Complex Shoulder Disorders: Evaluation and Treatment

Abstract

Evaluation of patients with shoulder disorders often presents challenges. Among the most troublesome are revision surgery in patients with massive rotator cuff tear, atraumatic shoulder instability, revision arthroscopic stabilization surgery, adhesive capsulitis, and bicipital and subscapularis injuries. Determining functional status is critical before considering surgical options in the patient with massive rotator cuff tear. When nonsurgical treatment of atraumatic shoulder stability is not effective, inferior capsular shift is the treatment of choice. Arthroscopic revision of failed arthroscopic shoulder stabilization procedures may be undertaken when bone and tissue quality are good. Arthroscopic release is indicated when idiopathic adhesive capsulitis does not respond to nonsurgical treatment; however, results of both nonsurgical and surgical treatment of posttraumatic and postoperative adhesive capsulitis are often disappointing. Patients not motivated to perform the necessary postoperative therapy following subscapularis repair are best treated with arthroscopic débridement and biceps tenotomy.

In 1972, Neer hypothesized that rotator cuff pathology was the result of impingement by the anterolateral acromion on the rotator cuff and that treatment should consist of removal of this portion of the acromion and the accompanying coracoacromial ligament. Over the past 30 years, improvements in diagnostic imaging modalities, such as magnetic resonance imaging (MRI) and arthroscopic shoulder evaluation, have resulted in a significant change in the way in which orthopaedic surgeons evaluate and treat rotator cuff pathology. Over the past 30 years, improvements in diagnostic imaging modalities, such as magnetic resonance imaging (MRI) and arthroscopic shoulder evaluation, have resulted in a significant change in the way in which orthopaedic surgeons evaluate and treat rotator cuff pathology as well as other common shoulder disorders. Despite these advances, there is still an incomplete understanding and a general lack of consensus among even the most experienced orthopaedic surgeons regarding treatment of complex shoulder conditions.

Revision rotator cuff surgery is one of the most challenging conditions for orthopaedic surgeons. A complete history and physical examination, along with careful evaluation of diagnostic studies, are required before considering whether surgery is a valid option for the patient with a massive rotator cuff tear. Physical examination findings and radiographic testing also can aid in determining the proper course of treatment.

Common causes of failed arthroscopic shoulder stabilization surgery include recurrence of instability, failure to detect associated injuries preoperatively, technical errors intraoperatively, and implant failure. Careful clinical evaluation and selected diagnostic studies, particularly those allowing for evaluation of the osseous anatomy, are important to...
and the biceps tendon. Repair can be done open or arthroscopically.

Massive Rotator Cuff Tear

Surgical management of massive rotator cuff tear is difficult, and results are often disappointing. To aid in determining which patients may benefit from reconstructive surgery, those with massive rotator cuff tears are classified as high or low functional demand. Further distinction is made between patients who have severe pain and those who are relatively pain-free. The size of the tear and the quality of the remaining rotator cuff are then assessed; patients are further subdivided into those with repairable or irreparable tears and those with or without pseudoparalysis (Figure 1).

Prior to attempting repair of a massive rotator cuff tear, it is helpful to determine whether the primary problem is pain or function. When the primary complaint is pain, the patient is asked whether he or she is satisfied with the current strength and function of the extremity. If the answer is yes, the patient is classified as low functional demand, and reconstruction is not considered. Such a patient is initially treated with subacromial injections; if this treatment is not successful, subacromial débridement with biceps tenotomy is preferred for the patient with an irreparable tear who does not have pseudoparalysis. Arthroscopic subacromial débridement with biceps tenotomy is considered. Patients who are not satisfied with the strength and function of the injured shoulder are classified as high functional demand. In these patients, the following conditions suggest that the tear is irreparable: (1) The examiner maximally externally rotates the arm in adduction or at 90° of abduction, and the patient is unable to hold this position actively. (2) The patient exhibits chronic pseudoparalysis during attempts to elevate the arm, with dynamic anterior subluxation of the shoulder occurring when anterior elevation is attempted. (3) The patient has coexistent deltoid injury.

