Evaluation and Management of Adult Shoulder Pain

A Focus on Rotator Cuff Disorders, Acromioclavicular Joint Arthritis, and Glenohumeral Arthritis

April Armstrong, BSc(PT), MD, MSc, FRCSC

KEYWORDS

• Shoulder • Rotator cuff disorders • Rotator cuff tears
• Acromioclavicular joint arthritis • Glenohumeral joint arthritis • Examination
• Evaluation • Treatment

KEY POINTS

- Limited passive external rotation is a salient feature of glenohumeral joint arthritis but not for rotator cuff disease or acromioclavicular (AC) joint disease.
- Plain radiographs may show AC joint arthritis, but unless they are tender on palpation in this region, this is a clinically insignificant radiographic finding.
- Rotator cuff disease is best categorized into 3 different groups to help guide treatment. Group 1 and Group 3 are best treated nonoperatively, whereas group 2 should be given consideration for earlier surgical treatment.
- There are risks of nonoperative treatment of rotator cuff tears, which include tear progression, muscle fatty degeneration, tendon retraction increasing difficulty with tendon mobilization and repair, and potential for future arthritis.
- Initial treatment of most nontraumatic shoulder problems involves a physical therapy program, medication such as nonsteroidal antiinflammatory drugs, and joint injections. However, early surgical repair is considered for rotator cuff tears in a physiologically younger individual with an acute tear or who has a chronic rotator cuff tear with minimal irreversible changes on magnetic resonance imaging.

Disclosure: consultant for Zimmer, not related to this work.
Department of Orthopaedics and Rehabilitation, Bone and Joint Institute, Penn State Milton S. Hershey Medical Center, 30 Hope Drive, Building A, Hershey, PA 17033, USA
E-mail address: aarmstrong@hmc.psu.edu

Med Clin N Am 98 (2014) 755–775
http://dx.doi.org/10.1016/j.mcna.2014.03.004 **medical.theclinics.com**
0025-7125/14/$ – see front matter

INTRODUCTION

Shoulder pain is a common reason for an office visit with a primary care physician, in some reports as high as 30% of referrals.[1–3] The focus of this article is on the evaluation and management of adult shoulder pain with a specific focus on rotator cuff disorders, acromioclavicular (AC) joint arthritis, and glenohumeral arthritis. Typically, these shoulder conditions are seen in individuals older than 40 years. Under extenuating circumstances, these entities may be seen in younger individuals, but there is usually a special circumstance, such as a history of trauma or previous surgery.

PATIENT HISTORY AND PHYSICAL EXAMINATION

Patients with a rotator cuff problem usually present with 1 of 2 typical histories. The first is a history of an abrupt onset of shoulder pain associated with a traumatic event, such as a fall on an outstretched arm or something as trivial as reaching above shoulder height and suddenly feeling a sharp pain. The patient may describe, "something tore in the shoulder." The second is a history of a gradual onset of aching shoulder pain that has not improved over time and the patient cannot recall any specific event or reason for the shoulder pain. Patients with shoulder arthritis, adhesive capsulitis, and AC joint arthritis tend to have more of a gradual onset of pain. Identifying aggravating and alleviating factors for the pain can also help to characterize the shoulder problem. Rotator cuff disease typically hurts more with elevation above the shoulder and is less painful at waist level. Adhesive capsulitis and arthritis tend to be painful with any shoulder motion. AC joint arthritis is often painful when reaching across the body (**Table 1**).

Often with rotator cuff disease, the patient describes the pain near the insertion of the deltoid in the lateral upper third of the arm rather than specifically at the shoulder. The patient may grab the whole side of the shoulder and describe pain in this region. The patient may describe the pain as less intense at rest during the day with worsening of their symptoms with movement of the shoulder, particularly with activities requiring reaching overhead, and at night, when they have fewer distractions for their pain. The pain experienced with adhesive capsulitis is intense, particularly at night, and also during the day, and is not relieved with rest, which differentiates it from a rotator cuff problem. Patients with glenohumeral arthritis or adhesive capsulitis are less specific about the location of the pain, but they focus usually on the fact that motion of the shoulder worsens their pain. Patients with AC joint arthritis are typically specific about the location of the pain and localize the pain right at the AC joint, on top of the shoulder. Patients may also show a positive cross-body test.[4] The examiner passively forward flexes the shoulder to 90° and horizontally adducts the arm as far as possible, which provokes the AC joint pain. Palpable pain localized over the AC joint is common. An injection of local anesthetic and corticosteroid into the AC joint can confirm whether this joint is a significant reason for their pain if it relieves the pain they are experiencing.

Table 1
Distinguishing features of pain

	Distinguishing Features of Pain	
	Onset	**Aggravating Factors**
Rotator cuff disease	Sudden or gradual	Overhead elevation
AC joint arthritis	Gradual	Reaching across the body
Glenohumeral arthritis	Gradual	Any shoulder motion

Often, the injection takes away 90% of their pain and confirms the diagnosis. It is not uncommon for AC joint arthritic changes to be seen on plain radiographs, but this is frequently an incidental finding. Unless the patient is symptomatic in this region on examination, this radiographic finding is not clinically significant. Pain related to the shoulder does not usually refer below the elbow; if you see this pattern, you must distinguish this from referred pain from the cervical spine.

The physical examination of the shoulder focuses on observation, palpation, range of motion, and strength testing (**Table 2**). Examination of the shoulder requires that the shoulder be exposed for observation of the entire shoulder, allowing for comparison with the opposite shoulder. Health care providers need to look for asymmetries and any evidence of atrophy of the rotator cuff musculature. Typically, this condition is most evident when looking at the infraspinatus, because chronic atrophic changes of this muscle belly are easy to identify, with prominence of the scapular spine and a scalloped appearance of the infraspinatus fossa. Atrophic changes of the supraspinatus may not be so readily appreciated, because the trapezius muscle lies above this muscle belly and can hide these changes. One should observe for other atrophic changes, such as with the deltoid, which would suggest possibly a neurologic reason, axillary neuropathy, for the shoulder problem.

