CHAPTER

16

Arthroscopic Repair of Posterior Shoulder Instability

ROBERT SELLARDS, RODNEY STANLEY, AND ANTHONY A. ROMEO

ARTHROSCOPIC REPAIR OF POSTERIOR SHOULDER INSTABILITY IN A NUTSHELL

Physical Examination:
- Apprehension with forward flexion, internal rotation adduction
- Jerk test: abduct shoulder with arm in forward flexion, internal rotation, adduction

Imaging:
- Shoulder radiographs, including an axillary lateral
- Computed tomography scan to determine articular head involvement

Decision Making:
- Traumatic or atraumatic posterior instability
- Dislocation or subluxation
- Acute or chronic posterior dislocation

Surgical Technique:
- Examine both shoulders under anesthesia
- Perform arthroscopic reduction if dislocated
- Create standard arthroscopic portals, with 7 o'clock portal in posteroinferior position
- Place camera in anterior portal
- Use suture shuttle technique with suture hook in 7 o'clock portal
- Place sutures posterior to anterior
- Place plication stitches anterior and posterior
- Plicate rotator interval

Postoperative Management:
- Splint in abduction brace
- Adhere to traumatic or atraumatic rehabilitation protocol

Case History

A 26-year-old, left-hand-dominant man presented 3 weeks after being attacked in a robbery. During the assault, he suffered an injury to his left shoulder. He was seen in the emergency room, had radiographs taken, and was told that he had no fracture (Fig. 16–1). The diagnosis was a shoulder contusion, and he received follow-up treatment from his primary care physician. The patient was started on a physical therapy program but failed to make any progress in range of motion. The concerned physician referred the patient to an orthopedic surgeon for evaluation (Table 16–1).

Physical Examination

This patient's range of motion was assessed. With his shoulder locked in 20 degrees of internal rotation, the patient could raise the arm to only 80 degrees of forward flexion. He was not able to abduct the shoulder. The coracoid process was noted to be prominent anteriorly, and the patient was unable to supinate his forearm. Neurologic examination of the extremity was normal.

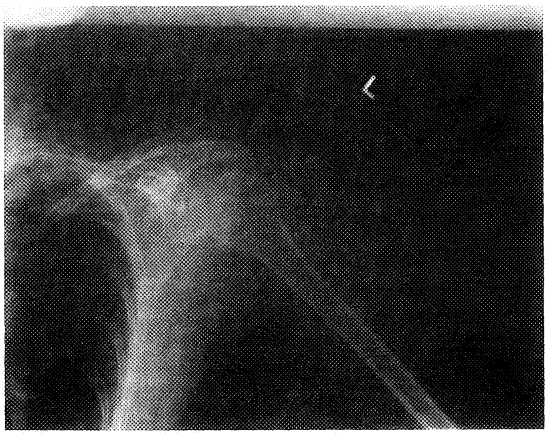


Figure 16–1 Anteroposterior radiograph of left shoulder taken in the emergency department.

Table 16–1 Important Points in History Taking—Posterior Instability

Mechanism of Injury
Direct: force directed at proximal humerus
Indirect: flexion, internal rotation, adduction (most common mechanism)
Associated Causes
Dislocation: 3 Es (ethanol, epilepsy, electricity)
Subluxation: joint laxity
Recurrent Instability
Where is the arm position when these events occur?
How often do these events occur?
Is this voluntary?

