Posterior and Multidirectional Instability

Madi Hospital

Seung-Ho Kim, M.D.

ABSTRACT

The posterior and multidirectional instability of the shoulder is a complex problem in terms of diagnosis and treatment. Increased joint volume by redundant capsular ligament has been regarded as a major pathogenesis of the posterior and multidirectional instability. Distinct from multidirectional hyperlaxity, multidirectional instability has symptoms related with increased translations in more than one direction. Recent report that shoulder symptom originates from labral lesion which was created by excessive rim-loading of the humeral head on the posteroinferior glenoid labrum during repetitive subluxation helps us to understand the pathogenesis of such instability. Painful jerk and Kim tests indicate labral lesion in the multidirectionally loose shoulder, suggesting multidirectional instability. Also, painful jerk test is a prognostic sign of failure of nonoperative treatment. The labral lesion can be an incomplete tear or a concealed lesion which often has been underestimated. Operative treatment is indicated when nonoperative treatment has failed. Arthroscopic capsulolabroplasty is a reliable procedure, which not only provides capsular balance, but also restores the labral height.

INTRODUCTION

Being relatively uncommon, the posterior and multidirectional instability remain as a complex entity. Although the true incidence is uncertain, the posterior instability has been reported to be 2 to 12 percent of all shoulder instability.[35,48] Perhaps, recent improvement in the knowledge of pathogenesis has increased the diagnosis of posterior and multidirectional instability. However, its incidence is still quite lower compared with anterior shoulder instability. Therefore, previous literature reports involved small number of patients with various results. The pathogenesis is still unclear, thus leaving diverse mechanisms attributable to the potential pathogenesis.

The three fundamental questions that have been raised in the posterior and

multidirectional instability are as follows. First, what is the principal pathology which is responsible for the posterior and multidirectional instability? This question basically asks what the difference between the posterior and multidirectional laxity versus instability is. Anecdotally, the presence or absence of the shoulder symptom differentiates the laxity versus instability. Then, where does the shoulder symptom come from? Second, who need a surgical treatment? By answering this question, we can properly select patients for surgical treatment. Third, when the nonoperative treatment failed, what surgical procedure should be performed considering the principal pathology? In this chapter, we will discuss previous and recent studies on biomechanics and clinical data to answer these three fundamental questions.

PATHOGENESIS OF THE POSTERIOR AND MULTIDIRECTIONAL INSTABILITY

Traumatic posterior instability develops distinct posterior labral tear which is potentially identical to the lesion in the traumatic anterior shoulder instability. The labrum is detached from the glenoid, which is so-called the reverse Bankart lesion. However, the reverse Bankart lesion is generally undisplaced from the glenoid while the anterior Bankart lesion is often displaced medially. Often, the anterosuperior aspect of the humeral head has reverse Hill-Sachs lesion which is also relatively indistinct compare with true Hill-Sachs lesion in the traumatic anterior instability. Usually, there are indentations or superficial scuffing of the articular cartilage.[23]

Atraumatic posterior and multidirectional instability has been controversial in terms of pathogenesis. Several anatomic structures have been implicated including bony and soft tissue abnormalities. Bony abnormalities include increased humeral retroversion, glenoid retroversion, and glenoid hypoplasia.[8,19] Previous studies of the glenoid version included only the osseous structure. However, the stability of glenohumeral joint is an integral function of both bone and soft tissue stabilizer. The increased cartilage thickness in the periphery[44] and the glenoid labrum[18,28,42] contributes to the stability of the joint, by increasing the concavity of the glenoid. Accordingly, the measurement of the glenoid version can be more ideal when the articular cartilage and labrum are considered as whole.

