CHAPTER 3

Evaluation of the Young Patient With Glenohumeral Arthritis

CDR Matthew T. Provencher, MD, MC, USN
Lance E. LeClere, MD

Introduction

Both the diagnosis and treatment of glenohumeral arthritis can be a challenge. The presence of concomitant shoulder pathology can cloud the clinical picture. In some scenarios, the diagnosis of glenohumeral arthritis is arrived at only after all other sources of symptoms have been excluded. The greatest challenge to the surgeon, however, may be developing a treatment plan for a patient with obvious advanced arthritis of the glenohumeral joint. This chapter discusses recommended examination techniques as well as common clinical and arthroscopic findings in young patients with glenohumeral arthritis. No specific criteria exist for what constitutes a "young" patient. A 45-year-old patient may be very active and may place similar demands on the shoulder, and therefore may have similar expectations of treatment outcomes, to those of a 30-year-old patient. An individualistic approach is important, but in general terms, we consider patients younger than 40 years as "young" in this chapter.

History

The diagnosis of glenohumeral arthritis in a young patient is often arrived at after other diagnoses have been ruled out. Advanced and global osteoarthritis of the glenohumeral joint may be associated with, or may perhaps be a result of, other shoulder pathology. The diagnosis of a relatively small but symptomatic chondral injury has been referred to as a diagnosis of exclusion.[1]

A full clinical history is imperative and should include questions regarding any previous traumatic events or episodes of instability, prior surgeries, and any history of postoperative pain control with intra-articular pain pumps. A complete medical history and family history for inflammatory arthropathies and autoimmune disorders also is important to rule out a more global joint diagnosis.

The etiology of glenohumeral arthritis in a young patient generally falls into one of three main categories: primary, posttraumatic, or postoperative. Primary glenohumeral osteoarthritis in a young patient should

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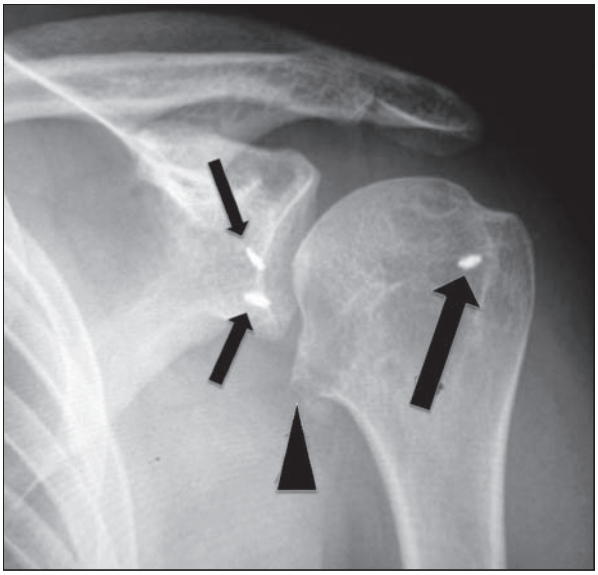
FIGURE 1



AP radiograph of a shoulder with anchor arthropathy shows proud metal suture anchors at the glenoid rim (arrows). Note the associated inferior humeral head osteophyte (arrowhead).

prompt further investigation into the patient's occupation and recreational activities; inquiry about any inflammatory arthropathies, autoimmune disorders, or sensory or neuropathic disorders; and questioning about other joints with arthritis. Posttraumatic glenohumeral arthritis most commonly occurs after multiple dislocation events, but bone loss and chondral damage can occur after a single dislocation or subluxation event.[2] Postoperative glenohumeral osteoarthritis has been associated with the use of prominent suture anchors (**Figure 1**), intra-articular pain pumps[3] (**Figure 2**), knotless suture anchors,[4] and thermal devices.[5] The surgeon also should look closely for signs of shoulder infection. The shoulder has been referred to as a relatively immunoprivileged area, and cultures or laboratory tests may have nonspecific or negative results, even in the presence of an infectious process (especially with an etiology of *Propionibacterium acnes*).