The extent of pain and the presence or absence of pseudoparalysis also help determine appropriate treatment using the following criteria: (1) Rotator cuff reconstruction is preferred for the patient with pain and a tear that can be repaired using arthroscopic or open techniques. (2) Arthroscopic subacromial débridement with biceps tenotomy is preferred for the patient with an irreparable tear who does not have pseudoparalysis. (3) Subcoracoid transposition of the pectoralis major muscle is recommended for the patient with a painful, irreparable isolated subscapularis tear. (4) Partial repair and latissimus dorsi transfer is preferred for the patient with an irreparable posterior superior rotator cuff tear (intact subscapularis) who demonstrates weakness, but not pseudoparalysis, irrespective of whether pain is present. (5) A re-

Figure 1

Preoperative photograph of a 65-year-old woman with a massive rotator cuff tear involving the supraspinatus, infraspinatus, and teres minor muscles, associated with pseudoparalysis of elevation and of external rotation in the right arm. Elevation was limited to 60°, and the arm fell into internal rotation with any attempt to elevate it anteriorly.

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verse (inverse) prosthesis is preferred for irreparable tears in patients with chronic pseudoparalysis.8

Determining the functional status of the shoulder and performing careful examination with preoperative clinical testing are critical steps before considering surgical options in the patient with a massive rotator cuff tear. This approach leads to improved patient satisfaction and helps to avoid failure of revision rotator cuff surgery.

**Atraumatic Shoulder Instability**

One of us (E.I.) classifies shoulder instability based on whether instability occurs in the midrange or at the end-range of motion. Although the amount of shoulder laxity present in the midrange varies by individual, the patient with atraumatic or midrange instability typically demonstrates excessive midrange laxity of the glenohumeral joint.9 In these individuals, repetitive translation of the humeral head out of the glenoid with normal activities may eventually damage the capsuloligamentous structures of the shoulder.10,11 End-range instability, often associated with an acute traumatic event or with repetitive microtrauma, occurs at the limits of shoulder motion, when the capsule is tensioned in an attempt to maintain shoulder stability.

When the arm hangs freely at the side in the absence of muscular contraction, the negative intra-articular pressure of the shoulder maintains the humeral head within the glenoid.12 The rotator interval, which is the only portion of the shoulder joint in which the thin capsule is not covered and reinforced by the musculotendinous portions of the rotator cuff, acts as a pressure absorber by dimpling in when the pressure becomes negative and by bulging out when the pressure is positive.13 The effectiveness of the shoulder in maintaining this negative pressure depends on capsular thickness, volume, and elasticity.14 In the patient with atraumatic instability, the capsule is often thin and the joint volume is enlarged.15-17 As a result, the pressure responsiveness is diminished, and shoulder stability may be compromised. With the arm in full elevation, or with inferior traction of the arm, normal shoulders demonstrate a sharp increase in negative intra-articular pressure, which increases linearly as the arm is pulled inferiorly.12,18 This adaptive response is less efficient in patients with shoulder instability.12,19,20

The normal ratio of humeral to scapular motion on arm elevation is 2:1.21 This ratio is higher in patients with atraumatic instability because of imbalance between the shoulder and the parascapular musculature, which results in less scapular abduction relative to the humerus.22 Scapular abduction helps prevent inferior translation of the glenohumeral joint.23 When the arm hangs freely at the side, the height of the glenoid rim that the humeral head has to override is much less with the scapula in adduction than with the scapula in abduction (Figure 2).

In a patient with atraumatic instability of the shoulder, the scapula may be adducted with the arm at the side, which aggravates the inferior displacement of the humeral head. When the arm is in motion, muscular contraction produces forces that result in compression of the humeral head against the glenoid fossa. The effect of the muscular activity in concert with the concavity of the shoulder to maintain stability is termed the “concavity-compression” effect.24 Muscle force imbalance between shoulder agonists and antagonists, as well as generalized muscular weakness, is observed in patients with atraumatic shoulder instability. Weakness is typically present in both internal and external rotators but is most significant in internal rotators.25 Despite muscular contraction in these patients, the humeral head is not centered on the glenoid.26

The ratio of the dislocation force to the compressive force is known as the stability ratio.27 The stability ratio of normal shoulders is 50% to 60% in the superior-inferior direction and 30% to 40% in the anterior-posterior direction.28 The ratio is higher in the superior-inferior direction because inferiorly, the labrum is thickest and its attachment most rigid.29