Table 16–2 Examination Findings—Locked Posterior Dislocation

Arm fixed in internal rotation, limited abduction
Prominent coracoid process
Inability to fully supinate forearm

Table 16–3 Examination Findings—Posterior Instability

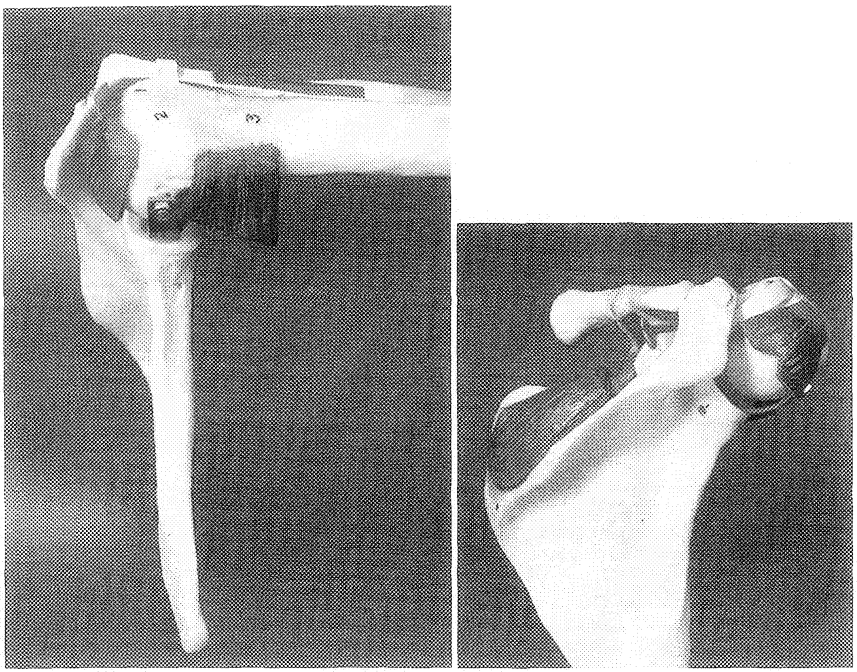
Positive posterior stress test or jerk test
Symptoms reproduced with arm flexed, internally rotated, adducted

Posterior dislocations of the shoulder often have a subtle presentation (Table 16–2). The shoulder may appear normal, with little loss of symmetry, when viewed anteriorly. Only when viewed laterally or from above is the coracoid prominence evident.[15] With regard to range of motion, there is usually no external rotation. The arm is fixed in 10 to 60 degrees of internal rotation and forward elevation is limited to less than 100 degrees.[8] A neurologic injury of the brachial plexus can occur with acute dislocations, so a thorough neurologic examination of the extremity is important.

In patients with posterior instability without a locked dislocation, provocative tests can re-create the patient's discomfort. The mechanism of injury for posterior instability is usually forward flexion, adduction, and internal rotation. When this movement is performed with posterior force directed at the patient's elbow, apprehension can be elicited.[5] From this same position, the jerk test can be performed (Fig. 16–2). With the scapula stabilized, posterior force is directed on the elbow to posteriorly displace the humeral head. The humerus is then abducted, eliciting a palpable "jerk" or "clunk" of the humeral head as it passes over the labral rim into the glenoid (Table 16–3).[12]

Imaging

A complete series of shoulder radiographs was obtained in this patient, including true anteroposterior, lateral scapular, and axillary views. The standard axillary radiograph revealed a locked posterior dislocation of the humeral head on the glenoid, with a significant reverse Hill-Sachs lesion (Fig. 16–3). There was no evidence of posterior glenoid erosions or calcifications and no evidence of excessive glenoid retroversion. The following day, a computed tomography scan was performed, revealing approximately 20% involvement of the articulating surface of the humeral head (Fig. 16–4). The scan did not demonstrate glenoid hypoplasia or abnormal humeral head retrotorsion.



A B

Figure 16–2 Model illustrating the provocative position of posterior instability. The humerus is forward flexed, internally rotated, and adducted. This position is viewed laterally *(A)* and posteriorly *(B)*.