It is important to observe the patient's willingness to move the shoulder and to assess the flow of movement of the shoulder, which allows you to assess their degree of pain, active weakness, and also the scapulohumeral rhythm.[5] If there is significant scapular winging, you need to distinguish this from a neurologic reason versus a scapular dyskinesis from poor mechanics.[6] Range of motion testing includes forward elevation, external rotation at their side, and internal rotation behind their back, both with active (patient uses their own muscle to generate the movement) and passive (motion generated by someone else moving the extremity and patient does not use their own muscles) motion. In patients with isolated rotator cuff disease, shoulder motion is not limited passively but may be limited actively. If active and passive motion is limited, diagnoses such as adhesive capsulitis and glenohumeral arthritis should be higher on the differential. Loss of passive motion in 3 planes of motion such as forward elevation, external rotation, and internal rotation suggests an articular problem or joint contracture. Loss of passive external rotation at the side is one of the first classic findings for glenohumeral arthritis and adhesive capsulitis. Some patients with massive rotator cuff tears develop glenohumeral joint arthritis, and once this develops, the

Table 2
Distinguishing features on physical examination

	Distinguishing Features on Physical Examination			
	Range of Motion	**Strength of Rotator Cuff**	**Palpation**	**Special Tests**
Rotator cuff disease	Full passive Full or limited active	Weakness	Occasionally, pain at greater tuberosity	Neer and Hawkins impingement tests
AC joint arthritis	Full passive Full active	No weakness	Localized pain at AC joint	Cross-body test
Glenohumeral Arthritis	Limited passive Limited active Limited external rotation salient feature	No weakness	No localized pain	None

treatment typically becomes focused on managing the arthritis and not the rotator cuff tear.

The Neer and Hawkins impingement tests may be used to identify rotator cuff irritability.[7] However, there is significant clinical diversity regarding the usefulness of these tests, and it is difficult to assess the relative sensitivity and specificity of shoulder diagnostic tests.[8,9] Therefore, the clinician should consider the components of the history and physical examination as adjunctive tools to gain more insight into the clinical picture of the problem. The Neer impingement sign passively elevates the shoulder above the patient's head, and stabilizes the scapula superiorly, to impinge the rotator cuff under the acromion (**Fig. 1**). The Hawkins impingement sign forward elevates the shoulder to 90° in neutral rotation and then internally rotates the shoulder, stabilizing the scapula, to impinge the rotator cuff under the acromion (**Fig. 2**).

When observing the patient reach behind the back, it is also important to watch for scapular winging, which suggests that the observed motion is occurring at the scapulothoracic joint rather than the glenohumeral joint. If scapular winging or loss of internal rotation motion is recognized, it is important to assess further for posterior shoulder capsular tightness.[10] The sleeper stretch is an effective way to assess for this posterior capsular tightness, because the patient lying on their side limits the scapulothoracic joint contribution to the motion (**Fig. 3**).[11] The patient lies on their side with the dependent arm flexed to 90°. The patient then pushes on the wrist of the dependent arm into internal rotation toward the bed, with the opposite arm, to show restricted internal rotation range of motion. This limited motion can be identified with rotator cuff disease, AC joint arthritis, and glenohumeral joint arthritis. The difference is found when using this stretch as a treatment. Patients with rotator cuff disease and AC joint arthritis are more likely to stretch and improve their posterior capsule tightness and thus improve their pain symptoms, whereas in patients with glenohumeral arthritis, this tightness is likely permanent.

Strength testing is important for any shoulder examination, but especially for patients with suspected rotator cuff tears. The rotator cuff is made up of 4 distinct tendons: (1) supraspinatus, (2) infraspinatus, (3) subscapularis, and (4) teres minor. Each of these tendons can be specifically tested for strength and integrity. The supraspinatus tendon is evaluated using the Jobe test (**Fig. 4**). The patient is asked to elevate their arm in the plane of the scapula on the chest wall until they are just short of 90° of forward elevation. They are then asked to turn their thumb down toward the floor to theoretically bring the supraspinatus tendon on top of the shoulder joint, and the examiner

Fig. 1. The Neer impingement test.

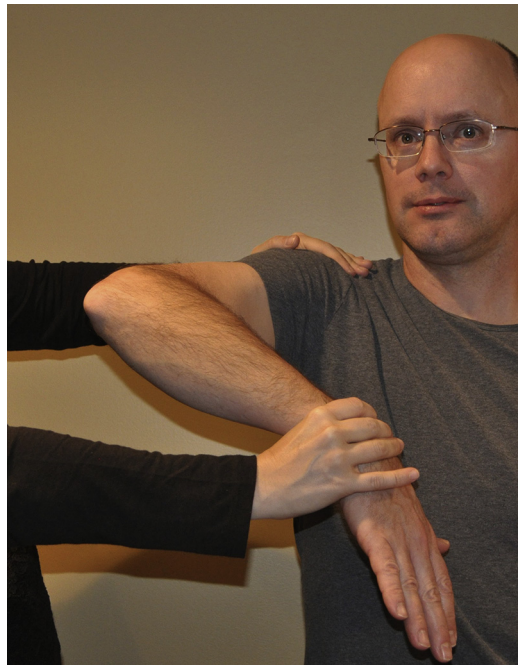

Fig. 2. The Hawkins impingement test.

then tries to push their arm to the floor, comparing at the same time with the opposite shoulder. Weakness or giving way could suggest a rotator cuff weakness involving the supraspinatus. More recently, a modified lateral Jobe test has been reported as effective in diagnosing supraspinatus tears.[12] Instead of the patient's arm held straight, the arm is bent 90° at the elbow. Infraspinatus weakness is tested with the arm at their side, elbow flexed to 90°, and neutral shoulder rotation, with their forearm pointing directly forward (**Fig. 5**). The examiner then attempts to rotate the arm internally while the patient resists with external rotation strength. This test has been described as one of the more effective tests to detect a rotator cuff tear.[13] A positive external lag test is

Fig. 3. The sleeper stretch.

Fig. 4. The Jobe test for supraspinatus strength testing.

one in which a patient is positioned in full external rotation at their side and is unable to hold this position because of significant external rotation weakness.[14] A positive external lag test suggests a large tear of the rotator cuff, and associated atrophy of the infraspinatus muscle belly on observation supports this finding. Subscapularis function is assessed using the belly press test (**Fig. 6**) or the liftoff test (**Fig. 7**).[15,16] The belly press test requires that the patient place both hands on their belly with neutral wrist alignment, and the patient is asked to bring their elbows forward to simulate internal rotation of the shoulder. Weakness is detected when the elbow lags behind and the patient cannot bring it forward. This test is useful for patients who are in too much pain to reach behind their back. The liftoff test requires that the patient reach behind their low back and then lift their hand off their back. This test requires patient to have enough internal rotation to perform the movement. The health care provider must ensure that the patient is truly activating the subscapularis and not the triceps muscle, which extends the elbow rather than lifting the arm off the low back. The

Fig. 5. Resisted external rotation at the side for infraspinatus strength testing.

