotator interval capsule is initially and consistently involved in capsulitis. The external rotation test solicits and stresses this interval without loading of the rotator cuff, labrum, biceps, or acromion. Additionally, even in the presence of secondary diagnoses or MRI findings, the surgeon must be sure that capsulitis is not a component of the patient's pathology as he or she considers surgical treatment. Surgical treatment in the presence of capsulitis can risk aggravating the condition and producing increased pain and stiffness. In cases with a history of trauma, other diagnoses, such as subscapularis tear, which may also be painful when externally rotating the arm at the side, should be considered.

We recognize several limitations with this study. First, ROM testing to evaluate both the response to the injection and resolution of stiffness would be beneficial. We believe, however, that having patients follow up in clinic for problems that have resolved with nonoperative treatment is generally unnecessary. Second, telephone surveys without a validated outcomes questionnaire are not commonplace. However, for an entity like adhesive capsulitis, whose treatment is based primarily on the patient's report of pain and functional limitation, we believe the simple questions we asked by telephone are appropriate. Third, evaluation of clinical examination maneuvers often raises the question of reproducibility from examiner to examiner. This test is simple and straightforward and is, in our opinion, easily reproduced by the clinician. Future prospective stud-

ies designed to more fully evaluate the specificity of the external rotation test are warranted and are being pursued.

CONCLUSION

The primary role of any physician is to provide patients with an accurate diagnosis. With the often vague and inconsistent pain associated with adhesive capsulitis, particularly in its earliest stages, a clinical diagnosis is often elusive. Although it is uncommon for a single examination maneuver to be diagnostic, our data suggest that pain with external rotation with the arm in a neutral position should be considered diagnostic for adhesive capsulitis in the absence of glenohumeral arthritis and trauma. With prompt and appropriate diagnosis and early initiation of nonoperative treatment, many patients with early adhesive capsulitis may be able to avoid the painful and limiting frozen shoulder that often follows. Moreover, it is important that capsulitis be diagnosed and not overlooked in patients who may have MRI findings to avoid unnecessary or improperly

timed operative treatment, which could lead to significant postoperative morbidity and complications. 

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