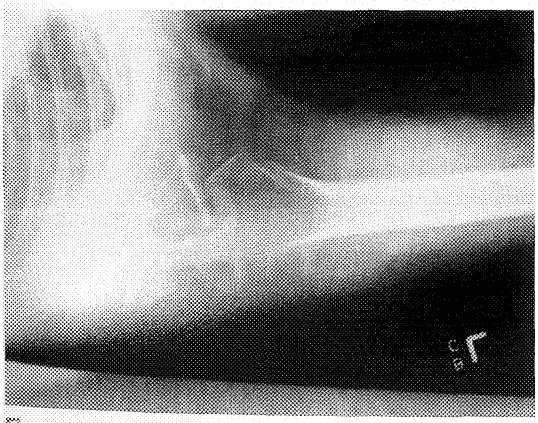


Figure 16–3 Axillary radiograph revealing a locked posterior shoulder dislocation.

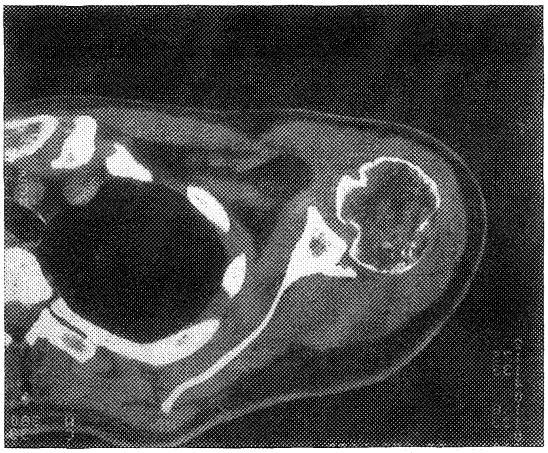


Figure 16–4 Axial computed tomography scan of a locked posterior shoulder dislocation. Approximately 20% of the humeral head articular surface is damaged.

In many emergency rooms, a routine shoulder series may not include an axillary view; thus, the glenohumeral joint may appear reduced to the untrained eye, and a patient may be discharged with a missed dislocation. The diagnosis is eventually made when the patient is seen by an orthopedic consultant and proper radiographs are obtained, sometimes weeks or months after the injury.[5,11]

Decision-Making Principles

It is important to determine the cause of the patient's instability. The first determination is whether the injury is traumatic or atraumatic (Table 16–4). In traumatic dislocations, it is possible that reduction alone will stabilize the shoulder joint. However, there is likely to be a complete disruption of the posterior capsulolabral structures, and instability may persist.[2] There is also a varying amount of humeral head involvement, which can be determined from the computed tomography scan. If more than 40% of the humeral head is damaged, hemiarthroplasty is the procedure of choice to restore an articulating surface with the glenoid (Table 16–5).[9,10]

Arthroscopic management enables the surgeon to address all aspects of the intra-articular soft tissue pathology associated with these traumatic injuries. An open anterior procedure does not allow adequate exposure for treatment of the posterior pathology, so the recommended procedure is to compensate for the posterior capsulolabral injury by transferring the lesser tuberosity and limiting internal rotation (McLaughlin procedure).[13] This approach does not adequately address the posterior capsulolabral complex, which contributes to the instability (Fig. 16–5). Analogous to the Bankart lesion of anterior dislocations, this reverse Bankart lesion should be repaired to restore posterior stability and provide the best opportunity for reestablishing normal function.

In the case of recurrent subluxation, it is important to determine whether there is a traumatic or atraumatic cause. If the cause is atraumatic, one must distinguish between voluntary and involuntary subluxation. Careful physical examination is necessary to rule out a multidirectional instability component, which would alter management of the injury. Atraumatic subluxation is often seen in the athletic population, especially those engaging in overhead sports.[4] The pathology varies from that of traumatic dislocations. In acute subluxation, there is an avulsion of the posterior band of the inferior glenohumeral ligament. In chronic subluxation, there is a large capsular redundancy, with stretching of the rotator interval (Fig. 16–6).[3,4] Traditional open methods have been described to address posterior instability in these individuals.[14] These procedures use a posterior open approach with a capsulorrhaphy. These atraumatic patients can also be managed arthroscopically, accomplishing the goal of reducing capsular laxity and restoring stability. This is achieved with suture plication of the posteroinferior capsule in combination with closure of the rotator interval.[1,16,19]

The treatment plan for the patient described earlier was a closed reduction under anesthesia. Then, if the stability was acceptable, he would be treated in a brace. If there was significant instability, the plan was to proceed with posterior stabilization.