Fig. 6. The belly press test for subscapularis strength testing.

last tendon to assess is the teres minor, and this is typically not involved unless there is a massive rotator cuff tear or an axillary nerve palsy. The hornblower test was described to test this muscle belly (**Fig. 8**).[17] The teres minor is most active when the shoulder is externally rotated in the abducted position, so the patient is asked to bring their arm overhead, with the shoulder abducted to 90° and elbow flexed to 90°. The patient is then asked to rotate their arm from 90° of shoulder elevation to full external rotation like a hitch-hiking motion. Inability of the arm to perform this movement results in the arm dropping to the face and overactivity of the deltoid muscle with increased abduction of the shoulder, looking like you are blowing on a horn, or the hornblower sign (**Fig. 9**). Patients with glenohumeral arthritis, adhesive capsulitis, and AC joint arthritis do not show significant rotator cuff weakness. However, if they are in too much pain, this may inhibit their ability to generate a forceful contraction and good strength on their examination.

Fig. 7. The liftoff test for subscapularis strength testing.

Fig. 8. The hornblower test for teres minor strength testing.

Fig. 9. The hornblower sign.

IMAGING

A standard anteroposterior (AP), true AP, outlet, and axillary shoulder radiographic series is recommended (Fig. 10). In patients with rotator cuff disorders, the radiographs are often normal (see Fig. 10). There may be some spurring of the anterior or lateral acromion and possibly a traction osteophyte at the location of the coracoacromial ligament traveling medially to the coracoid. It is controversial whether these spurs should be dealt with surgically, with more recent literature supporting isolated bursectomies and not resecting these bony prominences.[18] In patients with large to massive rotator cuff tears, superior migration of the humeral head and possibly arthritic signs may be observed (Fig. 11). The standard AP film is most useful for visualizing the AC joint in profile and better identifies joint space narrowing, osteophytosis, sclerosis, or cystic formation (Fig. 12). However, these radiographic findings are not uncommon in patients with no pain related to the AC joint, and so you must be careful to not overdiagnose this condition. The true AP and axillary images show the glenohumeral joint in

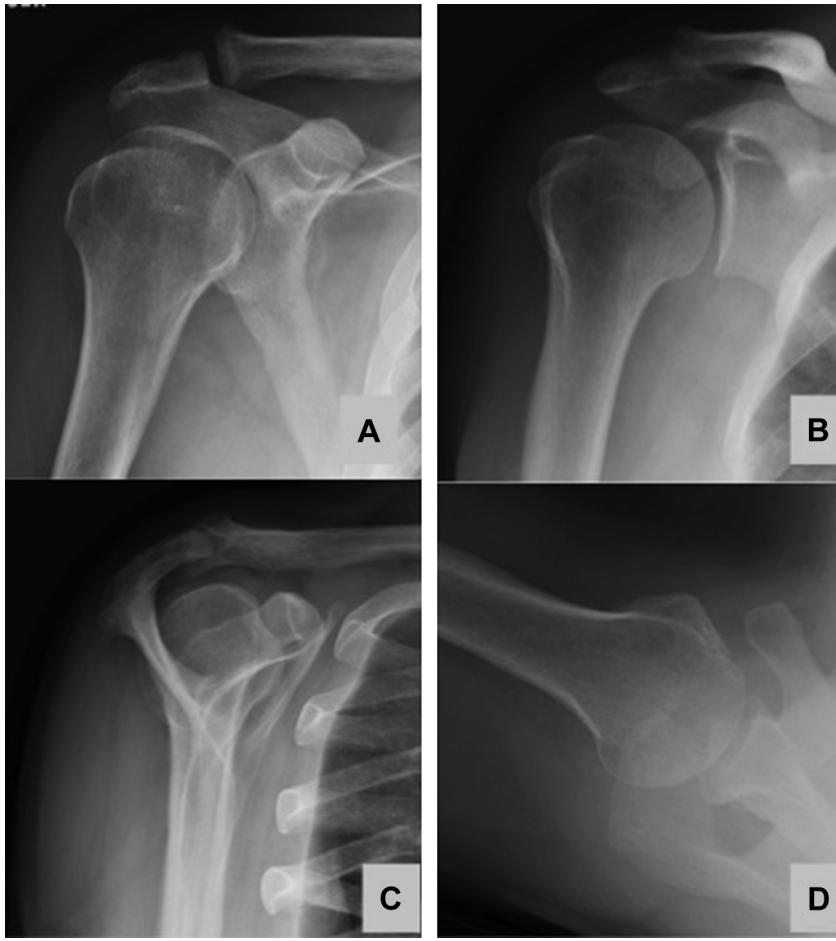

Fig. 10. Normal radiographic shoulder series. (*A*) AP view (perpendicular to thorax), (*B*) true AP view (perpendicular to glenohumeral joint), (*C*) outlet view, and (*D*) axillary view.

Fig. 11. True AP image of left shoulder of a patient with a chronic rotator cuff tear and superior migration of the humeral head and resultant arthritis of the glenohumeral joint.

profile and help to show joint space narrowing and arthritic changes associated with glenohumeral arthritis (**Fig. 13**). These images are important for distinguishing between shoulder arthritis and adhesive capsulitis. In patients with adhesive capsulitis, the radiographs are normal, with no evidence of arthritis.

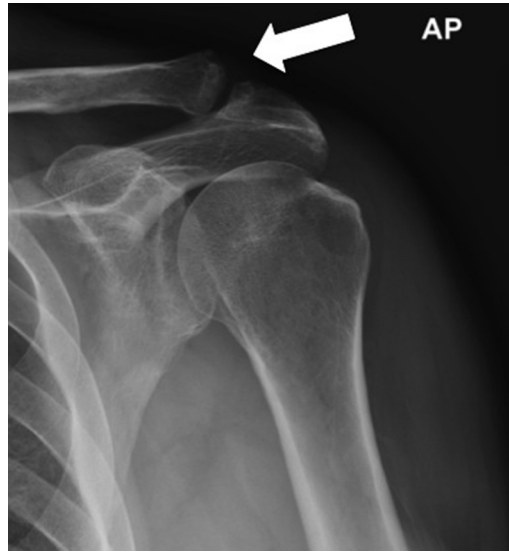

Fig. 12. AP image of left shoulder showing AC joint arthritis (*arrow*). There is narrowing of the joint space, sclerosis, and osteophyte formation.

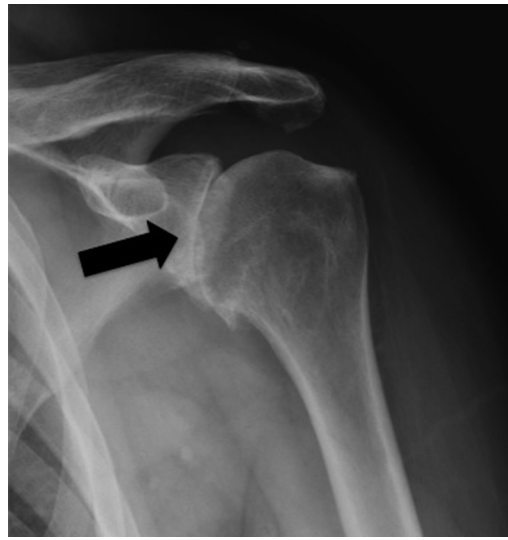

Fig. 13. True AP image left shoulder showing advanced glenohumeral joint arthritis. The *arrow* is pointing to the glenohumeral joint, which shows significant joint space narrowing, sclerosis, cystic formation, and osteophyte formation.