Obtaining the patient's social history, including both vocational and recreational activities, is important in that it identifies contributing causes of osteoarthritis and provides insight into the expectations of the patient and the surgeon regarding optimal treatment strategies and outcomes. A complete history also can help guide the surgeon in making treatment recommendations, managing postoperative expectations, and recommending lifestyle changes. Manual laborers and professional athletes can place high loads across the glenohumeral joint and may expect to return to very high levels of function. Some recreational athletes who also place high demands on the glenohumeral joint may have similar expectations. Elhassan et al[6] considered volleyball, baseball, basketball, football, hockey, and "heavy lifting" to be high-demand activities, whereas golf and basic swimming were not.

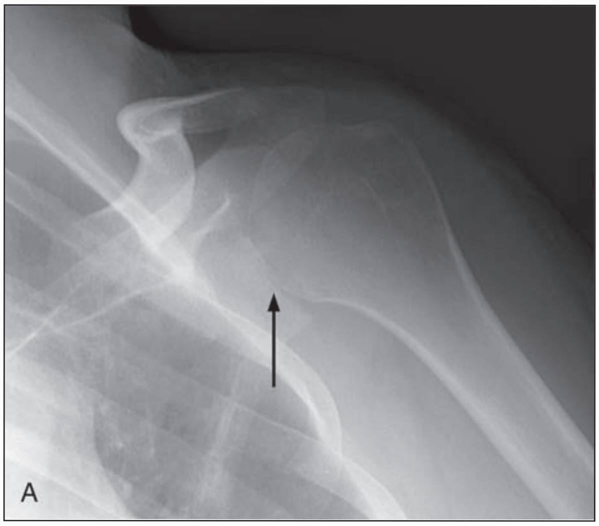
Patients with glenohumeral arthritis may report vague shoulder pain and may note that the pain occurs at night, causing difficulty with sleep.[1] Mechanical symptoms also may occur, and patients may report locking or catching.[7] Pain with shoulder range of motion and decreased range of motion also may occur. Patients often report dull, global shoulder pain that is worse with weightbearing activities. Athletes and laborers may note declining shoulder function and performance over time. Often, patients have been on an extensive trial of NSAIDs and/or physical therapy. Previous intra-articular steroid injections may have achieved a temporary improvement in symptoms.

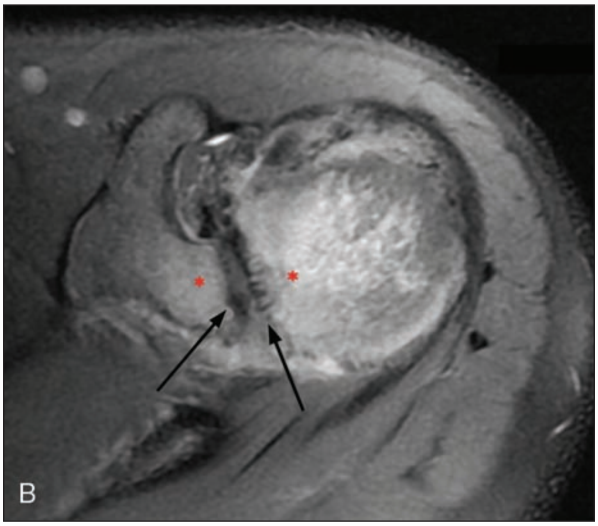
Physical Examination

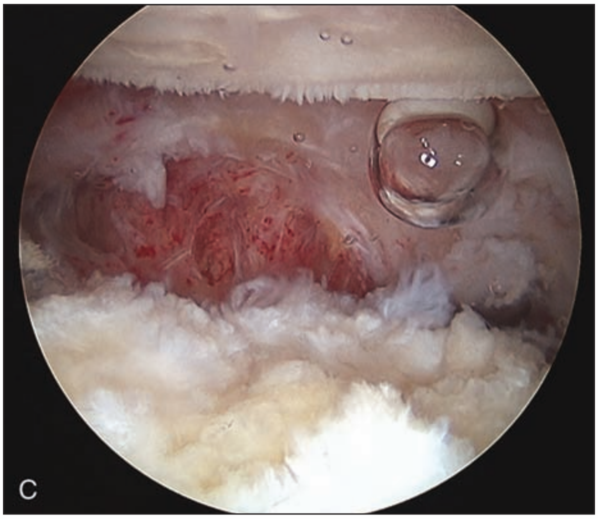
Glenohumeral arthritis and/or chondral injuries may be a diagnosis of exclusion. As such, the physical examination should be framed with this in mind. A thorough examination that seeks to rule out other primary sources of shoulder pain is essential.

