Glenohumeral Instability

Soft tissue lesions can include pathologic changes of the labrum, capsule, glenohumeral ligaments, rotator cuff, and dynamic muscular stabilizers. Classically, the Bankart lesion, which is an avulsion of the anteroinferior labrum and IGHLC from the glenoid rim, was viewed as the essential lesion for anterior dislocation (Figure 14).\(^2,7,8\) This results in decreased glenoid depth and reduction in force required for dislocation. Cadaveric and clinical data have shown that, although it is seen in most anterior dislocations, a Bankart lesion alone is not sufficient to cause dislocation.\(^8\) An anterior labroligamentous periosteal sleeve avulsion (ALPSA) lesion results after the labrum, IGHLC, and periosteum displace and heal medially along the scapular neck (Figure 15). This more chronic lesion results in a substantially higher risk of recurrent instability.\(^13\) Lesions of both the superior and posterior labrum also result in glenohumeral instability. Superior labrum anterior-posterior (SLAP) le-
sions can cause increased glenohumeral translation and result in instability (Figure 16). Correlations can be seen in patients who are less than 40 years of age and have concomitant SLAP tears and Bankart lesions. Posteroinfemor labral tears can be seen with posterior dislocations, and concealed avulsions of the posteroinfemor labrum or Kim lesions occasionally can result in posterior and multidirectional instability (Figure 17).

A capsular lesion can result after either acute traumatic or repetitive microtrauma. In cadaveric studies, researchers have shown that failure of the IGHLC can occur in multiple locations with instability. It occurs at the glenoid or humeral insertions or in the intras substance 40%, 25%, and 35% of the time, respectively. Humeral avulsion of the glenohumeral ligament lesions can occur after substantial trauma with or without concomitant lesions of the labrum (Figure 18). Capsular tears also can be seen in patients with acute dislocations. Repetitive microtrauma and capsular stretch occur in overhead athletes secondary to overuse. Fatigued dynamic stabilizers allow increased strain to the capsuloligamentous restraints. This results in plastic deformation of the capsule over time (Figure 19). In addition, atraumatic instability in patients with hyperlaxity is secondary to excessive capsular laxity and either macrotraumatic or microtraumatic insult.

With glenohumeral instability, the rotator cuff and other muscular stabilizers can be abnormal. Patients who are more than 40 years of age typically present with complete rotator cuff tears after dislocations (Figure 20). Anterior dislocations can cause tearing of the subscapularis and supraspinatus, and chronic...
superior subluxation of the glenohumeral joint is seen with massive rotator cuff tears. Abnormal muscular coordination and activity can be seen in patients with multidirectional instability. Electromyography (EMG) had displayed abnormal firing of the deltoid and shoulder girdle musculature associated with multidirectional instability.\(^\text{19}\)

Neurologic imbalance also occurs with glenohumeral instability. Electric shock and seizure can cause posterior dislocation. With sustained firing of all muscles of the shoulder girdle, the relatively stronger internal rotators overpower the external rotators, resulting in posterior dislocation. Nerve injury results in approximately 48% of the population after an acute instability episode (Figure 21).\(^\text{20}\) The axillary and suprascapular nerves are the most commonly affected, with an average recovery time of 12 to 45 weeks. Nearly complete nerve recovery can be expected in most patients, but a substantial loss of motion results too.\(^\text{20}\)

**DIAGNOSIS**

Accurate diagnosis of glenohumeral instability requires a complete knowledge of pertinent anatomy, pathophysiology, patient history, physical examination, and appropriate imaging. As mentioned, glenohumeral instability is a pathologic condition in which translation of the humerus outside the glenoid arc causes symptoms of pain and apprehension. Many different classification systems have been proposed. Factors examined include cause, direction, chronicity, and combinations thereof. Gerber and Nyffeler\(^\text{21}\) proposed an elegant classification system, which distinguishes among static, dynamic, and voluntary dislocation.

Static instability is diagnosed with radiographs and describes a degenerative condition that has resulted in fixed anterior, superior, or posterior subluxation of the humeral head.\(^\text{21}\) Dynamic lesions are either unidirectional or multidirectional and either are or are not associated with hyperlaxity.\(^\text{21}\) Individuals who voluntarily dislocate the shoulder fall into 3 groups: muscular, positional, and psychiatric dislocators.\(^\text{21}\) Accurate diagnosis allows communication among orthopaedic surgeons and implementation of appropriate treatment.

**Clinical and Imaging Evaluation**

A thorough history and physical examination are paramount to the diagnosis of glenohumeral instability. Multiple imaging techniques, examination under anesthesia, and arthroscopy are helpful tools that help establish a diagnosis when the cause of instability is unclear, but nothing is a substitute for a clinical diagnosis. Determining the exact details surrounding the onset and initial incident of instability is important. Factors, such as age, mechanism, position, and direction of instability provide important guides to treatment. In addition, types of previous treatment, including rehabilitation, immobilization, or previous operations, help delineate the problem. Finally, ongoing symptoms, including apprehension, shoulder pain, positional issues, neck pain, and voluntary or habitual dislocation guide treatment.
Physical examination has an important role in the diagnosis of shoulder instability. A complete musculoskeletal evaluation, including inspection, palpation, range-of-motion, strength testing, neurologic evaluation, cervical spine evaluation, shoulder stability testing, and other special tests, is essential. Visual inspection will uncover any signs of collagen disorders, such as widened scars, atrophy that indicates nerve injury, scapular diskinesis, or a sulcus sign pointing toward multidirectional instability (Figure 22). Any difference between active and passive range of motion, as well as in strength, should be assessed. Patients with anterior instability usually have tenderness over the posterior capsule, and patients with multidirectional instability generally display tenderness over the medial border of the scapula. Concomitant rotator cuff lesions present as weakness, tenderness over the greater tuberosity, or crepititation throughout the range of motion. Signs, such as thumb hyperabduction and finger, elbow, and knee hyperextension, point toward global ligamentous laxity (Figure 23A and B). Special tests to elucidate the cause of instability include the sulcus sign, load and shift, apprehension, and relocation.