MANAGEMENT OF ROTATOR CUFF DISORDERS

When deciding on management of rotator cuff disorders, it is helpful to divide the patients into one of 3 groups to help guide treatment.[19] Both nonoperative and operative of treatment of rotator cuff disorders have risks (**Tables 3** and **4**). These groupings take into consideration the natural history of full and partial thickness rotator cuff tears, the reparability of the tendon tear, and the potential for healing of rotator cuff tears. The surgical risks of treatment are readily easy to understand; however, the nonoperative risks of treating rotator cuff disease may be less obvious. These nonoperative risks include tear progression, muscle fatty degeneration, tendon retraction increasing difficulty with tendon mobilization and repair, and potential for future arthritis (**Fig. 14**). Tear progression has been reported in several studies when following the natural history of asymptomatic and symptomatic rotator cuff tears.[20–25] Increased tear size and poorer muscle quality have been associated with worse surgical outcomes, and therefore, earlier consideration for surgical repair is warranted in some cases.

Table 3
Risks of treatment

	Risks of Treatment
Nonoperative	Tear progression Muscle fatty degeneration Tendon retraction increasing difficulty with tendon mobilization and repair Potential for future arthritis
Operative	Anesthetic complications Infection Nerve injury Arterial injury Failure of tendon to heal

Table 4
Three groups of rotator cuff disease

	Defining Features	Risk of Nonoperative Treatment
Group 1	Rotator cuff tendonitis, impingement, or bursitis, partial thickness tear, or maybe a small (<1 cm) full thickness rotator cuff tear	Minimal
Group 2	<65 y old (or older individuals who act physiologically younger) with a chronic full thickness rotator cuff tear (except maybe <1 cm tear), an acute full thickness rotator cuff tear (except maybe <1 cm tear), or an acute or chronic rotator cuff tear with a significant change in functional status of the arm, or >40 y old with an acute shoulder dislocation and an acute rotator cuff tear	High
Group 3	>65–70 y old or physiologically older with a chronic full thickness rotator cuff tear or individuals of any age with a massive irreparable tear with significant retraction, fatty degeneration, and humeral head superior migration, and early articular arthritic change	Minimal

The first group (group 1) of patients refers to patients who have an examination consistent with a rotator cuff tendonitis, impingement, or bursitis, partial thickness tear, or it may be a small (<1 cm) full thickness rotator cuff tear. There is minimal risk to this patient group with nonoperative treatment. The likelihood that they will develop chronic irreversible rotator cuff change, such as tendon retraction, fatty degeneration, and glenohumeral arthritis, is small. Nonoperative treatment in patients with rotator cuff tendonitis, impingement, or bursitis has a high success rate.[26–28] In 1 randomized prospective control study,[29] there was no significant difference between

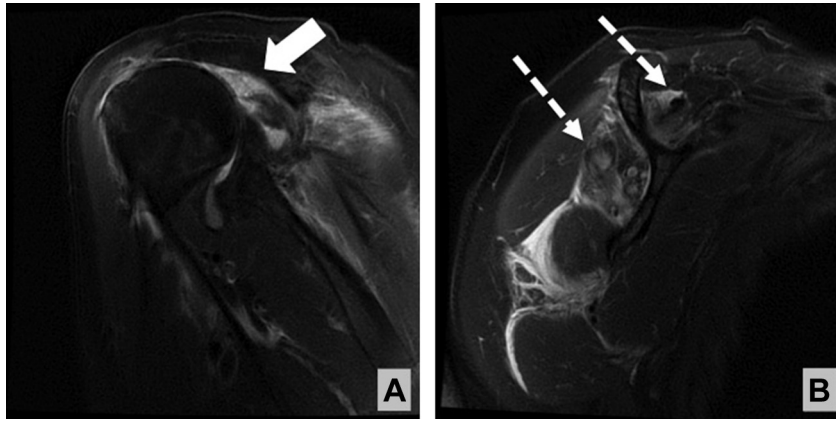

Fig. 14. MRI of right shoulder shows chronic irreversible changes to the rotator cuff. (*A*) Coronal image shows significant retraction of the rotator cuff tendon to the glenoid margin (*solid white arrow*) and superior migration of the humeral head. (*B*) Sagittal image shows significant fatty infiltration and atrophy of the supraspinatus and infraspinatus (*dotted white arrows*).

supervised physical therapy treatment and surgical treatment of arthroscopic subacromial decompression. With respect to partial thickness rotator cuff tears, there has been shown to be a slow, small risk for tear progression.[20,25] However, bursal sided partial thickness tears may not be so responsive to physical therapy treatment compared with articular partial thickness rotator cuff tears and may lead to earlier surgical intervention.[30,31] More recently, there has been some evidence that acute or chronic small (<1–1.5 cm) rotator cuff tears have a small risk of tear progression.[22] However, yearly monitoring, by the primary care provider or orthopedic surgeon, for tear progression and increased symptoms is recommended for younger individuals, who are at higher risk for irreversible changes if the tear increases in size. Nonoperative treatment options include physical therapy, antiinflammatory medications, and subacromial local and corticosteroid injections. Magnetic resonance imaging (MRI) is not indicated in this patient group.

The mainstay of treatment is physical therapy and the rehabilitation goals are to improve function for the patient and decrease pain. Patient education regarding activity modification as an effective initial treatment is important. The patient should be counseled to avoid or reduce any repetitive overhead activity or heavy lifting with the arm. Once the pain and function are improved, these aggravating activities may be reintroduced. The therapy program usually focuses on reestablishing normal range of motion, shown through normal glenohumeral and scapulohumeral kinematics. As mentioned earlier, often these patients have a tight posterior capsule, and therefore, physical therapy treatment often includes specific stretching for the posterior capsule. Strengthening exercises are gradually introduced when normal kinematics are established. Therapeutic modalities such as ultrasonography may also be included. A recent study analyzed the nonsurgical modifiable factors that contributed to pain and dysfunction in patients with symptomatic rotator cuff tears.[32] These investigators determined that scapulothoracic dyskinesis, range of motion in active abduction and forward elevation, and strength in abduction and forward elevation contributed significantly to pain or poor function.[32] They postulated that focused physical therapy treatment of these factors may provide better pain control in patients with symptomatic rotator cuff tears. Medications such as nonsteroidal antiinflammatory drugs (NSAIDs), acetaminophen, and possibly, a short-term opiate medication may be necessary to help control pain. Adequate pain control is important for the patient to be compliant with the physical therapy program.

