Diagnosis and Arthroscopic Management of Posterior Shoulder Instability

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Introduction

Posterior shoulder instability (PSI) is a condition increasingly diagnosed in young, active patients. Because of the need for its accurate diagnosis, it is important to understand the symptoms of PSI and the types of sports and other activities that raise the risk of its occurrence. Physical examination plays a key role in the diagnosis of PSI, and several specific, provocative tests can be performed to identify its presence. Patients in whom the nonsurgical management of PSI fails may be candidates for surgical intervention, with arthroscopic techniques providing good results when used under the appropriate indications.

Pathophysiology and Etiology

Posterior shoulder instability accounts for approximately 5% of cases of instability of the glenohumeral joint, although its incidence may be greater in population groups that routinely use their arms in ways likely to provoke injury to the shoulder joint, such as football players, weight lifters, and rock climbers.[1] The condition can occur as a consequence of an acute event or through repeated microtranslation of the shoulder joint.[2] Although acute injuries or dislocations of the shoulder are more readily identified than is repeated microtrauma, the latter can result from recurrent, insidious instances of instability, such as from the repeated imposition of a load posteriorly across the shoulder, as in the case of bench press or inclined press exercises in weight lifting, or in push-ups. The acute events responsible for PSI can be secondary to a forceful impact and shearing, as in blocking by a football lineman, or can result from fatigue of the structures that stabilize the shoulder, leading to laxity of the shoulder capsule, as in overhead throwing and swimming.

To understand glenohumeral instability, it is important to appreciate the relationship of the structures that provide static and dynamic stability to the shoulder with differing positions of the arm in space. The structures chiefly responsible for preventing posteroinferior translation of the shoulder joint are the posterior band of the inferior glenohumeral ligament (PIGHL), which is the main static restraint on the glenohumeral joint,[3] and the subscapularis muscle, which is the primary dynamic restraint on the joint.[4,5] The PIGHL is maximally tensioned with the arm flexed and internally rotated, which is why patients participating in sports that involve extending the arm in front of the body are at risk for PSI. This position, described by Mair and associates[6] in football and lacrosse players, is likely to create a shear force at the posterior labrum of the glenohumeral joint. In general, one should consider the following activities or sports as creating a risk for PSI: weight training, in bench pressing; push-ups; golf, in the backswing of the club; tennis, in the backhand stroke; rowing; swimming, in the butterfly and freestyle strokes; baseball, in overhead throwing and hitting; and football, in blocking by linemen. The posterior of the shoulder capsule, extending from the insertion of the long head of the biceps brachii to the PIGHL, is relatively thin and easily attenuated, and the posteroinferior capsule is injured through repetitive insult, which leads to redundancy and increased joint volume. However, posterior capsular injury alone does not create PSI.

The posterior capsule of the shoulder joint differs biomechanically from the anterior capsule and ligaments,[3] and this is one reason why patients with recurrent PSI present with complaints and have findings on examination that differ from those of patients with anterior instability of the shoulder. Moreover, the outcomes of posterior instability differ and are somewhat less

predictable than the outcomes of anterior instability.

Burkhart and colleagues[7,8] described the sequence of events in glenohumeral internal rotation deficit (GIRD) and its consequences in the setting of PSI. Specifically, throwers develop posteroinferior contracture of the shoulder capsule, which rotates the fulcrum of the glenohumeral joint posterosuperiorly. This allows the humeral head to clear the anteroinferior restraints on the joint, permitting more external rotation and greater posterosuperior translation (Figure 1).

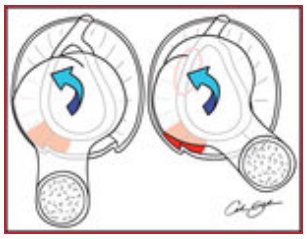

Fig. 1

When the posteroinferior portion of the shoulder capsule becomes contracted in the setting of GIRD, the humeral head clears the anterior soft tissue with abduction and external rotation, and alters the center of rotation of the humeral head to a more posterosuperior location (blue arrow). This can lead to posterosuperior pathology (red oval).