The examination of a patient with glenohumeral arthritis can be quite difficult because many examination maneuvers reproduce pain, and many provocative tests are nonspecific. A comprehensive physical examination of both shoulders is essential and should begin with the unaffected shoulder to achieve patient relaxation and gain the patient's confidence. A man should remove his shirt, and a woman should wear a tank top or sports bra during the examination. This is important to assess the entire shoulder and to view the scapula, which is important in overall shoulder function. The examiner should look for any muscle atrophy about the shoulder girdle, abnormal shoulder motion (active or

FIGURE 2







Images of the left shoulder of a 21-year-old man obtained 6 months after arthroscopy and pain pump placement. **A,** AP radiograph shows marked loss of joint space (arrow). **B,** Axial MRI shows diffuse signal intensity changes in the humeral head and glenoid subchondral bone (asterisks) and chondral surface irregularities (arrows). **C,** Arthroscopic view shows corresponding diffuse cartilage damage.

passive), asymmetry, surgical scars, swelling, or scapular winging and tracking.

Instability testing should be performed, including the load-and-shift test, the posterior stress test, the Kim test for posterior instability, the jerk test, and the apprehension/relocation test. Impingement testing also should be performed, including the Hawkins and Neer tests. It should be noted that pain on impingement testing may mimic pain due to osteoarthritis.[8] The biceps tendon should be palpated. Provocative tests of the long head of the biceps, such as the Speed and Yergason tests, often elicit pain that mimics glenohumeral arthritis pain on examination because of the intra-articular location of the tendon.[1] In addition, concomitant biceps inflammation is present in osteoarthritis of the shoulder and may be one of the earliest findings of degenerative joint disease.

The compression rotation test described by Ellman et al[8] can help differentiate between impingement pain and chondral pain. For this test, the patient lies in the lateral decubitus position with the affected side facing up. The examiner compresses the humeral head toward the glenoid while the patient internally and externally rotates the arm. Reproduction of pain indicates that glenohumeral chondral lesions are contributing to the patient's symptoms. This result does not rule out impingement as a component of the patient's pathology, however.[8]

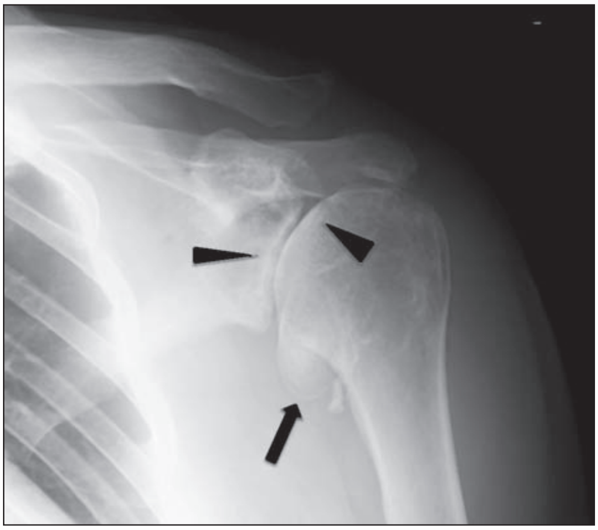
Close attention also should be paid to shoulder range of motion. Because capsular contractures can occur with chondral injuries,[9-11] the examiner should note any loss of motion, especially internal and external rotation with the arm abducted.[2] Cameron et al[12] noted associated stiffness of the shoulder in 22 of 61 patients (36%) who underwent arthroscopy for Outerbridge grade IV osteochondral lesions of the glenohumeral joint. Decreased range of motion predictably corresponds with tight or contracted structures, and these shoulders should be considered for release during arthroscopy. With the arm in abduction and external rotation, a contracted anteroinferior capsule usually is present. Decreased range of motion in abduction and internal rotation typically indicates a tight posterior capsule. Decreased external rotation with the arm at the side corresponds with a tight rotator interval and anterior capsule, and decreased range of motion with internal rotation at the side (hand on the back) corresponds with a tight posterior and posteroinferior capsule. Decreased abduction typically is associated with an inferior capsular contraction.