The sulcus sign is performed with the patient’s arm at the side in neutral rotation and adduction (Figure 24). The examiner places inferiorly directed force on the humerus and measures the distance between the humeral head and acromion. A distance of greater than 2 cm is considered a positive test and indicates inferior instability. A positive sulcus sign is a requirement for a diagnosis of multidirectional instability. In addition, the test can be performed with the arm at the side in maximal external rotation. This maneuver will tension the anterior capsule and rotator interval, and the persistence or resolution of a sulcus sign in external rotation highlights pathologic lesions in these structures.

Load-and-shift testing establishes clinically important translation of the humeral head on the glenoid. The test is performed either in the seated or supine position. The supine position with the scapula stabilized will effectively eliminate scapulothoracic motion (Figure 25). The arm is placed in the scapular plane in 20° of abduction and forward flexion, and the humeral head is loaded. An anterior, posterior, and inferior stress is placed and clinically important translation is graded. Grade 0 indicates minimal movement; grade 1+, the humeral head rides onto the labrum; grade 2+, the humeral head subluxes but spontaneously reduces; and grade 3+, the humeral head dislocates and remains dislocated (Figure 26).

Apprehension and relocation is best tested in the supine position (Figure 27). The arm is placed in 90° of abduction and maximal external rotation. The patient will express a feeling of apprehension or impending instability either through oral cues, facial expressions, or protectively contracting their muscles. Relocation can be assessed in conjunction with apprehension by placing a posteriorly directed force on the proximal
humerus. Both apprehension and pain should disappear. The presence and relief of pain only with apprehension and relocation is associated with conditions other than instability, but the relief of apprehension with relocation substantially increases the accuracy of the test for instability.\textsuperscript{22,23} For posterior apprehension, the shoulder is adducted, internally rotated, and flexed to 90°, and a posterior force is applied. In addition, a posterior jerk test and novel Kim test can be used to assess the shoulder for posterior instability with a symptomatic posterior labral tear.\textsuperscript{24,25} The jerk test is performed with the patient seated. The examiner applies an axial force to the arm in 90° of abduction and internal rotation. The arm is horizontally adducted with axial force maintained. Pain and a “clunk” are indicative of a positive test (Figure 28).\textsuperscript{24} The Kim test is performed with the patient seated and the arm in 90°
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d of abduction. The examiner holds the elbow and places a strong posterior and inferior force on the arm while placing an axial load and diagonally elevating the arm to 45°. Sudden onset of shoulder pain indicates a positive test (Figure 29). When painful, the posterior jerk test can be an indicator of future failure of nonoperative management. The jerk test combined with the novel Kim test has a sensitivity of 97% at detecting a substantial posteroinferior labral lesion.

Imaging can provide further information to the complete instability evaluation. Plain radiographs are the initial imaging modality of choice to assess concentricity of the glenohumeral joint and bony pathologic lesions, such as bone loss or fracture. For an acute instability episode, radiographic views must include true anteroposterior (AP) and axillary-lateral views of the shoulder (Figures 30A and B). Without an axillary-lateral view, an acute dislocation can be missed, especially if it occurs in the posterior direction. Special views, such as the West Point, Stryker notch, or AP in internal rotation views, highlight bony defects, such as bony Bankart or Hill-Sachs lesions. Ultimately, computed tomography (CT) scan with 3-dimensional reconstruction views provide the most accurate detail of bony anatomy and should be obtained if clinically important bone loss is suspected (Figure 31).

Magnetic resonance imaging (MRI) remains the criterion standard for imaging of the shoulder in patients with instability (Figure 32). Advantages of MRI include superior soft tissue resolution, multiplanar images, no ionizing radiation, and the ability to view the rotator cuff and intraarticular structures. Injection of intraarticular contrast, or magnetic resonance arthrography (MRA), increases the sensitivity and accuracy in the diagnosis of subtle labral and ligamentous lesions, anterior labral tears, SLAP lesions, partial-thickness rotator cuff tears, and both acute and chronic labroligamentous lesions.

**Patient Selection**

Decisions for treatment of instability are based on several factors, including mechanisms, chronicity, age, direction, classification, and patient factors. Nonoperative management is appropriate for many instability patterns. Patients with atraumatic episodes, voluntary instability, posterior instability, multidirectional instability, and certain cases of chronic dislocations and patients who are children or athletes in season can be treated successfully with nonoperative measures. Principles of nonoperative management include treatment with reduction, a period of immobilization, and directed physical therapy. Operative treatment is recommended for irreducible or open dislocations, recurrent dislocations, substantial bony defects with recurrence, and failure of nonoperative management for patients with anterior, posterior, or multidirectional instability. Because of high rates of redislocation and