With regard to the dynamic stabilizers of the shoulder joint in throwers, fatigue of the subscapularis tendon permits additional external rotation, increasing contact pressures in the glenohumeral joint. These changes in the dynamic and static stabilizers of the shoulder, along with their flexed, adducted, and internally rotated position on follow-through, create the risk of posterior propagation of a type II superior labrum anterior-to-posterior (SLAP) tear to a type VIII SLAP tear, with potential posterosuperior instability. Involvement of the anterosuperior structures in PSI, such as the superior glenohumeral ligament and the rotator interval, has also been questioned, and is likely less important than that of the posterosuperior structures. Other static stabilizers that can be involved in PSI are the chondrolabral surface and bone of the glenoid fossa. The former plays a key role in the concavity-compression mechanism in the shoulder joint as its integrity increases the amount of lateral humeral displacement necessary for subluxation.[9,10] Osseous defects in the glenoid consist of a range of pathologies including glenoid hypoplasia, deficiency of the posterior glenoid rim, and glenoid retroversion. A variety of treatments exist for these deficiencies, but none is arthroscopic.

Diagnosis

Patient History

Posterior shoulder instability should be considered when evaluating patients younger than 35 years who participate in activities in which the arm is positioned in front of the body in flexion and internal rotation and who complain of vague shoulder pain. The possibility of PSI in such patients is probably underappreciated, and their participation in the sports named earlier should be probed. The shoulder pain in such cases, which is typically deep and posterior, is these patients' most common complaint.[11,12] Patients with PSI may also give a history of positional instability during flexion and internal rotation of the arm, or of muscular instability in voluntary movement.[13] The important difference in these two situations is that the former is a result of true pathology whereas the latter involves ligamentous laxity or muscular imbalance, and patients who have this are not good candidates for surgery. A detailed history, including the number of dislocations or "instability events" involving the shoulder, as well as the timing of the first incident, are important in making an accurate diagnosis of PSI.

Physical Examination

Physical examination of the patient for possible PSI should begin with a direct inspection for asymmetry and atrophy of the shoulder. It is very important to fully assess the dynamic behavior of the scapula because scapular stability and function are paramount to the optimization of treatment for PSI and successful rehabilitation of the patient. Patients with PSI

typically have tenderness at the posterior glenohumeral joint line, and may have increased external rotation of the shoulder, although its range of motion (ROM) is typically normal and symmetric.[14]

Provocative Tests

Please refer to the included video for demonstrations of the physical examination maneuvers.

Specific testing for PSI includes the modified load-and-shift test,[15] examination for the sulcus sign, testing for instability on voluntary motion, and the jerk test.[4] The examiner can perform the jerk test with the patient in the upright position while holding the patient's arm by the elbow and taking it from a position of forward flexion through internal rotation (subluxated humeral head) and into abduction. As the arm is brought into abduction, the examiner can appreciate the relocation of the humeral head. During the jerk test, the examiner should stabilize the patient's distal clavicle and scapular spine. Similarly, the shoulder can be tested for instability on voluntary motion by having the patient perform the jerk test volitionally. With the patient in the lateral decubitus position, a modified load-and-shift test can be done by grasping the head of the humerus with three or four fingers and bringing the arm from abduction and internal rotation into adduction and flexion, with observation for subluxation. The procedure can be repeated to confirm the presence of subluxation. The modified load-and-shift test can then be repeated with increasing forward flexion correlating with more posteroinferior lesions, with the goal of reaching the 7 o'clock position. A final test for PSI is the Kim test,[16] which involves provocative positioning of the arm in 90º of abduction while elevating it, with downward and posterior force being applied to detect symptoms. The combined sensitivity of a positive jerk test and positive Kim test in identifying PSI is 97%.[16]