Imaging

Radiography

Standard AP, scapular Y, and axillary views of the shoulder should be obtained. Joint space narrowing, osteophyte formation, and overall alignment of the glenohumeral joint should be noted. In 1983, Samilson and Prieto[13] introduced their grading system for glenohumeral arthritis. This grading system was developed in patients with glenohumeral arthropathy as a sequela of shoulder instability and was based on the size of osteophytes that formed at the inferior aspect of the humeral head and/or glenoid. According to this system, glenohumeral arthritis is classified as mild, moderate, or severe based on radiographic evidence seen on the AP view. A shoulder with osteophytes less than 3 mm in height is considered to have mild disease. Moderate disease is characterized by osteophytes between 3 and 7 mm and mild joint irregularities. Shoulders with osteophytes greater than 7 mm, with narrowing of the joint and subchondral sclerosis, are considered to have severe disease (**Figure 3**). This classification scheme has been shown to have excellent intraobserver agreement.[14]

FIGURE 3



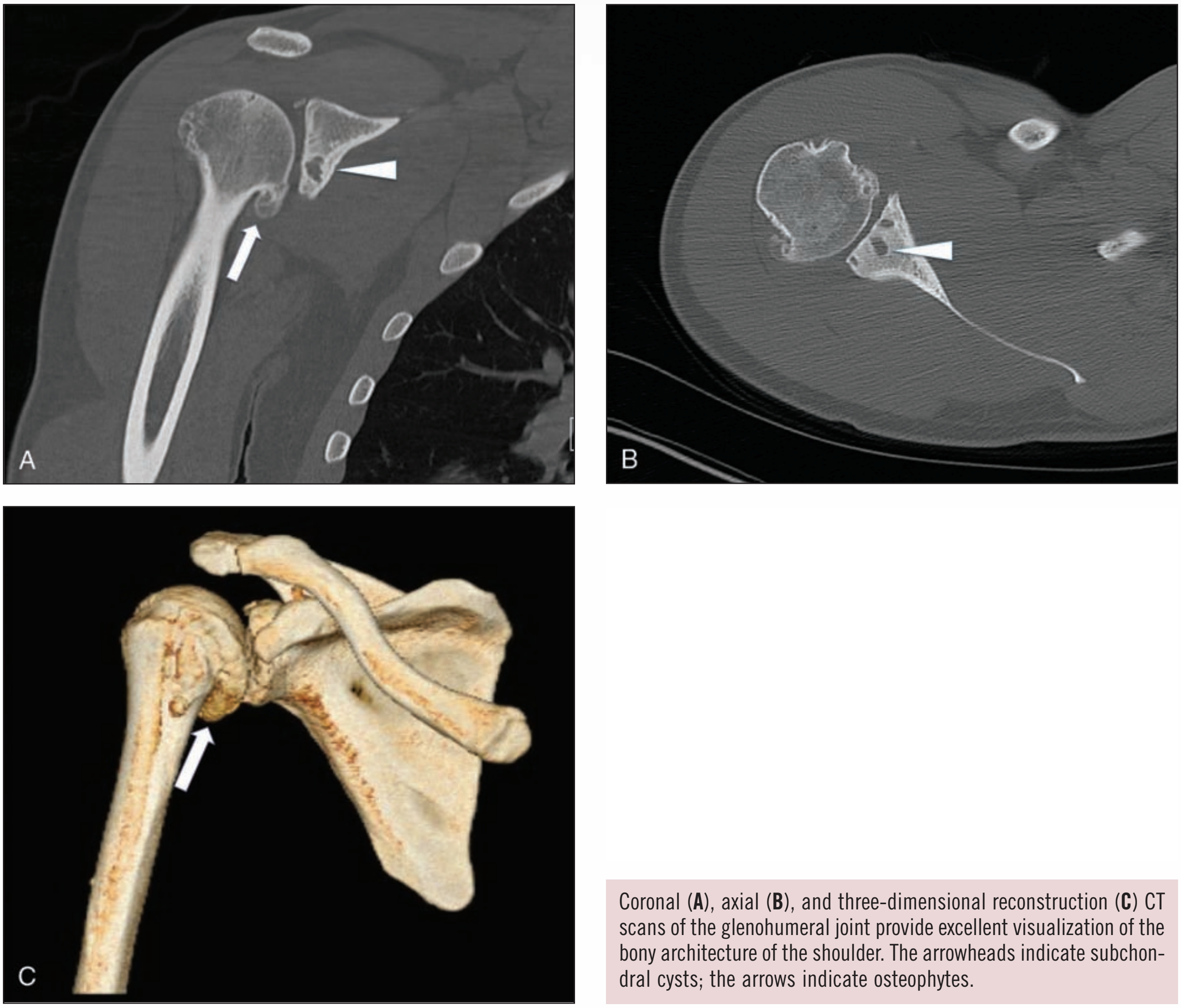
True AP radiograph depicts severe glenohumeral arthritis in a patient who underwent arthroscopic Bankart repair 2 years prior. Note the marginal osteophyte on the inferior aspect of the humeral head (arrow) and the subchondral sclerosis (arrowheads).