The author evaluated four measurements which represents glenohumeral containment (bony and chondrolabral glenoid version, labral height, and glenoid depth) on T2 axial images of the MR-arthrogram of 33 shoulders with atraumatic posteroinferior multidirectional instability.[25] The shoulder with a documented labral tear was excluded. The measurements were compared with 33 age-matched

control patients without glenohumeral pathology. The angle of version of the bony and chondrolabral glenoid was measured in three consecutive planes (upper 25%, middle 50%, and lower 75% from upper limb of the glenoid) perpendicular to the long axis of the glenoid. Although posteroinferior instability group had greater retroversion in both bony and chondrolabral glenoid in the middle and lower planes, chondrolabral glenoid had more retroversion than bony glenoid in the lower plane. There was decreased height of the posterior labrum in the lower plane of the instability group. Glenoid depth in the middle and lower plane was significantly shallower in the instability group. Therefore, Loss of containment in the middle and lower parts of the chondrolabral glenoid is a consistent finding in shoulders with atraumatic posteroinferior multidirectional instability and is principally due to the loss of posterior labral height (Fig. 1).[25]

Soft tissue abnormalities include insufficiency of rotator interval tissue, such as coracohumeral and superior glenohumeral ligaments,[37,39] and posterior inferior capsular mechanism.[5,6,38,43] Generally the consensus in the pathogenesis of the atraumatic posterior and multidirectional instability is an excessive capsular laxity.[4,7,14,39,40,45,47] However, increased capsular ligamentous laxity alone cannot explain the posterior and multidirectional instability, which often occurs in the mid-range of motion where normally the capsular ligaments becomes loose. Other static and dynamic restraints of the glenohumeral joint may provide more important role in maintaining stability in the atraumatic posterior and multidirectional instability. These are concavity-compression by muscular force and geometric conformity of the glenohumeral joint which are mainly provided by articular cartilage and labrum. Thicker periphery and thinner in the central part of the glenoid articular cartilage forms conforming ball and socket joint together with thinner periphery and thicker central part in the humeral head articular cartilage. Glenoid labrum further reinforces glenohumeral conformity by doubling the depth of glenoid socket. Any alteration in this chondrolabral integrity of the posteroinferior aspect can disrupt joint conformity which will facilitate the posterior and multidirectional instability.[28,31] In the author's measurement, retroversion of the chondrolabral glenoid partially explains potential pathogenesis

of the posterior and multidirectional istability.[25]

It is interesting to know that there are two groups of people who have increased translation in posteriorly, inferiorly, and anteriorly. One group is asymptomatic and the other is symptomatic. Also asymptomatic people often become symptomatic over the time. Although, shoulder is loose in three directions, concurrent production of symptoms is in one or multiple directions. There are evidence that the amount of translation is not fundamentally different between healthy subject who have asymptomatic laxity and those who need surgical intervention.[30,32,33] Given these facts, there may be other pathology which is responsible for the shoulder symptom, rather than just an increased joint volume. The author found that majority of patients with asymptomatic jerk test, which was represented by painless posterior clunk in the multidirectional instability, were successful with the nonoperative treatment. However, patients with symptomatic jerk test, which was represented by sharp pain with posterior clunk, were not responding with the rehabilitation and invariably had posteroinferior labral lesion in the arthroscopic finding.[27] The author concluded that the jerk test was a hallmark for predicting the failure of nonoperative treatment in the posteroinferior instability. Shoulders with a painful jerk test have a posteroinferior labral lesion.[27]

Interestingly, the incidence of the labral lesion in the posterior and multidirectional instability varies depending on the authors. Compared to articles reporting open inferior capsular shift, literatures advocating arthroscopic procedures reported more common incidence of labral lesions as well as capsular redundancy. Perhaps, arthroscopic examination ensured more thorough evaluation of the labral lesions and arthroscopic magnification allowed the detection of more subtle lesions.

TYPE OF LABRAL LESIONS

The author previously reported that all patients who underwent arthroscopic surgery for posterior and multidirectional instability had variable degree of labral lesions in the posterior and inferior portion of the glenoid.[24] These labral lesions were classified into 4 types. Type I labral lesion is an incomplete detachment, in which the posteroinferior labrum is separated from the glenoid margin but not medially displaced. This type is more common in traumatic posterior instability than multidirectional instability. Type II lesion is a marginal crack, so-called Kim's lesion which is an incomplete and concealed avulsion of posteroinferior labrum. Type III lesion is a chondrolabral erosion, and type IV lesion is a flap

tear of the labrum (Fig 2A-D).[23,24,26]