The glenoid has a deep concavity in the superior-inferior direction and a shallow concavity in the anterior-posterior direction. In the patient with atraumatic instability, the glenoid is sometimes hypoplastic,16,30,31 and retroversion may be increased.11,16 The stability ratio is lower with a shallow, retroverted glenoid, particularly in the inferoposterior direction. On plain radiographs with the arm in elevation, humeral head slipping may be observed,16 and the center of the humeral head may be translated posteriorly or inferiorly.32
In addition to being detectable by the sulcus sign and the anteroposterior drawer test, atraumatic laxity can be clinically detected by the hyperabduction test.33 The latter is the only quantitative test that measures the length of the inferior capsule. The shoulder angle of abduction is measured while scapular motion is prevented. The normal shoulder has a hyperabduction angle of 85° to 90°. In the patient with an elongated inferior capsule, this angle may exceed 105°.

Plain radiographs are taken with the arm hanging by the side with and without weights. Normally, the humeral head subluxates only when a weight is applied; in the patient with atraumatic instability, subluxation may occur even without the application of weight. With the arm in an elevated position, the humeral head may subluxate in a posterolateral direction because of a hypoplastic glenoid.16 Computed tomography (CT) and MRI scans are helpful in evaluating retroversion and dysplasia of the glenoid. Magnetic resonance arthrography often reveals enlarged joint capacity and a widened rotator interval.

Although nonsurgical treatment of atraumatic shoulder instability with a supervised rehabilitation program is effective in only 66% to 85% of patients, it should be attempted before surgical treatment is considered.25,34 Strengthening exercises to improve scapular abduction are important and should include both isometric and isotonic exercises with resistance bands. Wall push-up exercises are also useful to strengthen the scapular stabilizers.25,34 A scapular band helps support the scapula from behind, in addition to controlling excessive adduction of the scapula (Figure 3). This band has been shown to improve the effectiveness of scapular stabilization exercises.25 When nonsurgical treatment of atraumatic shoulder instability is not successful after 6 months, surgical treatment should be considered.

Capsular redundancy is always present; thus, inferior capsular shift is the treatment of choice to decrease capsular volume. This shift is effective because it reduces the capsular volume and increases the responsiveness of pressure to external load.35 Surgical closure of the rotator interval is thought to increase the reinforcement of the capsule in this location and reduces midrange instability without affecting end-range instability.36

The failure rate of isolated capsulorrhaphy with or without rotator interval closure is 6% to 14%37-39 and may be related to the concomitant presence of glenoid dysplasia.40 Preoperative imaging is essential, and osteotomy may be required if imaging reveals glenoid dysplasia or increased glenoid retroversion. In the patient with dysplasia, glenoid concavity can be increased with either glenoid osteotomy16 or capsulolabral augmentation.8 Studies have indicated that 15% of patients with voluntary posterior subluxation require glenoid osteotomy in addition to a capsular procedure.41 Glenoid osteotomy has resulted in an increase in the stability ratio of up to 34%42 and in capsulolabral augmentation up to 25%.33 In the experience of one of us (E.I.), the need for glenoid osteotomy is relatively low.

Failed Arthroscopic Shoulder Stabilization Surgery

Recurrence of instability is one of the main complications of arthroscopic stabilization of the shoulder.44 Failure of both open and arthroscopic stabilization surgery is reported to be between 7% and 19%.45 The clinical examination helps in determining possible causes of recurrent dislocation. Failure to diagnose the type of instability during the initial surgery may lead to possible failure of the primary stabilization procedure. Subscapularis pathology may also lead to failure of shoulder stabilization procedures; this muscle should be carefully examined in patients who have failed stabilization surgery.

Plain radiographs may reveal technical errors that occurred during the initial procedure, such as poor placement or loosening of suture anchors or other fixation devices (Figure 4). Magnetic resonance arthrography aids in evaluating anterior labral repair and may reveal pathology that was not appreciated during the stabilization procedure, such as a humeral avulsion of the glenohumeral ligament, posterior or superior injuries, and associated rotator cuff lesions.46 CT scans are useful in determining
whether failure is the result of bone loss of the glenoid or of osseous defects of the humerus.47,48

The ideal candidate for revision surgery is the patient with traumatic unidirectional instability with a repairable Bankart lesion and good-quality capsular tissue.49 Patients with seizure disorders, scapular dyskinesia, multidirectional instability, and voluntary dislocators are typically not optimal surgical candidates. For these patients, nonsurgical treatment should be maximized before alternatives are considered.