Diagnostic Imaging

Preoperative studies in the setting of suspected PSI are important both for ruling out bony pathology and identifying labral pathology. Radiographs and CT scans help in the evaluation of glenoid erosion or retroversion and in detecting a reverse Hill-Sachs lesion. Radiographs should include the standard (AP view, along with the scapular Y and axillary views). The AP view should be a true AP view of the glenohumeral joint, with the x-ray beam angled at about 40º from horizontal in the sagittal plane. The axillary radiograph is paramount in both the acute and chronic setting for identifying dislocation or bone loss, respectively.

Other specific views that can be used in identifying PSI are the West Point view, which is beneficial for further evaluating the glenoid rim. For this view the patient is put into the prone position with the arm in neutral rotation and 90º of abduction. The x-ray beam is then directed from inferior to superior through the shoulder at an angle of 25º. The Stryker notch view is commonly used in examining for a possible Hill-Sachs lesion, but is less beneficial in the setting of posterior instability, in which it may reveal only the rare reverse Hill-Sachs lesion. CT scans provide more detailed information about glenoid version and possible bone loss. MRI alone, or MRI arthrography, can further elucidate suspected labral pathology and the integrity of the rotator cuff. The authors base the need for CT scans on the suggestion of bone loss in radiographs and even more so in MRI.

PSI may also be accompanied by a posterior humeral avulsion of the glenohumeral ligament (PHAGL) or pathology of the rotator interval. MRI with arthrography is useful for characterizing partial avulsions of the posterior labrum, the so-called Kim lesions. These labral lesions can be classified into the following four groups: lesions marked by incomplete detachment of the labrum, incomplete and concealed avulsions of the labrum (Kim lesions), lesions marked by chondrolabral erosion, and flap tears (Figure 2). Recognition of these lesions is important because surgical intervention with capsulolabral repair typically yields favorable results in such cases.

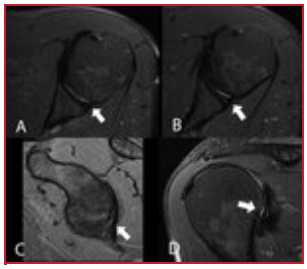

Fig. 2

T2-weighted magnetic resonance images of the shoulder in the axial (**A** and **B**), sagittal (**C**), and coronal (**D**) planes, demonstrating a posteroinferior labral tear.

Management Options

Nonsurgical Treatment

Physical therapy for patients with PSI should focus on scapulothoracic mechanics and strengthening of the rotator cuff, and specifically of the subscapularis muscle. Two thirds of patients will respond in programs for strengthening and improving proprioception.[17] Most of these responders are patients with a history of repetitive microtrauma, as opposed to those who have had a single traumatic event or who have clear labral pathology, who will more likely require surgical stabilization. Although not a hard and fast rule, patients with GIRD and posterior instability are likely to derive greater benefit from therapy than those in whom labral pathology is the result of a forceful, shearing event, such as football linemen and weight lifters. Nevertheless, despite the tendency of GIRD to respond to therapy, labral pathology commonly requires arthroscopic treatment. The results in patients with GIRD and posterior instability are dramatic, with a 90% response to therapy, as opposed to only a 10% response in those with traumatic injuries. Notwithstanding this, patients who are identified as having PSI should have their scapular mechanics optimized and undergo strengthening before any surgical management of their condition is undertaken. Patients with a history of nontraumatic dislocation of the shoulder who do not have psychological pathology or a voluntary component of their disorder usually demonstrate stability at an average of 5 weeks with a dedicated program of scapular strengthening and conditioning.[17] Although there is no established duration for such a program, the authors believe that it should continue for at least 3 to 6 months.