Special views of the glenohumeral joint may allow further analysis of the joint. The anteroinferior glenoid is best visualized with a West Point view or an apical oblique view,[1] whereas a Hill-Sachs lesion is best shown with a Stryker notch view or an axillary view.[1]

Computed Tomography

CT scans provide excellent visualization of the bony anatomy of the glenohumeral joint (**Figure 4**). New techniques, which include three-dimensional (3D) reconstruction and digital subtraction of the humeral head or glenoid, allow detailed examination of the joint surfaces of these bones. CT-based classification schemes also have been developed[15] and may help in preoperative planning.[16] Knowledge of the glenoid version is

FIGURE 4



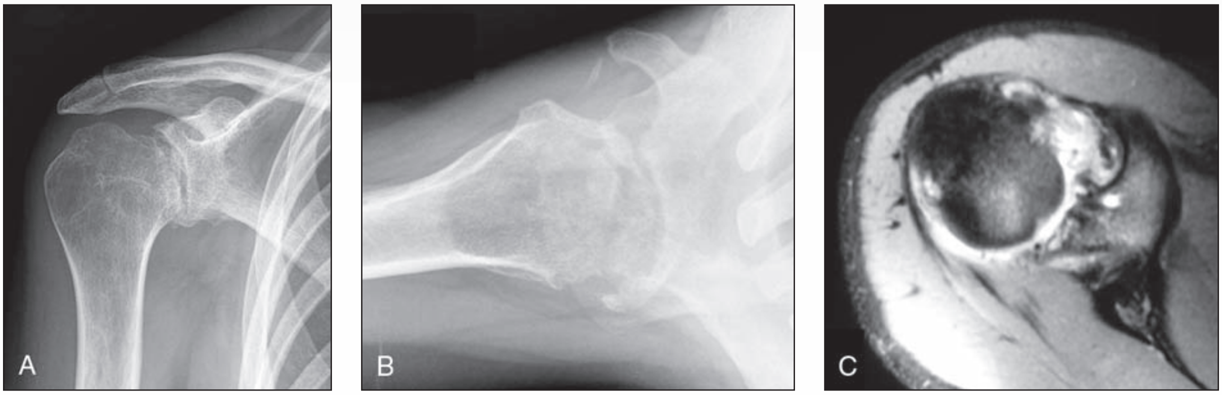
Coronal (**A**), axial (**B**), and three-dimensional reconstruction (**C**) CT scans of the glenohumeral joint provide excellent visualization of the bony architecture of the shoulder. The arrowheads indicate subchondral cysts; the arrows indicate osteophytes.

essential when arthroplasty is the chosen treatment, and CT scans are more accurate than axillary radiographs at assessing glenoid version.[17]

Magnetic Resonance Imaging

Although radiographs and CT scans are excellent for evaluating the bony architecture of the glenohumeral joint, MRI is the preferred method for evaluating chondral irregularities[18-21] (**Figure 5**). Previous work on the evaluation of cartilage lesions using MRI has shown that several imaging sequences are helpful. McCarty and Cole[7] found that proton-density and T2-weighted fast spin-echo (FSE) sequences, fat-suppressed T1-weighted 3D spoiled gradient-echo (GRE) sequences, and 3D double-echo steady-state sequences were both sensitive and specific when evaluating Outerbridge grade II through IV lesions. With regard to evaluating MRI and magnetic resonance arthrography for chondral lesions, Hayes et al[22] described subtle cartilage lesions as signal intensity alterations or irregular surface areas in both modalities. Guntern et al[19] classified marked lesions on magnetic resonance arthrography as defects that involve