Arthroscopic revision surgery is the treatment of choice for the patient in whom failure is the result of an inadequately healed Bankart lesion. Arthroscopic revision surgery also is preferred when preoperative evaluation indicates the presence of other associated conditions (eg, superior labral tear or lesion) that can best be addressed with arthroscopic visualization and treatment. Diagnostic arthroscopy should be considered even when open treatment has been selected for the revision surgery because associated lesions that have not been apparent on preoperative evaluation may be diagnosed and treated appropriately (Figure 5).

Open revision shoulder stabilization surgery is considered when capsular quality is insufficient to allow effective arthroscopic stabilization. In addition to capsular procedures, open surgery is often chosen because it allows for procedures such as the Bristow-Latterjet,49 which helps address osseous deficiency of the glenoid. Open procedures are also helpful when capsular laxity is accompanied by lesions of the subscapularis and, more recently, in cases in which cartilage restorative procedures can be performed to address humeral head chondral defects.

Failure of implants inserted during arthroscopic stabilization may result in significant chondral injury. Removal of these implants may require open exposure of the shoulder if arthroscopic removal cannot be performed.

Rehabilitation should be carefully performed following the initial shoulder stabilization procedure and following a revision procedure. It is important for the patient to regain external rotation because loss of this motion may lead to adhesive capsulitis. However, external rotation, both in adduction and abduction, should be avoided until 4 to 5 weeks postoperatively to avoid injuring the repaired capsuloligamentous structures. Restoration of scapular musculature is also critical because scapular dyskinesia may result in unsatisfactory results even when anatomic shoulder joint lesions have been appropriately addressed during surgery.

The treatment approach of one of us (G.P.) begins with arthroscopic surgery following an intrascalene block and general anesthesia. The patient is oriented in a modified lateral decubitus position, with the shoulder in 70° of abduction and 25° of forward flexion, with traction of 5 kg. A standard posterior viewing portal is used; an anterosuperior portal is created with an inside-out technique, and an anteroinferior portal is created with an outside-in technique.

The glenoid is carefully inspected and is compared with preoperative CT scans. Its size and shape are determined and measured with the assistance of a calibrated probe. In the presence of >20% osseous loss of the glenoid, the Bristow-Latterjet procedure is used.

If a protruding fixation device is found, removal is attempted. An unhealed or previously untreated Bankart lesion is repaired with two or three double-loaded bioabsorbable devices, with adequate tensioning of the anterior glenohumeral ligaments. Capsular tensioning of the posterior band on the inferior glenohumeral ligament with capsular plication is also performed. Repair of a humeral avulsion of the glenohumeral ligament can be performed arthroscopically with an auxiliary anterior portal at the 5 o’clock position, using a metallic double-loaded suture anchor. Other disorders, such as rotator cuff tears and biceps lesions, are also treated during the arthroscopic procedure.
One of us (G.P.) performs the Bristow-Laterjet procedure in a beach-chair position. A vertical incision is made from the tip of the palpable coracoid to the axilla. The cephalic vein is shifted laterally, with the deltoid muscle and the pectoralis shifted medially. The coracoid is then identified and the conjoined tendon retracted medially. A 3-cm vertical and 3-cm horizontal (superior portion) L-shaped incision is made in the subscapularis tendon. The tendon is then retracted medially, and débridement is performed on the glenoid neck to remove any scar tissue. The coracoid process is resected with a 90° saw and is positioned in line with the articular cartilage immediately below the equatorial line of the glenoid surface. Normally, one 4.5- × 40-mm malleolar screw is used with a washer to affix the coracoid to the glenoid rim. The subscapularis is repaired with nonabsorbable sutures.

Postoperatively, arthroscopic revision repairs are treated with a shoulder immobilizer for 3 weeks. The patient then begins assisted passive mobilization, avoiding external rotation. After 5 weeks, the patient begins active exercises in a pool and passive mobilization in external rotation. The patient treated with the Bristow-Laterjet procedure begins passive mobilization of the shoulder at 2 weeks postoperatively in the scapular plane; at 4 weeks, passive mobilization in external rotation is allowed. Active exercises in the pool are permitted after the 5th week.

At 8 weeks postoperatively, patients whose repairs were done arthroscopically and those who were treated with the Bristow-Laterjet procedure are advanced to strengthening exercises. Patients in the latter group are allowed to participate in contact sports at 3 months, whereas patients treated arthroscopically can not do so until 5 months postoperatively.