If the patient has a poor response to the therapy and medications, a subacromial corticosteroid injection may be used as an adjunct to the treatment program. Subacromial injections can be approached from an anterior, lateral, or posterior approach. I prefer the posterior approach, with the patient sitting. The posterolateral corner of the acromion and the site of injection is typically 1 cm medial and 2 cm distal to the posterolateral corner of the acromion to avoid hitting the acromion (**Fig. 15**). The patient is asked to rest their forearm comfortably on their lap to relax the deltoid. I mix the lidocaine and corticosteroid in the same syringe for 1 injection. You must make sure that the needle is deep enough and penetrates the subacromial space to avoid complications of skin depigmentation and subcutaneous atrophy. The use of subacromial injections is controversial. A systematic review[33] concluded that there was little evidence to support the use of corticosteroid injections in managing rotator cuff disease; however, the available literature to make this conclusion was suboptimal. There was evidence that subacromial injections may help, particularly in the short-term, to improve range of motion and pain, but not in the long-term.[34–37] The decision to inject a patient should be individualized to the patient's circumstances. Injections are helpful for patients with calcific tendonitis, for patients who are acutely painful and unable to

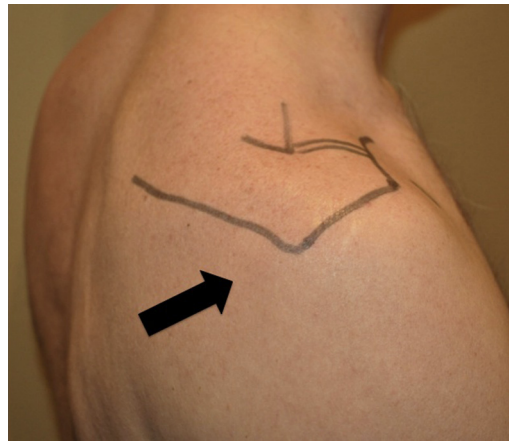

Fig. 15. Posterior approach to subacromial injection. The patient is asked to rest their forearm comfortably on their lap to relax the deltoid. The posterolateral corner of the acromion is identified, and the site of injection is typically 1 cm medial and 2 cm distal to the posterolateral corner of the acromion to avoid hitting the acromion (*arrow*).

participate in physical therapy, or for patients who have reached a plateau with the therapy program and are having difficulty progressing. The injections should be used sparingly, because there is evidence that corticosteroids can weaken the tendons and cause histologic changes.[38,39] It is recommended to wait at least 4 months between injections. If pain persists after 1 or 2 injections and physical therapy treatment has been optimized, advanced imaging, such as MRI, to better define the soft tissue disease, should be considered.

The second group (group 2) refers to patients younger than 65 years (or older individuals who act physiologically younger) who present with a chronic full thickness rotator cuff tear (except maybe <1 cm tear), an acute full thickness rotator cuff tear (except maybe <1 cm tear), or an acute or chronic rotator cuff tear with a significant change in their functional status of the arm (**Fig. 16**). This group includes the patient older than 40 years who had an acute shoulder dislocation and is therefore at a higher risk for an acute rotator cuff tear. Early surgical repair should be considered for this group of patients without significant muscle deterioration secondary to risk for chronic irreversible rotator cuff changes.[40–44] There is a high risk for tear progression, including fatty changes of the rotator cuff muscle and tendon retraction, with nonoperative treatment. Patients with a symptomatic rotator cuff tear have a 50% risk of tear progression in 2 years and tear progression, which correlates with increasing symptoms.[20,21,25] Patients presenting with a symptomatic rotator cuff tear have a 35% risk of contralateral rotator cuff tear, and this increases to 50% risk if age is greater than 80 years.[23] It is recommended that this patient group obtain MRI and a referral to a specialist for consideration of surgical repair of the rotator cuff.

The surgical literature also supports that group 2 has a higher rate of healing of the rotator cuff with surgery.[45–48] Surgical treatment options include arthroscopic and mini-open rotator cuff repair. An arthroscopic approach requires the surgeon to make approximately 3 to 6 small (<1 cm), incisions to repair the rotator cuff while watching a video camera and working through the small incisions. The mini-open approach requires an open incision through the deltoid muscle to repair the rotator cuff.

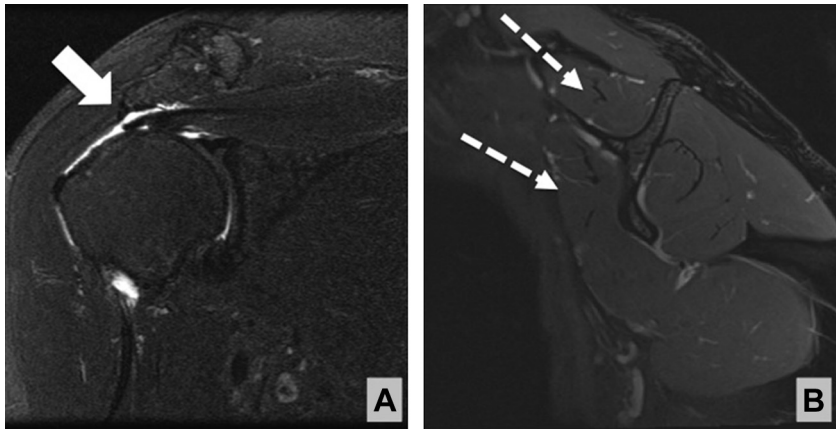

Fig. 16. MRI of right shoulder shows rotator cuff without significant chronic changes. (*A*) Coronal image shows retraction of the rotator cuff tendon half the width of the humeral head (*solid white arrow*) and no superior migration of the humeral head. (*B*) Sagittal image shows no significant fatty infiltration of the supraspinatus or infraspinatus (*dotted white arrows*).

The third group (group 3) refers to individuals who are older than 65 to 70 years or physiologically older with a chronic full thickness rotator cuff tear or individuals of any age with a massive irreparable tear, with significant retraction, fatty degeneration, and humeral head superior migration and early articular arthritic change. These individuals have a limited capacity for rotator cuff healing after repair, and therefore, nonoperative treatment should be optimized, with little risk to the patient, because the irreversible changes are already present (see **Fig. 14**). MRI is not needed for this patient group initially, because the diagnosis is clearly delineated with the physical examination. If nonoperative treatment is not successful, it may be reasonable to consider surgical intervention and referral to a specialist but to also understand that the goals and outcomes may be limited. Taking medical cost accountability into mind, it is recommended that the specialist decide whether the patient needs MRI, because the decision to operate may be easily determined by the physical examination and plain films and may be an unnecessary cost if no surgical intervention is feasible.