Open Versus Arthroscopic Surgical Management

Posterior Stabilization

In the history of surgical treatment of anterior shoulder instability, open procedures were the gold standard. In appropriate patients, however, it has since been shown that arthroscopic treatment yields similar results. The same is not the case with posterior instability, in which open procedures have been successful in 30% to 70% of patients and are fraught with complications, technical difficulty, and unpredictable outcomes. Arthroscopic stabilization for PSI is the treatment of choice in the absence of significant glenohumeral bone loss or increased glenoid retroversion in the setting of erosion. Not only can stabilization be achieved by this means, but one can also address other, concomitant pathology.

Although they are not covered in detail in this article, significant glenoid bone loss or posterior glenoid erosion should be treated with an open procedure such as glenoid osteotomy, insertion of a bone block, or rotational osteotomy of the proximal humerus.

Arthroscopic Stabilization for Posterior Shoulder Instability

Indications and Contraindications

Indications for arthroscopic stabilization of the unstable posterior shoulder are recurrent, posttraumatic, unidirectional posterior subluxation; multidirectional instability with symptoms accompanying motion in the posteroinferior direction; and symptomatic posterior labral tears. Absolute contraindications to arthroscopic stabilization are severe erosion of glenoid bone or retroversion of the glenoid exceeding 20°,[18] and instability with voluntary muscular motion. Relative contraindications to arthroscopic stabilization are syndromic laxity; failed prior arthroscopic stabilization; patient discomfort with the arthroscopic technique; and glenoid erosion with retroversion of 8° to 20°.

Surgical Technique

Video

Arthroscopic Management of Posterior Shoulder Instability

(touch graphic to view video)

Operating Room Setup and Patient Positioning

For the arthroscopic stabilization of shoulders with posterior instability, the authors prefer the patient to be in the lateral decubitus position with the arm that is to be treated in balanced suspension at 50º of abduction and 15º of forward flexion.

Portal Location

The standard posterior and anterosuperior portals for arthroscopy of the shoulder should be established after marking of the anatomic landmarks. The following additional portals should be marked and created after confirmation of the patient's pathology: (1) the posterolateral or "7 o'clock" portal, at 3 to 4 cm directly lateral to the posterolateral edge of the acromion; the midlateral or "50-yard" portal, midway in the sagittal plane of the acromion; and the midglenoid portal.

Arthroscopic Technique

During diagnostic arthroscopy for PSI, a large posterior labral tear can be recognized by viewing through either the anterior or posterior portal, although the authors prefer working with the arthroscope camera in a posterior position, as discussed later. The type of lesion in the shoulder should be identified because it may have various fissures, flaps, and tear patterns that differ from an anterior labral tear (Figure 3). Beyond complete tears and flaps, one may notice more subtle fissures, with loss of containment of the humeral head, which are more likely to be seen in patients with posterior rather than anterior pathology. These include Kim lesions resulting from repetitive microtrauma. These defects should be treated as frank tears, with the treatment including débridement, preparation of the glenoid, and subsequent repair. The recommendation for this is based on the patient's history and the finding on physical examination of posteriorly directed symptoms.

Fig. 3

Arthroscopic images corresponding to the MRI scans shown in Figure 2 demonstrate a bucket-handle tear in the glenoid labrum of a patient with catching symptoms with shoulder ROM. **A,** Anterior view, **B,** posterior view, and **C,** anterior view after repair.

To begin preparation for the arthroscopic surgical repair of a posterior labral tear between the labrum and the native glenoid, the anterior midglenoid working portal is established. Although it may seem paradoxical, this portal provides excellent access to and visualization of the chondrolabral junction. The labrum is then prepared for fixation. The preparation is a three-step process that begins with elevation of the labrum, followed by the shaving away of excess connective tissue, and a final burring (or rasping) of the sublabral bone.