FIGURE 5



AP (**A**) and axillary (**B**) radiographs and an axial MRI (**C**) depict advanced glenohumeral arthritis in the right shoulder of a 38-year-old man. Note the extensive subchondral erosions, loss of joint space, and marginal osteophytes.

more than 50% of the cartilage thickness and may include defects of the subchondral bone.

Both MRI and magnetic resonance arthrography have limitations. Yeh et al[20] found that the thickness of articular cartilage tended to be overestimated on magnetic resonance arthrography in areas with thin cartilage (eg, the humeral head) and underestimated in areas of thick cartilage (eg, the glenoid). Furthermore, Guntern et al[19] found that magnetic resonance arthrography detection of glenohumeral chondral abnormalities was moderate, with only fair interobserver agreement.

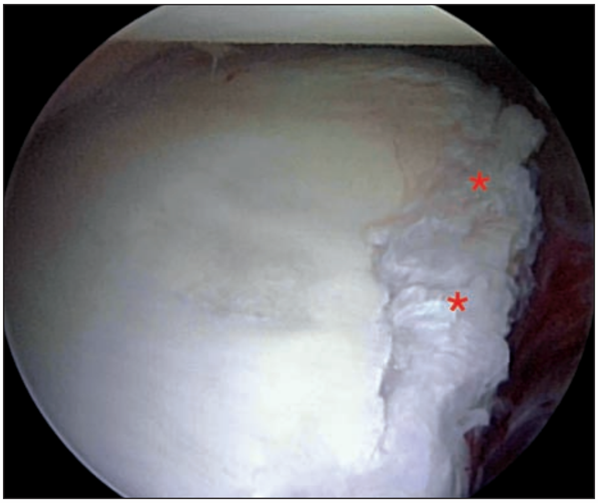
Recent studies are more encouraging, however. Hayes et al[22] demonstrated a high sensitivity and specificity of MRI evaluation of glenohumeral chondral lesions of 87.2% and 80.6%, respectively. Interestingly, no difference was found in accuracy when comparing MRI with magnetic resonance arthrography.[22]

Arthroscopy

Arthroscopy remains the gold standard in terms of characterizing chondral lesions in young patients with glenohumeral arthritis. Although advances have been made in MRI and magnetic resonance arthrography, the direct visualization and tactile feedback of arthroscopy afford the surgeon superior assessment of lesions. If the diagnosis remains unclear even after advanced imaging, it is not unreasonable to consider diagnostic arthroscopy.

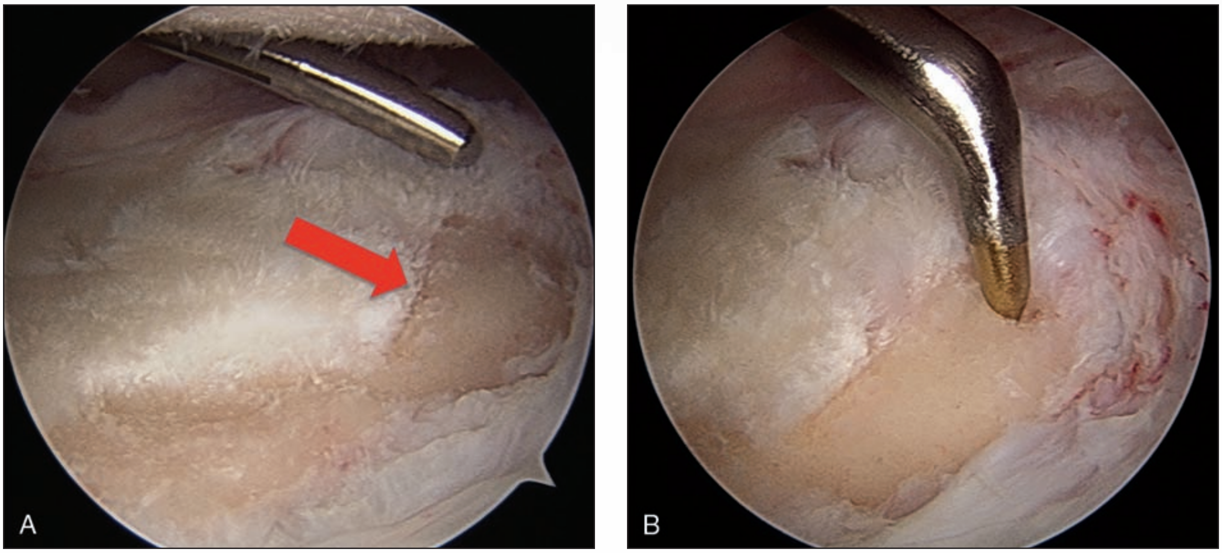
Several important characteristics must be noted during arthroscopy, including the extent of chondral damage; the size, depth, and polarity of lesions (ie, whether they occur on the glenoid, the humeral head, or both); and associated findings (**Figure 6**). Multiple algorithmic approaches have been proposed for the treatment of