MANAGEMENT OF AC JOINT ARTHRITIS

The treatment options for AC joint arthritis are similar to those for rotator cuff disorders. Activity modification, physical therapy, medication, and joint injection are the typical nonoperative options for treatment. The corticosteroid injection has 2 purposes: confirming the diagnosis and therapeutic treatment of the pain. AC joint injections are technically more difficult, because the space is narrow because it is a small joint (**Fig. 17**). The AC joint is identified by palpation and feeling the defect between the distal end of the clavicle and the acromion. Looking at the plain radiographs can also provide an idea of the orientation of the joint, because this can vary between individuals. Once the soft spot of the AC joint is identified, the local anesthetic is injected into the joint to confirm that the joint has been localized. The needle is then kept in place, and the syringe is exchanged with a syringe filled with no more than 1 mL of corticosteroid and exchanged again with local anesthetic to flush the corticosteroid into the joint. The AC joint is superficial and care should be taken to minimize the risk of skin depigmentation and subcutaneous fat atrophy.

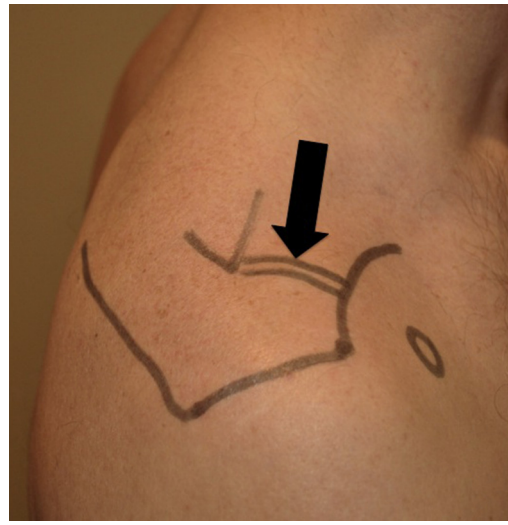

Fig. 17. AC joint injection. First localize the AC joint by palpation and feel the defect between the distal end of the clavicle and the acromion. Localize the soft spot and inject using a superior approach to the AC joint (*arrow*).

The nonoperative options are not so effective at permanently controlling the patient's pain, and these patients are more likely to require surgery. The surgical options for treatment include open and arthroscopic techniques for distal clavicle resection. The open technique requires a superior vertical or horizontal incision over the AC joint and division of the deep deltotrapezial fascia to elevate the muscle to expose the distal clavicle.[49] The distal 1 cm of the clavicle is excised, and meticulous closure of the deltotrapezial muscle and fascia is necessary. Careful postoperative follow-up is required to monitor for healing of the reattached deltoid and trapezius. Localized dehiscence of this soft tissue coverage can lead to ongoing persistent pain and weakness. Two arthroscopic techniques have been described: (1) direct and (2) indirect. The direct technique[50] uses 2 small incisions superiorly, anterior, and posterior to the joint to introduce instruments to resect the distal end of the clavicle. The indirect technique[51,52] uses a bursal approach in combination with an acromioplasty. The distal end of the clavicle is identified from the bursal surface and resected arthroscopically. The technique has the advantage of preserving the superficial AC ligaments and deltotrapezial musculature.

MANAGEMENT OF GLENOHUMERAL JOINT ARTHRITIS

The nonoperative treatment options include activity modification, physical therapy, medication, and intra-articular joint injection. Physical therapy may not be so effective for patients with advanced disease, because more activity and motion may aggravate their symptoms. Antiinflammatory medications are typically prescribed, whereas narcotic medications are usually avoided. Intra-articular injections can be effective in controlling arthritic symptoms. I prefer an anterior approach through the rotator interval, which is a natural space between the supraspinatus and the subscapularis (**Fig. 18**). The coracoid is marked out, and the injection is typically aimed just lateral to the coracoid, approximately 1 to 2 cm inferior to the clavicle. The local anesthetic is first injected to confirm the location. Leaving the needle in place, the syringe is exchanged and corticosteroid injected, followed by exchanging the syringe yet again

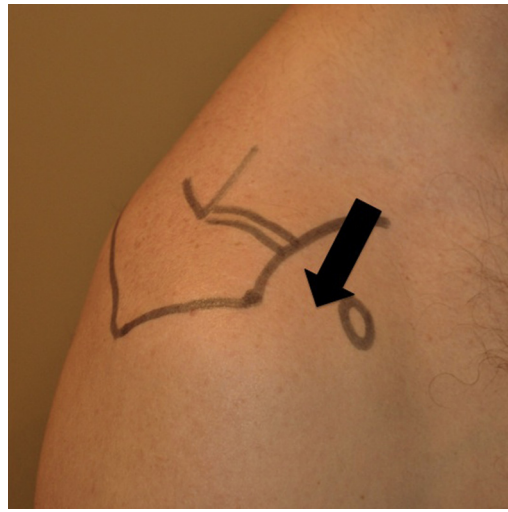

Fig. 18. Anterior approach for intra-articular joint injections. The coracoid is marked out and the injection is typically aimed just lateral to the coracoid, approximately 1 to 2 cm inferior to the clavicle. The injection is aimed to penetrate the joint through the rotator interval (*arrow*). First, local anesthetic is injected to confirm intra-articular location of the needle, and then leaving the needle in place, the syringe is exchanged and corticosteroid is injected. The syringe is exchanged yet again for local anesthetic to flush the steroid into the joint.

for local anesthetic to flush the steroid into the joint. When nonsurgical treatment fails and the pain is affecting the patient's quality of life, surgical intervention may be considered. For more advanced disease, the surgical treatment of choice is an anatomic total shoulder arthroplasty, with excellent results reported (**Fig. 19**).[53,54] In younger patients less than 40 years old, arthroscopic capsular release and extensive debridement may be considered, with guarded results.[55]

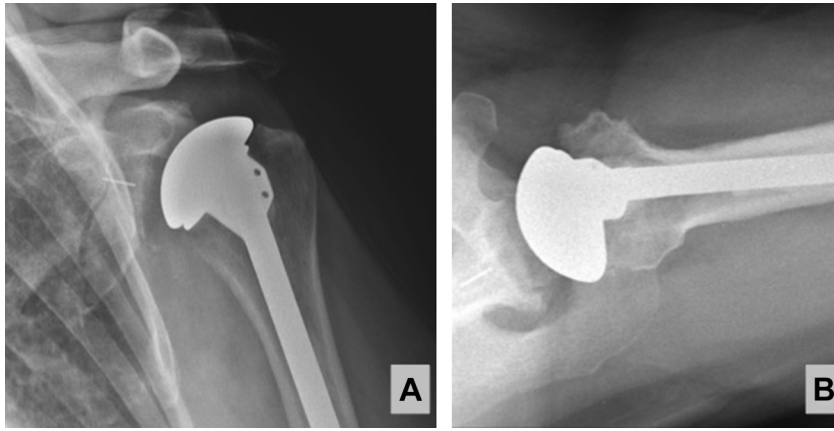

Fig. 19. Anatomic total shoulder arthroplasty for shoulder arthritis. (*A*) True AP view. (*B*) Axillary view.