Table 16–4
Classification of Posterior Dislocations

Acute posterior dislocation: <6 weeks
Chronic posterior dislocation: >6 weeks
Recurrent subluxation
Traumatic
Atraumatic
Voluntary
Involuntary

Table 16–5
Management of Posterior Dislocations

<40% Articular Surface
Reduce
Evaluate stability
Stable
Splint in 10 degrees of external rotation
Unstable
Arthroscopy
Repair capsule and labral avulsion
Splint in 10 degrees external rotation
>40% Articular Surface
Reduce
Hemiarthroplasty

Surgical Technique

Positioning

The patient was brought into the operating room, intubated, and placed in the right lateral decubitus position. An axillary roll was secured beneath his right axilla, and the beanbag was deflated, stabilizing the patient on the table. Patient positioning is specifically addressed in Chapter 8.

Examination under Anesthesia

Before the patient is secured in the lateral position, both shoulders should be carefully evaluated. This provides an opportunity to compare the laxity between the injured and uninjured shoulders. It is also important to determine whether there is a component of multidirectional instability.

In this patient, closed reduction was attempted. The shoulder was externally rotated with one hand, and the other hand was placed on the medial aspect of the proximal humerus, providing lateral distraction. This maneuver was not successful in achieving a reduction.

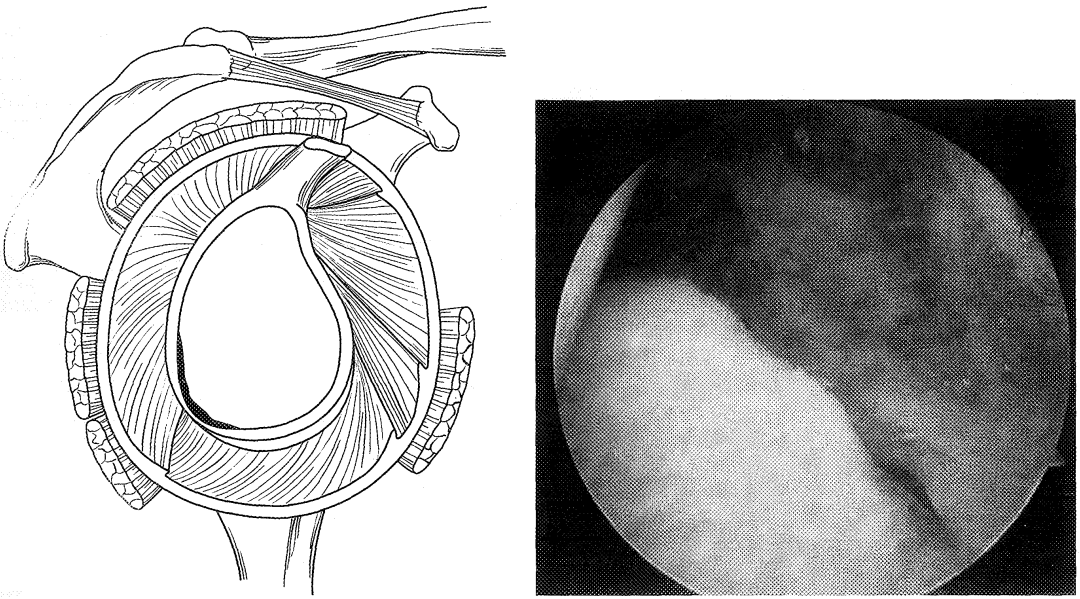


Figure 16-5 *A*, Posteroinferior location of the capsulolabral avulsion after traumatic posterior dislocation. *B*, Arthroscopic view of the labrum, which is separated from its glenoid insertion. This is visualized from the posteroinferior arthroscopic portal.