The Kim's lesion refers to a superficial tearing between the posteroinferior labrum and the glenoid articular cartilage without a complete detachment of the labrum (marginal crack). The posteroinferior labrum lost its normal height and became a flat labrum, with subsequent retroversion of the chondrolabral glenoid. Probing the lesion demonstrates fluctuation of the posteroinferior labrum and reveals a loose attachment(Fig. 3). These labral lesions are limited to the posteroinferior quadrant of the glenoid for shoulders with posterior instability, typically present in 6 to 9 o'clock position for the right shoulder and 3 to 6 o' clock position for the left shoulder. For shoulder with multidirectional posteroinferior instability, the lesion is extended to entire inferior glenoid labrum. When the superficial portion is incised with an arthroscopic knife, for one or two millimeter in depth, the lesion reveals detachment of the deep portion of the labrum from the medial surface of the glenoid.[23,24,26]

Our hypothesis of the pathogenesis of the Kim's lesion is the repetitive rim-loading theory. Because the posteroinferior capsule attaches on the inferior portion of the posteroinferior labrum, the posterior and inferior force initially exerts on the inferior portion of the posteroinferior labrum and tears initiates from the deep portion of the labrum. Since the magnitude of the posteroinferiorly directed force in the posteroinferior subluxation is less severe than that of the anterior instability, the deep portion tear can be limited within the labrum without propagating to the superior portion of the chondrolabral junction. Also, excessive rim loading of the humeral head on the posteroinferior labrum during repetitive subluxation produces shear force between the bony glenoid and the labrum. With repetitive episodes of the subluxation of the humeral head, frequent movement of the concealed avulsion creates a marginal crack in the chondrolabral junction (Fig. 4). Therefore, the triad of the Kim's lesion consists of marginal crack or erosion, chondrolabral retroversion, and incomplete and concealed avulsion. We believe that the 4 types of labral lesions are a spectrum of severity of the instability. Perhaps, Kim's lesion may over time be converted into type I incomplete detachment when the marginal crack is extended to the deep portion tear.

The marginal crack in the posteroinferior instability is different from similar lesions, which are often incidentally found in other conditions, such as degenerative arthritis or rotator cuff disease. Therefore, the marginal crack itself is not a hallmark of the sign of posteroinferior instability. Symptomatic posterior and inferior subluxations with a positive jerk test (painful clunk) together make

the diagnosis of the posteroinferior instability.

EVALUATION

Careful evaluation of patient's history provides information on the direction, mechanism and severity of instability. Especially it is important to notice the severity of the symptom. The degree of interruption of daily or sports activity by the presenting symptom further guides the selection of the treatments methods. Mild discomfort of the shoulder in daily activity, such as mild pain or weakness of the shoulder while carrying a heavy object or dull aching following strenuous physical activity, is usually successfully managed by rehabilitation exercise program.

Shoulder examination should include range-of motion, strength, scapular rhythm, and translation test in all directions. Translation in anterior and posterior direction are tested by the load and shift test. The amount of translation is described according to the grading system of Altcheck et al.[1] Anteroposterior humeral translation was rated as grade 0 (no translation), grade 1+ (translation less than the margin of glenoid), grade 2+ (translation beyond the margin of glenoid with spontaneous reduction), or grade 3+ (translation beyond the glenoid without spontaneous reduction). Inferior translation is evaluated by the sulcus sign.36 A downward traction force is applied to the adducted shoulder and the inferior translation of the humerus is measured by estimating the distance between the inferior margin of lateral acromion and the humeral head. 0+ is equivalent to no movement: 1+, less than one centimeter; 2+, one to two centimeters; and 3+, more than two centimeters.

Two Reliable Tests

Two sensitive and specific physical tests are the jerk and Kim tests. Like the McMurray test for evaluation of the meniscal injury in the knee joint, the basic principle of the jerk and Kim tests is a pain provocation by compressing the labral lesion. The jerk test is performed in a sitting position. While stabilizing the patient's scapula with one hand and holding the affected arm at 90-degree abduction and internal rotation, the examiner grasps the elbow and axially loads the humerus in a proximal direction. The arm is moved horizontally across the body. A positive result is indicated by a sudden clunk as the humeral head slides off the back of the glenoid. When the arm is returned to the original position, a second jerk may be produce by the humeral head returning to the glenoid (Fig. 5). The painless jerk group includes patients with posterior clunk, but without

any significant pain provocation, while the painful jerk group includes patients who show abrupt pain in accordance with posterior clunk. The author found that painful clunk in the jerk test is invariably associated with structural defect, a posteroinferior labral lesion. Majority of shoulders with the painful jerk test fail to improve by the nonoperative treatment.[27] Our arthroscopic finding supported that the abrupt pain during the jerk test may be elicited from a rim-loading of the humeral head over the pathologic posteroinferior labral lesion.