Arthroscopic revision of failed arthroscopic stabilization procedures can be undertaken when bone and tissue quality are good. For the patient with significant glenoid deficiency, the Bristow-Laterjet procedure is preferred.

### Idiopathic and Postoperative Adhesive Capsulitis

Idiopathic adhesive capsulitis is an intrinsic process involving the glenohumeral capsule, primarily the coracohumeral ligament. This condition must be distinguished from posttraumatic adhesive capsulitis, an extrinsic process that may be seen following injury or shoulder surgery and that results in scarring between tissue layers of the shoulder.

Idiopathic adhesive capsulitis typically presents insidiously in patients between ages 40 and 60 years. The disease process has been described as having three phases: freezing, frozen, and thawing. It has been associated with systemic diseases such as diabetes, thyroid disease, and hyperlipidemia. The incidence of this condition is also higher in patients with Dupuytren contracture and Peyronie disease as well as in patients who have undergone cardiac surgery and cervical spine procedures.

There is no consensus regarding the pathophysiology of idiopathic adhesive capsulitis. Myofibroblasts similar to those seen in Dupuytren contracture have been identified by some investigators. Cytokines such as transforming growth factor-β, platelet-derived growth factor, and human growth factor have been identified in the early inflammatory phase. Metalloproteinases and their inhibitors are altered in various phases of the disease.

Postoperative or posttraumatic adhesive capsulitis typically occurs following immobilization or reduced motion associated with the trauma of surgery or injury. Procedures that involve exposure of the deltopectoral interval, particularly when they include tightening of the anterior glenohumeral capsule, are associated with an increased risk of contracture. Both glenohumeral and scapulothoracic ranges of motion are decreased. Significant fibrosis is most commonly identified in the area of the coracohumeral ligament, in the interval between the base of the coracoid and the top of the subscapularis, between the conjoined tendon and the subscapularis, and between the rotator cuff and the overlying acromion and deltoid muscle in the scapulothoracic region.

Physical examination is helpful in determining the site of the most involved capsule. Anterosuperior tightness (ie, tightness of the coracohumeral ligament and rotator interval) limits external rotation in abduction, while anteroinferior contracture (ie, of the inferior glenohumeral ligament) limits external rotation in abduction. Posterior tightness (ie, of the posterior capsule) limits cross-body adduction and internal rotation. Loss of passive external rotation in adduction is the most sensitive test for adhesive capsulitis.

Serologic testing for patients with adhesive capsulitis should include a complete blood count, determination of C-reactive protein level, erythrocyte sedimentation rate (to detect sepsis or malignancy), fasting blood glucose level, and fasting lipid profile. Radiographic examination, including an outlet view, is essential to rule out conditions such as a locked glenohumeral dislocation, chondrolysis, calcific tendinitis, and failure of fixation in patients who have undergone surgical procedures.

The goal of treatment of idiopathic
adhesive capsulitis is to reduce discomfort and improve mobility. In most patients who are not diabetic, there is normally a gradual and almost complete return of movement and eventual absence of pain. In the early phase, inflammation is greatest and treatment is symptomatic, consisting of pain management and restriction of activities. Passive stretching is counterproductive in this stage and is particularly painful. Intra-articular steroid injections of the glenohumeral joint may be effective. Anterior and superior steroid injections are technically easier than a posterior approach, and steroid injection by a radiologist under fluoroscopic control can also be considered. Injections should be limited to no more than three per 6-month period.

Passive stretching is more effective once the severe pain of the initial inflammatory phase has diminished. Hydrodilatation has also been shown to be effective in this phase of treatment. Historically, manipulation under anesthesia was often considered the treatment of choice for this condition, but arthroscopic capsular release is now increasingly preferred. Examination under anesthesia before commencing surgery is important because it helps to identify the specific capsular structures involved in adhesive capsulitis (Figure 6).

Arthroscopic capsular release can be performed in the beach-chair or lateral decubitus position. Because the capsule is thickened and the intra-articular space is diminished, special care is required to avoid penetration of the posterior humeral head during the arthroscopic instrumentation on arthroscope insertion. Addition of epinephrine to the arthroscopic irrigation fluid helps provide better visualization. When adequate visualization of the anterior capsule is not possible, an inside-out technique may be necessary to insert an anterior cannula. Care should be taken to mark bony landmarks before initiating the arthroscopic procedure and to remain lateral to the coracoid while passing instrumentation during the inside-out technique.