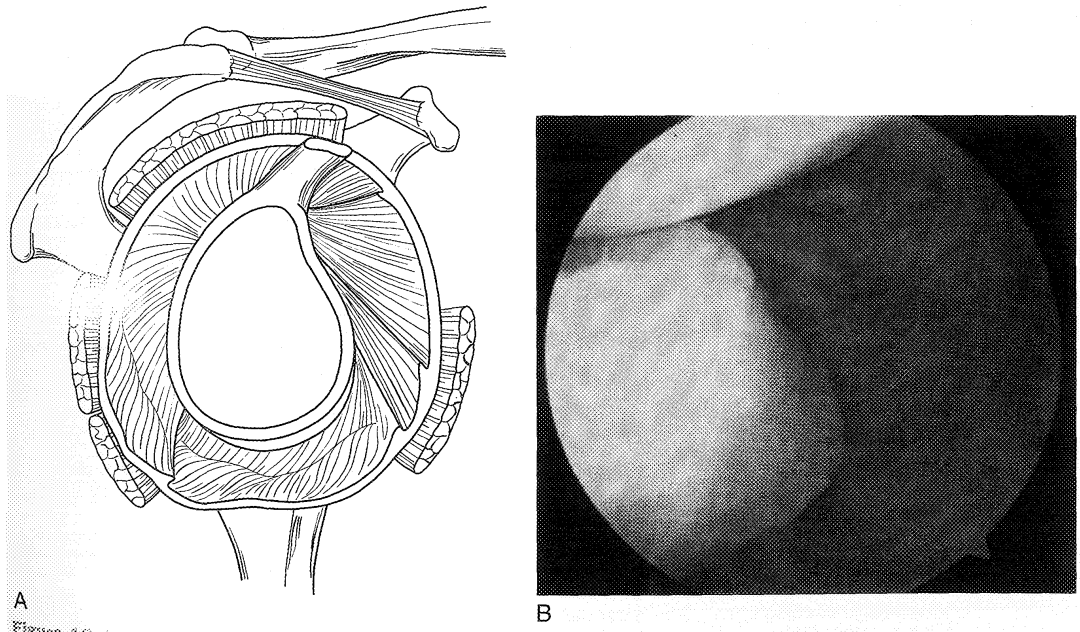


Figure 16-6 *A*, Inferior capsular redundancy resulting from chronic, atraumatic posterior instability. The inferior glenohumeral ligament has lost its tension after repeated episodes of humeral head subluxation. *B*, Arthroscopic visualization of the posteroinferior glenoid. The inferior capsule is patulous and incompetent.

An arthroscopic reduction was then attempted. Through a small posterior skin incision made at the site of the posterior arthroscopic portal, a 4-mm metal rod, commonly referred to as a switching stick, was introduced into the glenohumeral joint. It was placed medial and superior to the humeral head, resting on the anterior rim of the glenoid. After complete relaxation of the shoulder with paralysis by the anesthesiologist, a reduction maneuver was performed. The assistant provided lateral and slight distal traction of the extremity while the surgeon slowly levered the switching stick anteriorly using the anterior rim of the glenoid as a fulcrum. The switching stick provided a direct lateral force through the rotator cuff tissue, not the humeral articular surface, separating the humeral impaction fracture from the posterior glenoid rim. As the arm was gently externally rotated, the humeral head was felt to reduce within the glenohumeral joint. This was confirmed on clinical examination. The arm was placed on the patient's side and was easily dislocated a second time with the humerus in neutral rotation. Based on this instability, the plan was to proceed with arthroscopic surgical stabilization.