The Kim test is performed in a sitting position with the arm in 90° abduction. With examiner holding elbow and lateral aspect of the proximal arm, a simultaneous axial loading force and 45° upward diagonal adduction is applied on the distal arm, while downward and backward force is applied on the proximal arm. A sudden onset of posterior shoulder pain indicates positive test regardless of accompanying posterior clunk of the humeral head. During the test, it is important to apply a firm axial force compression force on the glenoid surface by the humeral head. Therefore, sitting against the back of a chair rather than a stool provides a good counter support of the axial loading in the examining arm (Fig. 6).

The Kim test was more sensitive in the predominant inferior labral lesion while jerk test was more sensitive for the predominant posterior labral lesion. The sensitivity in detecting the posteroinferior labral lesion is increased to 97% when the 2 tests are combined.[27] Correlation of the symptom with the physical examination is also of mandatory in making diagnosis. Patients with mild shoulder symptom usually have asymptomatic jerk and Kim tests.

Radiographic Evaluation

Plane radiographs includes anteroposterior, axillary lateral and Stryker-Notch view to evaluate any bony abnormality suggesting anterior instability. Hill-Sachs lesion in the Stryker-Notch view indicates traumatic anterior instability. Usually, plane radiographs do not provide any useful sign in the posterior and multidirectional instability. Inferior stress anteroposterior radiographs are obtained in the standing position with a 10-pound weight applied downward on both arms37. Asymmetric inferior translation between both shoulders may suggest superimposed traumatic instability in multidirectional instability. However, the significance of the inferior stress radiograph is unclear.

MRI-arthrogram using an intra-articular contrast improves visualization of the labral lesion as well as capsular redundancy. T1 and T2-weighted axial and

coronal images of the MRI-arthrogram. A high index of suspicion is needed when evaluating the labral lesion in the MRI-arthrogram. Often the lesion is very subtle or negative. Capsular volume is increased in the posterior and axillary recess in the oblique coronal images. Posteroinferior labral lesion can be classified using the classification system of Kim et al[23,24] (Table 1). The MR type I lesion is a separation without displacement, type II, incomplete avulsion (cystic lesion), and type III, loss of contour (Fig. 7).

SUMMARY OF PATHOGENESIS: CAPSULAR LAXITY VERSUS RIM-LOADING MECHANISM

The author believes that increased translation by the increased capsular ligamentous laxity is underlying pathology of the posterior and multidirectional instability. This increased capsular laxity can be in-borne or developmental and asymptomatic or minimally symptomatic initially. In this stage, attempted translation does not produce symptoms. Jerk and Kim tests reveal posterior clunk without shoulder pain.

However, repetitive subluxation overloads the posteroinferior glenoid labrum by the excessive rim-loading of the humeral head. This excessive rim-loading eventually develops posteroinferior labral lesion varying from simple retroversion to incomplete detachment. In this stage, patient's symptom which is shoulder pain, originates from the labral lesion when the humeral head glides over the pathologic labrum. The compressive force on the torn labrum in the jerk and Kim tests generates shoulder pain. Therefore, intact labrum does not produce shoulder pain no matter how lax the glenohumeral joint is. Increased translation alone produces asymptomatic posterior clunk until the repetitive rim-loading eventually develops posteroinferior labral lesion. Therefore, the posterior and multidirectional instability are a spectrum of pathology(Fig. 8).