SUMMARY

Rotator cuff disorders, AC joint arthritis, and glenohumeral joint arthritis each have their salient features during the history and physical examination. For instance, weakness during muscle strength testing is typical for rotator cuff disorders, localized pain over the AC joint for AC joint arthritis, and loss of passive external rotation with glenohumeral joint arthritis. Understanding these patterns can help to quickly guide the clinician to the appropriate treatment plan. In most instances, initial treatment may be focused on a nonoperative program, including physical therapy, medications such as NSAIDS, and joint injections. Surgical intervention is considered when nonsurgical treatment fails or in the second subgroup of rotator cuff disease, when nonsurgical treatment has a higher risk of causing further harm. This group of patients is typically the physiologically younger individuals who have an acute tear or who have a chronic rotator cuff tear with minimal irreversible changes on MRI. In this patient group, continued nonoperative treatment puts them at risk of rotator cuff tear progression, muscle fatty degeneration, tendon retraction increasing difficulty with tendon mobilization and repair, and potential for future arthritis.

REFERENCES

1. Greving K, Dorrestijn O, Winters JC, et al. Incidence, prevalence, and consultation rates of shoulder complaints in general practice. Scand J Rheumatol 2012; 41(2):150–5.
2. Armed Forces Health Surveillance Center (AFHSC). Arm and shoulder conditions, active component, US Armed Forces, 2003-2012. MSMR 2013;20(6):18–22.
3. Bruls VE, Bastiaenen CH, de Bie RA. Non-traumatic arm, neck and shoulder complaints: prevalence, course and prognosis in a Dutch university population. BMC Musculoskelet Disord 2013;14:8.
4. Buchberger DJ. Introduction of a new physical examination procedure for the differentiation of acromioclavicular joint lesions and subacromial impingement. J Manipulative Physiol Ther 1999;22(5):316–21.
5. Giphart JE, Brunkhorst JP, Horn NH, et al. Effect of plane of arm elevation on glenohumeral kinematics: a normative biplane fluoroscopy study. J Bone Joint Surg Am 2013;95(3):238–45.
6. Kibler WB, Sciascia A, Wilkes T. Scapular dyskinesis and its relation to shoulder injury. J Am Acad Orthop Surg 2012;20(6):364–72.
7. MacDonald PB, Clark P, Sutherland K. An analysis of the diagnostic accuracy of the Hawkins and Neer subacromial impingement signs. J Shoulder Elbow Surg 2000;9(4):299–301.
8. Hanchard NC, Lenza M, Handoll HH, et al. Physical tests for shoulder impingements and local lesions of bursa, tendon or labrum that may accompany impingement. Cochrane Database Syst Rev 2013;(4):CD007427.
9. Hegedus EJ, Goode AP, Cook CE, et al. Which physical examination tests provide clinicians with the most value when examining the shoulder? Update of a systematic review with meta-analysis of individual tests. Br J Sports Med 2012;46(14):964–78.
10. Myers JB, Laudner KG, Pasquale MR, et al. Glenohumeral range of motion deficits and posterior shoulder tightness in throwers with pathologic internal impingement. Am J Sports Med 2006;34(3):385–91.
11. Maenhout A, Van Eessel V, Van Dyck L, et al. Quantifying acromiohumeral distance in overhead athletes with glenohumeral internal rotation loss and the influence of a stretching program. Am J Sports Med 2012;40(9):2105–12.

12. Gillooly JJ, Chidambaram R, Mok D. The lateral Jobe test: a more reliable method of diagnosing rotator cuff tears. Int J Shoulder Surg 2010;4(2):41–3.
13. Hermans J, Luime JJ, Meuffels DE, et al. Does this patient with shoulder pain have rotator cuff disease?: The rational clinical examination systematic review. JAMA 2013;310(8):837–47.
14. Hurschler C, Wülker N, Windhagen H, et al. Evaluation of the lag sign tests for external rotator function of the shoulder. J Shoulder Elbow Surg 2004;13(3): 298–304.
15. Yoon JP, Chung SW, Kim SH, et al. Diagnostic value of four clinical tests for the evaluation of subscapularis integrity. J Shoulder Elbow Surg 2013;22(9):1186–92.
16. Scheibel M, Magosch P, Pritsch M, et al. The belly-off sign: a new clinical diagnostic sign for subscapularis lesions. Arthroscopy 2005;21(10):1229–35.
17. Walch G, Boulahia A, Calderone S, et al. The 'dropping' and 'hornblower's' signs in evaluation of rotator-cuff tears. J Bone Joint Surg Br 1998;80(4):624–8.
18. Chahal J, Mall N, MacDonald PB, et al. The role of subacromial decompression in patients undergoing arthroscopic repair of full-thickness tears of the rotator cuff: a systematic review and meta-analysis. Arthroscopy 2012;28(5):720–7.
19. Lashgari CJ, Yamaguchi K. Natural history and nonsurgical treatment of rotator cuff disorders. In: Norris TR, editor. Orthopaedic knowledge update: shoulder and elbow 2. Rosemont (IL): American Academy of Orthopaedic Surgeons; 2002. p. 155–62.
20. Maman E, Harris C, White L, et al. Outcome of nonoperative treatment of symptomatic rotator cuff tears monitored by magnetic resonance imaging. J Bone Joint Surg Am 2009;91(8):1898–906.
21. Safran O, Schroeder J, Bloom R, et al. Natural history of nonoperatively treated symptomatic rotator cuff tears in patients 60 years old or younger. Am J Sports Med 2011;39(4):710–4.
22. Fucentese SF, von Roll AL, Pfirrmann CW, et al. Evolution of nonoperatively treated symptomatic isolated full-thickness supraspinatus tears. J Bone Joint Surg Am 2012;94(9):801–8.
23. Yamaguchi K, Ditsios K, Middleton WD, et al. The demographic and morphological features of rotator cuff disease. A comparison of asymptomatic and symptomatic shoulders. J Bone Joint Surg Am 2006;88(8):1699–704.
24. Moosmayer S, Tariq R, Stiris M, et al. The natural history of asymptomatic rotator cuff tears: a three-year follow-up of fifty cases. J Bone Joint Surg Am 2013; 95(14):1249–55.
25. Mall NA, Kim HM, Keener JD, et al. Symptomatic progression of asymptomatic rotator cuff tears: a prospective study of clinical and sonographic variables. J Bone Joint Surg Am 2010;92(16):2623–33.
26. Tashjian RZ. Is there evidence in favor of surgical interventions for the subacromial impingement syndrome? Clin J Sport Med 2013;23(5):406–7.
27. Morrison DS, Frogameni AD, Woodworth P. Non-operative treatment of subacromial impingement syndrome. J Bone Joint Surg Am 1997;79(5):732–7.
28. Brox JI, Gjengedal E, Uppheim G, et al. Arthroscopic surgery versus supervised exercises in patients with rotator cuff disease (stage II impingement syndrome): a prospective, randomized, controlled study in 125 patients with a 2 1/2-year follow-up. J Shoulder Elbow Surg 1999;8(2):102–11.
29. Haahr JP, Østergaard S, Dalsgaard J, et al. Exercises versus arthroscopic decompression in patients with subacromial impingement: a randomised, controlled study in 90 cases with a one year follow up. Ann Rheum Dis 2005; 64(5):760–4.