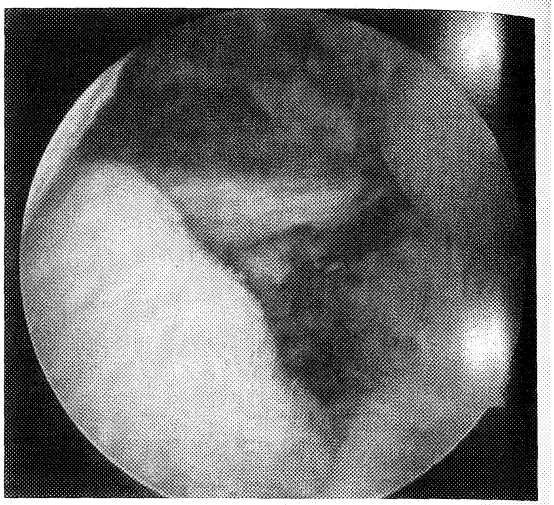


Figure 16–8 Traumatic disruption of the posteroinferior glenoid labrum after a posterior dislocation. The arthroscopic instrument illustrates the extent of the lesion.

Diagnostic Arthroscopy

One should carefully evaluate the condition of the posteroinferior quadrant. This includes an assessment of the labrum, joint capsule, and glenoid bone stock. In this case, there was a significant amount of blood within the joint, with obvious cartilage fragments. The large reverse Hill-Sachs lesion was identified on the anterior aspect of the humerus, seen best from the anterior portal (Fig. 16–7). The capsulolabral complex had been completely disrupted off the posteroinferior glenoid rim (Fig. 16–8).

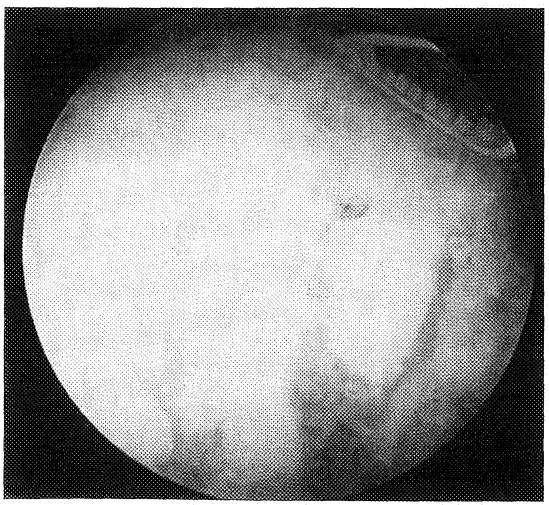


Figure 16–7 Arthroscopic view of a reverse Hill-Sachs lesion of the humeral head.

Specific Surgical Steps

1. Establish a standard posterior portal.
2. Establish an anterior portal in the rotator interval.
3. Perform glenohumeral diagnostic arthroscopy.
4. Using switching sticks, place the camera in the anterior portal.
5. Carefully examine the posteroinferior quadrant.
6. Establish the 7 o'clock portal[6] with a large-bore screw-in cannula, which will accommodate an angled suture hook (Linvatec, Largo, FL) (Fig. 16–9).
7. Prepare the glenoid for soft tissue reattachment with an arthroscopic rasp and bur. Be sure to debride the entire glenoid neck to provide a large surface for tissue repair.
8. Plicate the capsule beyond the tear, both posteriorly and anteriorly. This is performed by passing the suture hook through the capsule and then exiting at the labral articular cartilage junction (Fig. 16–10). The PDS suture is then advanced into the joint and pulled through the posterosuperior portal. A number 2 nonabsorbable suture is passed through a loop in the PDS. The PDS is then used as a suture shuttle, pulling the nonabsorbable suture through the capsulolabral complex.
9. The suture limb is retrieved from the posterosuperior cannula with a crochet hook. This limb is then pulled out through the posteroinferior cannula, and an arthroscopic knot is tied (Fig. 16–11). The goal of this stitch is twofold. It functions in plicating the capsule and also prevents propagation of the labral tear.
10. The suture anchor is placed at a 45-degree angle to the plane of the glenoid. The anchor should be slightly on the articular surface. This ensures restoration of the labral "bumper" (Fig. 16–12).