TREATMENT

Initial treatment should include nonoperative treatments. Non-operative treatment consisted of extensive rehabilitation including strengthening exercise of rotator cuff, deltoid, and scapular stabilizer muscles. The majority of the patients with multidirectional hyperlaxity and many of the patients with multidirectional instability respond to the extensive rehabilitation program. Burkhead and Rockwood[10] reported that rehabilitation exercise is successful in 80 percent of patients with atraumatic instability. In the author's experience, young female who had hyperlaxity and spontaneous onset of mild symptom tend to respond well

with the non-operative treatments. Despite of persistent hyperlaxity, these patients show improved symptom and return to their activity.

Operative Treatment

Historically, open surgical treatment for the posterior and multidirectional instability included bony and soft tissue procedures. Bony procedures which addresses geometric abnormality include rotational osteotomy of the humerus, glenoid osteotomy, or bone block procedures.[7,8,17] Soft tissue procedures are reverse Putti-Platt[18], reverse Bankart repair[16], and the Boyd-Sisk procedure.[7]

In 1980, Neer and Foster[37] introduced a new type of capsular procedure, which they termed" inferior capsular shift", for the reconstruction of multidirectional instability. They approached either to the posterior or anterior depending on the direction of the instability, in which the shoulder was most unstable. The principle of the inferior capsular shift was to detach the capsule from the neck of the humerus and shift it to the opposite of the calca (inferior portion of the neck of the humerus) to not only obliterate the inferior pouch and capsular redundancy on the side of the surgical approach, but also to reduce laxity on the opposite side. Subsequent studies generally supported the original Neer and Foster's description[3,11,29,41] although the results were not uniformly successful.[15]

A limited number of studies have been reported for arthroscopic treatment of posteroinferior multidirectional instability in the peer-reviewed literature.[12,34,46] Duncan and Savoie[12] reported their preliminary results of ten patients who were treated with arthroscopic modification of the inferior capsular shift procedure described by Altcheck and Warren. In one to three years of follow-up, all patients had satisfactory results according to the Neer system. McIntyre et al[34]. reported the results of the modified transglenoid, multiple suture technique described by Caspari. Nineteen consecutive patients were successful at a mean follow-up of 34 months except for one patient who had recurrent anterior subluxation. Treacy and Savoie[46] reported a retrospective study of twenty-five patients who underwent arthroscopic capsular shift performed with the transglenoid technique. At a mean follow-up of sixty months, they had twenty-two patients with stable shoulders and full range of motion. Overall, the results were successful in 88 % to 100 %. No further back-up clinical study has been published yet except for many articles on thermal capsular shrinkage procedure.[2,9,13,20] Recently, the author reported highly successful outcomes with the arthroscopic capsulolabroplasty procedure.[24]

ARTHROSCOPIC CAPSULOLABROPLASTY

The arthroscopic capsulolabroplasty procedure is a battery of three major procedures including arthroscopic posteroinferior labroplasty, superior shift of the posteroinferior and anteroinferior capsule, and rotator interval closure. The basic rationale of the posteroinferior labroplasty is both restoration of the posteroinferior labral height and capsular tension.

Posteroinferior Labroplasty

We use general anesthesia and lateral decubitus position for all patients. The arm is positioned in lateral traction at 30° abduction and 10° forward flexion. After the surface landmarks drawing, the posterior portal is created two centimeters inferior to the posterolateral acromial angle. This point is about one centimeter lateral to the standard posterior glenohumeral portal, and provides a proper angle to the posteroinferior labrum and capsule. Two anterior portals are created just below the acromioclavicular joint (anterosuperior portal) and above the leading edge of the subscapularis (anterior midglenoid portals) while maintaining at least a one-centimeter distance between the two anterior portals. We use a large clear threaded cannula (Linvatec, Largo, Florida, USA) for posterior and anterior midglenoid portals and a small non-threaded cannula (Universal cannula, Linvatec) for the anterosuperior portal.