An electrocautery instrument is essential, and it is often the only instrument required for successful surgical treatment of adhesive capsulitis (Figure 7). Initial débridement with the electrocautery device should focus on débriding tissue in the area of the rotator interval. The superior border of the subscapularis should be identified (Figure 8). Initial débridement is limited to the area superior to the subscapularis and inferior to the long head of the biceps, with resection of the coracobrachial and superior glenohumeral ligaments. Not only should the capsule be divided, but a portion should be removed or ablated to avoid early recurrence of this condition. Division of rotator interval tissue should continue until the lateral base of the coracoid can be visualized. The remaining anterior capsule is then divided from proximal to distal until

Photograph demonstrating preoperative examination under anesthesia. Limitation of external rotation is one of the most common findings with adhesive capsulitis.

Intraoperative arthroscopic image demonstrating use of an electrocautery device during capsular release in a patient with adhesive capsulitis.

The upper border of the subscapularis should be identified to avoid injury to this structure during débridement of the rotator interval.
the inferior pole of the glenoid is reached. This completes the anterior release.

The arthroscope is then moved to the anterior portal, and the posterior capsule is divided. Great care should be taken during the electrosurgical division of the posterior capsule below the equator of the glenoid, and the instrument should be directed toward the glenoid to avoid injury to the axillary nerve. Some surgeons recommend avoiding removal of the most inferior portion of the posterior capsule because of the potential for injury to the axillary nerve.

Arthroscopic instruments are then removed, and range of motion is assessed. If external rotation is still restricted, a gentle but firm manipulation is performed to achieve the desired range of external rotation, in both adduction and abduction.

The assessment of posttraumatic and/or postoperative loss of motion differs from that for idiopathic capsulitis. This condition is often accompanied by scarring and adhesions between tissue layers as a result of surgical disruption of these structures and postoperative bleeding. Early aggressive mobilization is often effective in reducing these adhesions.

Prior to a recommendation of surgical management of posttraumatic or postoperative capsulitis, the cause of stiffness should be identified. The patient should be advised that surgical release is done with the intent to improve mobility rather than to achieve a normal range of motion.

Surgical intervention for postoperative capsulitis may involve both arthroscopic and open releases. The site of capsular release is determined by physical examination. The most likely sites of postoperative scarring should also be determined. Arthroscopic release is often done when the subacromial space or the capsule is the primary site of pathology. When scarring extends to the region between the coracoid and the conjoined tendon and subscapularis, open releases are often more effective. For restriction in motion caused by contracture of the subscapularis, open release or lengthening of the subscapularis or arthroscopic tenotomy may be required.

Isolated contracture of the coraco-humeral ligament can be released arthroscopically or through a small deltoid-splitting incision placed lateral to the coracoid. When intra-articular biceps adhesions are encountered, arthroscopic release is indicated. The tendon may be released or, if necessary, its intra-articular portion excised. Tenodesis is usually not performed because postoperative therapy is aggressive and may disrupt the surgical reconstruction. Scarring between the base of the coracoid and the superior margin of the subscapularis may extend well medially. Release in this region may endanger the axillary nerve and thus should be performed cautiously. This is particularly the case following surgical procedures that use a deltoteporal approach. In these cases, scarring may cause the nerve to displace more laterally than normal, and the nerve may be found to course over the anterior and inferior glenohumeral capsule rather than the glenoid neck.

When scarring between the subscapularis and underlying glenoid neck (and joint capsule) is suspected, this tissue plane can be accessed digitally over the top of the subscapularis, but it is probably best reached by division and possible elongation of the subscapularis tendon. This allows for circumferential release of the subscapularis similar to that performed with soft-tissue release for shoulder arthroplasty. One centimeter of lengthening of the subscapularis will result in 15° to 20° of additional external rotation.

Postoperative mobilization should be immediate, aggressive, and prolonged. Continuous passive motion machines may be helpful, and family members can assist in mobilization of the shoulder.

Idiopathic and posttraumatic capsulitis are unique conditions that require different assessments and treatment. The prognosis for idiopathic capsulitis is good, irrespective of whether the patient is diabetic. Initially, nonsurgical treatment should be undertaken and should include intra-articular steroid injection, passive mobilization (after acute pain has subsided), and a home exercise program. If this is not effective, arthroscopic release is indicated. Posttraumatic or postoperative capsulitis is caused by pathologic soft-tissue scarring and contracture and may respond to early, aggressive stretching. Surgical release for this type of capsulitis is technically demanding, rehabilitation is difficult, and results of treatment, whether surgical or nonsurgical, are often disappointing.