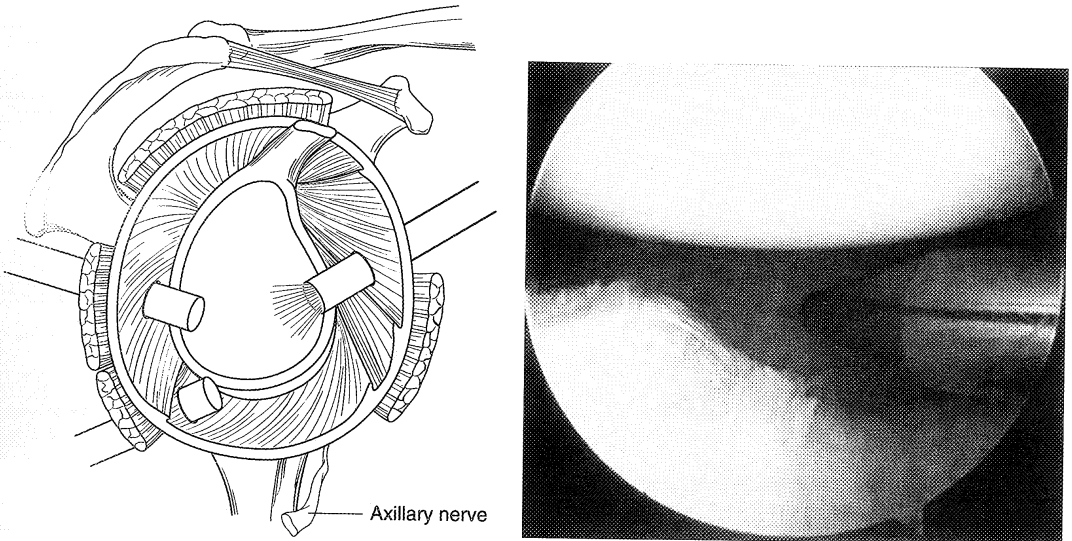


Figure 16-9 *A*, Schematic representation of the 7 o'clock arthroscopic portal. From this location, accurate anchor placement can be achieved on the glenoid. This portal is also used for suture passage and knot tying. Note that the axillary nerve is a safe distance from the cannula. *B*, Arthroscopic insertion of the 7 o'clock cannula as viewed from the posterosuperior portal.

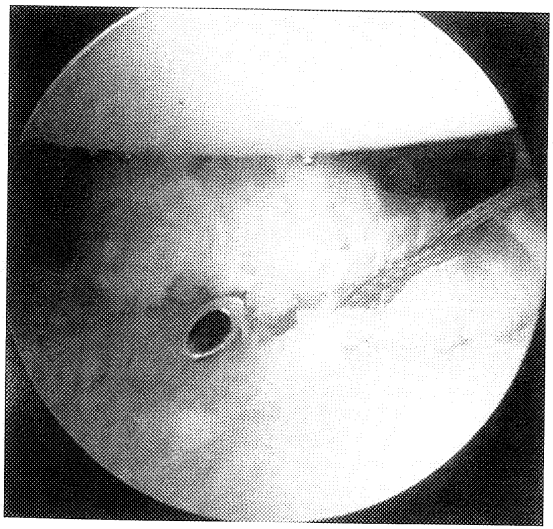


Figure 16-10 The arthroscopic suture hook is passed through the capsulolabral complex, exiting at the edge of the glenoid. The number 1 PDS is then advanced and pulled through the posterosuperior cannula.