From both posterior and anterior portals, diagnostic arthroscopy is performed while focusing on the posteroinferior labrum and capsule. Associated lesions are treated first. Partial thickness tear of the articular surface of the rotator cuff tendon are debrided. While viewing from the anterior superior portal, a loose flap of the posteroinferior labrum, if encountered, is debrided. Posteroinferior labral lesion is visualized better through the anterosuperior portal. Palpation of the posteroinferior labrum is mandatory since the tear of the posteroinferior labrum sometimes exists at the deep portion of the labrum, while the chondrolabral junction has chondrolabral erosion or superficial crack which apparently mimics intact attachment (Fig. 9A). Probing reveals looseness of the posteroinferior labrum. When the superficial portion of chondrolabral junction is detached by the Liberator knife (Linvatec), the loose deep portion is easily palpated. The posteroinferior labrum is completely detached from the glenoid using the Liberator and motorized shaver. We expose the underlying muscle in order to achieve proper mobility (Fig. 9B) until the posterior and inferior labrum is easily brought up on the glenoid surface with a blunt grasper (Fig. 9C).

A small meniscal rasp (Linvatec) is introduced through the posterior portal to abrade the inferior and posterior glenoid wall. The glenoid wall is freshened by a shaver (full radius resector) and the fresh bony surface is exposed. Inferior and posterior capsule are abraded to enhance the healing potential using convex rasp (Linvatec). A small pilot marking is created on the glenoid rim using a small pituitary forcep, which is introduced through the posterior portal. A bone punch is introduced and aimed at the medial end of the pilot marking to create an anchor hole on the surface two millimeters from the margin of the glenoid (Fig. 9D). A suture anchor (Mini-Revo, Linvatec) with number-2 nonabsorbable sutures (Ethibond, Ethicone, Somerville, New Jersey, USA) is fixed while maintaining the orientation of the eyelet. One end of the suture, which is closer to the capsule, is retrieved out of the anterior midglenoid portal. A 90 degree-angled suture hook, which is loaded with Shuttle-Relay (Linvatec), is introduced through the posterior portal, piercing the inferior capsule at the same level of the glenoid (Fig. 9E). The suture is shifted about one centimeter proximally. Then it is passed under the posteroinferior labrum. The Shuttle-Relay is retrieved out of the anterior midglenoid portal. The suture is loaded into the eyelet of the Shuttle-Relay and pulled back out of the posterior portal. An arthroscopic knot tying is performed. We use the SMC knot, which is a sliding knot and had an internal locking mechanism.21,22 Three to six suture anchors are used for labroplasty depending on the size of the labral lesion (Fig. 9F).

Superior Shift of the Posteroinferior and Anteroinferior Capsule

When the labral lesion is confined within the posteroinferior portion of the glenoid, superior shift of the posterior capsule is performed. The suture hook pierces the posterior capsule at the same level of the glenoid surface to avoid taking lateral capsule. The suture hook is shifted superiorly about one centimeter and then passed under the labrum. The Shuttle-Relay is retrieved through the anterosuperior portal and a No-2 nonabsorbable suture is engaged in the eyelet of the Shuttle-Relay. The Shuttle-Relay with the suture is pulled back through the anterior midglenoid portal and the SMC knot tying is performed. Sutures are placed and tied successively to achieve a superior capsular shift until the superior most suture is placed at the level of the biceps insertion(Fig. 10).

For the shift of the anteroinferior capsule, the arthroscope is inserted through the posterior portal. Inferior and anterior capsule as well as corresponding glenoid labrum are abraded using the arthroscopic rasp. The suture hook is introduced through the anterior midglenoid portal, piercing the inferior capsule 1 cm away from the labrum. When simultaneous passage of the suture hook through the

inferior capsule and the labrum is difficult, two steps are performed separately. The suture hook is shifted and passed under the labrum to make a knot tying. Proximal shift of the inferior capsule is repeated in 1 cm distance between each suture until the last suture ends at the anterior base of the biceps root .

Rotator Interval Closure

To perform arthroscopic closure of the rotator interval, the arthroscope is maintained in the posterior portal, while the anterior midglenoid cannula is retrieved slightly out of the capsule. A penetrating suture retriever (Mitek, Johnson and Johnson, Somerville, NJ, USA), loaded with a No-2 nonabsorbable suture (Ethibond, Ethicone), is introduced through the anterior midglenoid cannula to pierce the anterior capsule and middle glenohumeral ligament (capsular tissue overlying the superior edge of the subscapularis tendon). Another penetrating suture retriever is inserted into the joint through the anterosuperior cannula. The cannula and suture retriever are then slowly withdrawn from the joint to lie just anterior to the capsule. The penetrating suture retriever pierced the superior capsule. The suture in the penetrating suture retriever of the anterior midglenoid cannula is handed out to the other suture retriever. One or two additional sutures are repeated in the same manner using sutures with different colors. In a blind manner, one end of the suture in either portal is passed to the other portal under the deltoid muscle and the SMC sliding knots are created, while maintaining the arm in about 40° abduction and 30° external rotation (Fig. 11A-B). A catheter for the self-controlled pain pump (Accufuser, Woo Young Medical, Seoul, Korea) is inserted through the anterior skin with the aid of the spinal needle.