At this point the arthroscope is reinserted anteriorly and an 8-mm cannula is inserted into the posterior portal. After sufficient preparation, a spinal needle is used to confirm the position of the posterolateral portal (described earlier). This portal has been shown to provide adequate access to the posteroinferior glenoid while also being sufficiently distant from neurovascular structures so as to minimize the risk of their injury.[19,20] Utilizing a percutaneous approach, the guide for a suture anchor drill is gently passed through the joint capsule until it rests against the humeral head. During this procedure, care is taken to protect the axillary nerve, which lies 12 to 15 mm from the 6 o'clock position. The likelihood of injuring the nerve can be decreased by avoiding the use of penetrating hooks at the 5 o'clock to 6 o'clock position, using more rotation than translation to plicate the soft tissue in suturing, and having the patient in the lateral decubitus position.

After the suture anchor inserter has been passed through the capsule, suture anchors are introduced along the same trajectory. The first anchors should be inserted in the most inferior aspect of the joint capsule, working superiorly and posteriorly from this location. This decreases the chance of crowding the intracapsular space and losing visualization through a decreased intracapsular volume. The final construct tends to contain three or four anchors spaced approximately 5 mm apart.

Pearls, Pitfalls, and Complications

Specific consideration should be given to several aspects of the arthroscopic surgical treatment of PSI. First, the failure to allow an adequate trial of preoperative physical therapy, which in the case of nontraumatic etiologies should last 6 months, can result in unnecessary surgery. Second, it is important to remember that the axillary nerve is 12 to 15 mm inferior to the 6 o'clock portion of the glenoid rim. Therefore, if the joint capsule is to be included in plication, it should be pierced inferiorly to a depth of only 2 to 3 mm. Care should also be taken to avoid chondral damage.

Another point to be kept in mind is that overtightening of sutures can create problems. The authors prefer to imbricate only about 3 to 10 mm of the joint capsule with the complete labrum, depending on the extent of the pathology, size of the capsule, and findings on examination in a particular case of PSI.

The need for closure of the rotator interval has been of some debate. With regard to this, we would raise the following three points. First, data obtained from sectioning in PSI demonstrate increased posteroinferior translation of the humeral head.[21] This is eliminated when the tissue is imbricated in line with the fibers; however, it is impossible to do this in an arthroscopic repair. Second, biomechanics studies following arthroscopic closure of the rotator interval after a repair done to correct PSI has not been shown to predictably decrease either inferior or posterior translation of the shoulder.[22,23] Third, Jost et al[24] have shown that the plication done in this procedure results in a loss of external rotation, and we therefore do not believe it has a role in the repair of PSI.

Postoperative Care and Rehabilitation

Patients who have undergone arthroscopic surgery for the correction of PSI have their treated arm positioned in 30° of abduction and neutral to slight external rotation. This is continued for 6 weeks, during which active ROM exercise of the elbow, wrist, and hand is encouraged, together with pendulum exercises and gentle passive scaption. The patient begins passive motion on postoperative day 2 with limits of flexion to 120° and abduction to 90°, and avoidance of flexion with internal rotation. The beginning of active ROM activity varies, but initiating it at a period of 4 to 6 weeks after surgery is reasonable. At this same point, active strengthening of the rotator cuff and scapular stabilizers begins. This progresses to full activity or training at 4 to 6 months postoperatively.

Outcomes

Current studies show promising results of the arthroscopic surgical repair of PSI, although not as positive as those for anterior shoulder instability. In a series of 33 patients with an average follow-up of 39.1 months, the senior author of this chapter (M.T.P.) found an average score of 95 on the American Shoulder and Elbow Surgeons (ASES) Standardized Shoulder Assessment Form and a value of 82% of normal on the Western Ontario Shoulder Instability (WOSI) Index. Four of the patients had recurrent instability, with the worst outcomes occurring in patients whose PSI had a voluntary positional component.[11] Similarly, Bradley et al[25] reported an average ASES score of 85 at an average of 27 months after the arthroscopic repair of 100 shoulders with PSI, with a failure rate of about 15%. Ninety percent of the patients returned to athletic activity, with 67% resuming such activity at the same level as before their injuries.

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