30. Fukuda H, Hamada K, Nakajima T, et al. Partial-thickness tears of the rotator cuff. A clinicopathological review based on 66 surgically verified cases. Int Orthop 1996;20(4):257–65.
31. Cordasco FA, Backer M, Craig EV, et al. The partial-thickness rotator cuff tear: is acromioplasty without repair sufficient? Am J Sports Med 2002;30(2):257–60.
32. Harris JD, Pedroza A, Jones GL, et al. Predictors of pain and function in patients with symptomatic, atraumatic full-thickness rotator cuff tears: a time-zero analysis of a prospective patient cohort enrolled in a structured physical therapy program. Am J Sports Med 2012;40(2):359–66.
33. Koester MC, Dunn WR, Kuhn JE, et al. The efficacy of subacromial corticosteroid injection in the treatment of rotator cuff disease: a systematic review. J Am Acad Orthop Surg 2007;15(1):3–11.
34. Alvarez CM, Litchfield R, Jackowski D, et al. A prospective, double-blind, randomized clinical trial comparing subacromial injection of betamethasone and xylocaine to xylocaine alone in chronic rotator cuff tendinosis. Am J Sports Med 2005;33(2):255–62.
35. Adebajo AO, Nash P, Hazleman BL. A prospective double blind dummy placebo controlled study comparing triamcinolone hexacetonide injection with oral diclofenac 50 mg TDS in patients with rotator cuff tendinitis. J Rheumatol 1990;17(9):1207–10.
36. Petri M, Dobrow R, Neiman R, et al. Randomized, double-blind, placebo-controlled study of the treatment of the painful shoulder. Arthritis Rheum 1987; 30(9):1040–5.
37. Blair B, Rokito AS, Cuomo F, et al. Efficacy of injections of corticosteroids for subacromial impingement syndrome. J Bone Joint Surg Am 1996;78(11): 1685–9.
38. McWhorter JW, Francis RS, Heckmann RA. Influence of local steroid injections on traumatized tendon properties. A biomechanical and histological study. Am J Sports Med 1991;19(5):435–9.
39. Tillander B, Franzén LE, Karlsson MH, et al. Effect of steroid injections on the rotator cuff: an experimental study in rats. J Shoulder Elbow Surg 1999;8(3):271–4.
40. Mantone JK, Burkhead WZ Jr, Noonan J Jr. Nonoperative treatment of rotator cuff tears. Orthop Clin North Am 2000;31(2):295–311.
41. Wirth MA, Basamania C, Rockwood CA Jr. Nonoperative management of full-thickness tears of the rotator cuff. Orthop Clin North Am 1997;28(1):59–67.
42. Bassett RW, Cofield RH. Acute tears of the rotator cuff. The timing of surgical repair. Clin Orthop Relat Res 1983;(175):18–24.
43. Petersen SA, Murphy TP. The timing of rotator cuff repair for the restoration of function. J Shoulder Elbow Surg 2011;20(1):62–8.
44. Sugihara T, Nakagawa T, Tsuchiya M, et al. Prediction of primary reparability of massive tears of the rotator cuff on preoperative magnetic resonance imaging. J Shoulder Elbow Surg 2003;12(3):222–5.
45. Boileau P, Brassart N, Watkinson DJ, et al. Arthroscopic repair of full-thickness tears of the supraspinatus: does the tendon really heal? J Bone Joint Surg Am 2005;87(6):1229–40.
46. Goutallier D, Postel JM, Gleyze P, et al. Influence of cuff muscle fatty degeneration on anatomic and functional outcomes after simple suture of full-thickness tears. J Shoulder Elbow Surg 2003;12(6):550–4.
47. Gulotta LV, Nho SJ, Dodson CC, et al. Prospective evaluation of arthroscopic rotator cuff repairs at 5 years: part I–functional outcomes and radiographic healing rates. J Shoulder Elbow Surg 2011;20(6):934–40.

48. Cho NS, Lee BG, Rhee YG. Arthroscopic rotator cuff repair using a suture bridge technique: is the repair integrity actually maintained? Am J Sports Med 2011;39(10):2108–16.
49. Novak PJ, Bach BR Jr, Romeo AA, et al. Surgical resection of the distal clavicle. J Shoulder Elbow Surg 1995;4:35–40.
50. Flatow EL, Cordasco FA, Bigliani LU. Arthroscopic resection of the outer end of the clavicle from a superior approach: a critical, quantitative, radiographic assessment of bone removal. Arthroscopy 1992;8(1):55–64.
51. Gartsman GM. Arthroscopic resection of the acromioclavicular joint. Am J Sports Med 1993;21(1):71–7.
52. Kay SP, Ellman H, Harris E. Arthroscopic distal clavicle excision. Technique and early results. Clin Orthop Relat Res 1994;(301):181–4.
53. Denard PJ, Raiss P, Sowa B, et al. Mid- to long-term follow-up of total shoulder arthroplasty using a keeled glenoid in young adults with primary glenohumeral arthritis. J Shoulder Elbow Surg 2013;22(7):894–900.
54. Khan A, Bunker TD, Kitson JB. Clinical and radiological follow-up of the Aequalis third-generation cemented total shoulder replacement: a minimum ten-year study. J Bone Joint Surg Br 2009;91(12):1594–600.
55. Namdari S, Skelley N, Keener JD, et al. What is the role of arthroscopic debridement for glenohumeral arthritis? A critical examination of the literature. Arthroscopy 2013;29(8):1392–8.