FIGURE 6



Arthroscopic view of a glenolabral articular disruption (GLAD) lesion shows advanced chondral changes and subsequent fibrocartilaginous fill of the previous defect (asterisks).

FIGURE 7



Arthroscopic views of a focal cartilage lesion of the glenoid. **A,** The lesion (arrow) before treatment. **B,** The lesion being treated with microfracture.

glenohumeral cartilage defects based on these characteristics.[1,7] It is important to have a treatment plan and to discuss clear expectations with patients before offering arthroscopic intervention. Because it may not be known which branch of the algorithm the patient is on before arthroscopy, it is important to discuss all possible outcomes with the patient. The type and extent of postoperative rehabilitation and immobilization, as well as any possible future interventions or surgeries, may be determined by what is discovered during arthroscopy as well as by any arthroscopic interventions used.

An important distinction should be made between focal and extensive chondral damage. A well-circumscribed lesion is much more amenable to palliative and reparative techniques such as chondroplasty and microfracture (**Figure 7**), as well as to restorative techniques, such as osteochondral plugs or transfers, than is more chondral damage. Diffuse, widespread loss of cartilage requires more involved reconstructive options such as bulk allograft. Similar distinctions can be made between small and large chondral lesions. Smaller lesions (generally <2 cm^2)[1] are more amenable to palliative and reparative techniques. One of the best initial surgical treatments is arthroscopic capsular release and débridement, with or without biceps tendon release or tenodesis. This procedure is discussed in chapter 6.

In general, unipolar cartilage lesions are much more responsive to palliative and reparative techniques than are bipolar lesions.[23] Bipolar lesions, which are defined as chondral lesions on both the glenoid and the humeral head, can portend a poorer prognosis, especially if secondary bony changes on the glenoid, such as posterior erosion or a biconcave glenoid conformation, are present.

It is important to note any associated findings at the time of arthroscopy. These findings include the size and location of marginal osteophytes, associated glenoid bone loss, biceps tendinitis, rotator cuff tears, and/or capsular or rotator interval contractures. Patients with a history of previous surgery should be inspected for proud implants, such as suture anchors, or extensive chondrolysis from intra-articular pain pumps or thermal devices.[24]

Conclusions

The diagnosis and treatment of glenohumeral arthritis in the young patient remains a challenge. Obtaining a complete and accurate patient history can aid in determining whether the arthritis is due to primary, posttraumatic, or postoperative causes and can guide treatment. Performing a thorough physical examination is paramount, and the results may identify concomitant shoulder pathology that either contributes to the underlying cause or should be addressed as part of the overall treatment plan. Obtaining the correct shoulder imaging is important to help characterize the size and extent of any focal cartilage lesions, to assess whether lesions are unipolar or bipolar, to characterize bony or osteophytic changes, and to identify important concomitant shoulder pathology that often also needs to be addressed. Arthroscopy is a valuable early treatment modality, but it also can help in staging later disease for larger, more extensive treatment in advanced arthritis of the glenohumeral joint in the young patient.

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