Decision Making for the Selection of Subset of Arthroscopic Capsulolabroplasty

We are able to perform both anterior and posterior procedures by the same arthroscopic approach through the same three arthroscopic portals. Within the three subsets of the arthroscopic capsulolabroplasty procedure, we used posteroinferior labroplasty and superior shift of the posteroinferior and anteroinferior capsule when posterior instability is more predominant than inferior instability (positive jerk test and grade 1+ or 2+ sulcus sign) regardless of the degree of anterior translation if the anterior translation is asymptomatic. All three sets of arthroscopic capsulolabroplasty procedure including rotator interval closure are performed when inferior instability is more predominant than the posterior component (Positive jerk test and grade 3+ sulcus sign) (Table 2).

Postoperative Rehabilitation

We use a sling immobilizer with a pillow spacer, which keeps the shoulder in about 30(abduction and neutral rotation for three weeks. The arm is maintained posterior to the longitudinal axis of the trunk. Isometric strengthening exercises are performed with the aid of the contralateral arm. After three weeks, a pendulum and active-assisted range-of-motion exercises are initiated including forward elevation in the scapular plane and external rotation exercises with the arm at the side. After four weeks, internal rotation behind the back is initiated. Internal rotation with the elevated arm (cross-body adduction position) is prohibited until six weeks. After six weeks, internal rotation motion with the elevated arm and strengthening exercises are initiated. When the shoulder has regained strength by the manual strength test (above 4 positive), we allowe patients in professional and collegiate level to more vigorous strength exercises. Sports activities are allowed after four to six months depending on the isokinetic measurement (more than 80% of the contralateral side for forward elevation, external rotation at the side, and internal rotation in 90° abduction).

Outcomes

At the mean follow-up of 51 months following arthroscopic capsulolabroplasty procedure in 31 patients, twenty-one patients had excellent Rowe score, nine good, and one fair score. Shoulder scores were improved from 41±12 to 91±10 in Rowe scale, 79±9 to 95±5 in ASES score, and 24±3 to 33±2 in UCLA score. Thirty patients had stable shoulder and one patient had recurrent instability. All patients had improved shoulder score, and function and pain scores. Twenty-eight patients returned to more than 90% of previous activity. There was no surgical complication. All patients had a labral lesion and variable capsular stretching in the posteroinferior aspect. There were eleven type I labral lesions (Incomplete detachment), twelve type II (Kim's lesion: Incomplete and concealed avulsion), six type III lesions (Chondrolabral erosion), and two type IV (Flap tear).

SUMMARY

The author can answer the three fundamental questions which were posted in the beginning of this chapter as follows: Atraumatic posterior and multidirectional laxity is attributable to the capsular ligamentous laxity and can be asymptomatic initially. Over the time, repetitive subluxation of the humeral head exerts excessive rim-loading on the posteroinferior glenoid labrum which develops retroversion of the glenoid labrum and eventually creates labral tears. In

this stage, a patient develops shoulder pain during daily and sports activity. Besides increased translations, diagnosis should be based on the symptom reproduction by the jerk and Kim tests. The jerk test is a hallmark for predicting the prognosis of nonoperative treatment in the posteroinferior instability. Shoulders with a painful jerk test have posteroinferior labral lesion and are irresponsive to the nonoperative treatments. In these patients, early surgery may be indicated. Surgical procedure should correct both the capsular laxity and retroversion of the posteroinferior glenoid labrum. Simple capsular plication or inferior capsular shift is insufficient for correcting two major pathologies. Arthroscopic capsulolabroplasty restores capsular tension as well as labral height.

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