Injuries of the Subscapularis and Long Head of the Biceps

Subscapularis tears are often associated with lesions of the long head of the biceps, rotator interval, or supraspinatus tendon. Subscapularis tears are often complete or partial, involving only the superior portion of the subscapularis tendon. Biceps instability is commonly associated with subscapularis tears (Figure 9). Disruption or distension of the ligamentous pulley of the biceps tendon occurs, resulting in fraying of the medial aspect of the tendon. Partial tears of the subscapularis may result in dislocation of the tendon, which then comes to rest on the lesser tuberosity. Complete subscapularis rupture may be associated with intra-articular medial disloca-
tion of the biceps tendon. Finally, with disruption of the rotator interval, the tendon may dislocate extra-articularly and come to rest on the anterior surface of an intact subscapularis.

The patient who sustains a tear of the subscapularis typically recalls a traumatic episode associated with rupture of the tendon. Forced external rotation or extension of a partially abducted arm is a typical mechanism of injury. In the older patient, acute dislocation of the shoulder may be accompanied by a tear of the subscapularis. Degenerative tears may also occur, similar to what is encountered with tears of the posterosuperior rotator cuff tendon.

Physical examination findings in the patient with subscapularis tear may include increased passive external rotation with the arm at the side, weakness on internal rotation, a positive lift-off test (Figure 10), and a positive belly-press test (Figure 11). Radiographs are typically negative, although avulsions of the lesser tuberosities have been reported. Shoulder arthrography may demonstrate biceps dislocation or subluxation, suggesting rupture of the subscapularis. CT arthrography and magnetic resonance arthrography are the tests of choice to diagnose partial or complete ruptures of the subscapularis. In addition to detecting subscapularis injuries, CT and MRI scans reveal the extent of atrophy and fatty infiltration of the subscapularis. The extent of fatty infiltration is of particular importance and is a significant prognostic factor in assessing the likelihood of successful repair of the tendon.

Several factors determine the type of treatment needed for tears of the subscapularis. Patient motivation is important. Those who are not motivated to perform the type of postop-

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**Figure 9**

Classification of dislocations of the long head of the biceps. **A**, Intra-articular dislocation with an intact anterior fascia (complete rupture of the subscapularis). **B**, Intra-articular dislocation with complete rupture of the subscapularis. **C**, Dislocation within the subscapularis fibers, with displacement medial to the lesser tuberosity. **D**, Extra-articular dislocation over an intact subscapularis, with disruption of the rotator interval.

**Figure 10**

The lift-off test is positive when the patient cannot hold the hand off the back. **A**, Standing position. **B**, Negative test. **C**, Positive test.

**Figure 11**

operative therapy needed following subscapularis repair are best treated with arthroscopic débridement and biceps tenotomy.\(^78\)

The presence of concomitant irreparable posterosuperior rotator cuff, Goutallier grade III or higher fatty infiltration of the subscapularis, and fixed anterior subluxation of the humeral head may contraindicate subscapularis repair.\(^76, 79, 80\)

Pectoralis major transfer may be used to treat the young, motivated patient with an irreparable tear of the subscapularis for whom nonsurgical treatment has been unsuccessful.\(^81\)

Full passive mobility should be obtained prior to subscapularis repair. This repair may be accomplished with open or arthroscopic techniques. Most repairs can be achieved with an anterosuperior deltopectoral-splitting approach.\(^82\)

The deltopectoral approach can be used for more retracted tears.\(^69\) All repairs are accompanied by a biceps tenodesis.\(^83\)

## Summary

Despite improvements in imaging modalities and surgical techniques, treatment of complex shoulder conditions remains challenging. Revision rotator cuff surgery is among the most challenging, but other conditions include failed arthroscopic shoulder stabilization surgery, idiopathic and traumatic adhesive capsulitis, and lesions of the anterosuperior rotator cuff and biceps tendon.

A complete patient history and the careful evaluation of preoperative diagnostic tests are essential in determining proper means of treatment.

## References

Citation numbers printed in bold type indicate references published within the past 5 years.