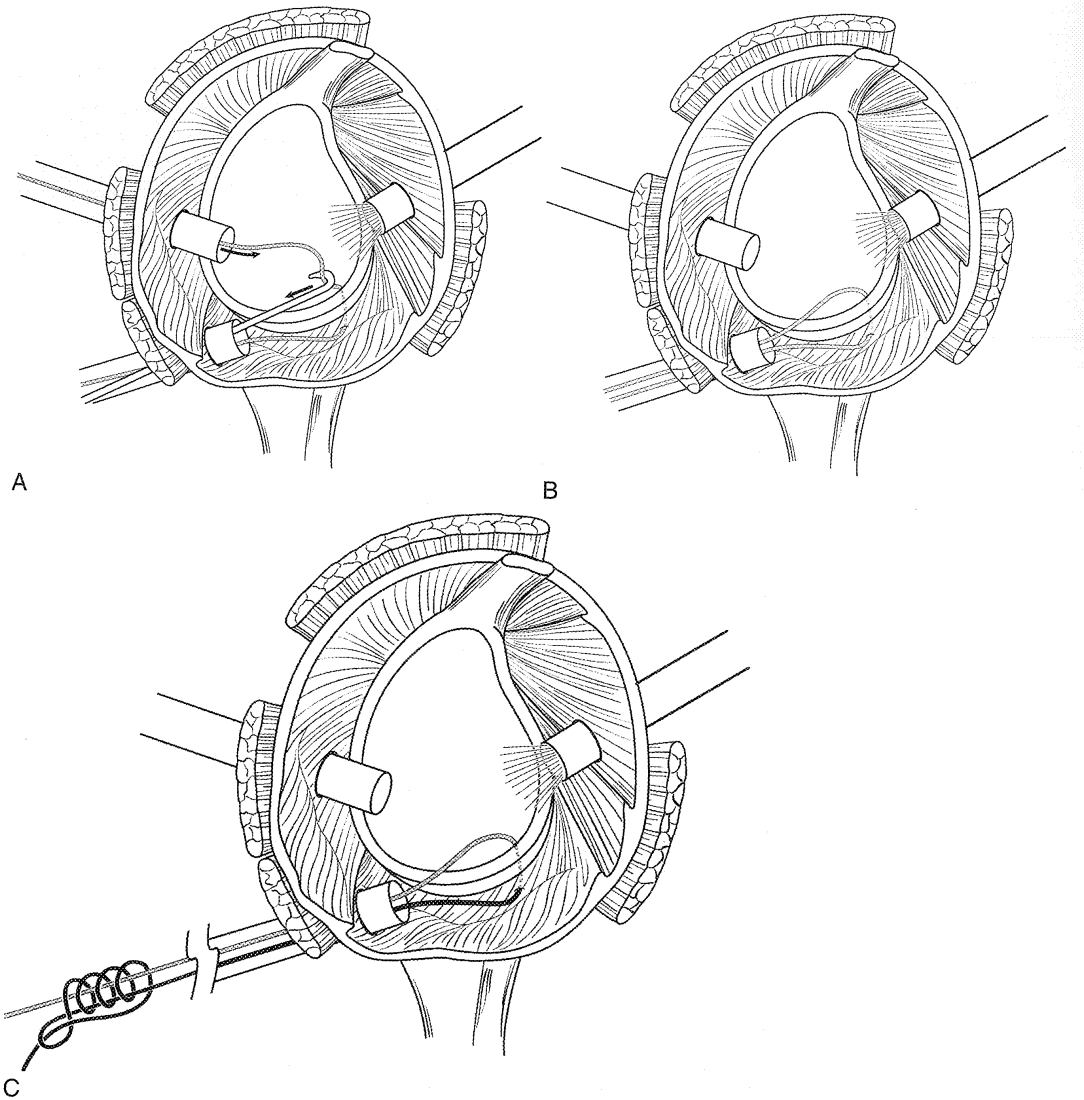
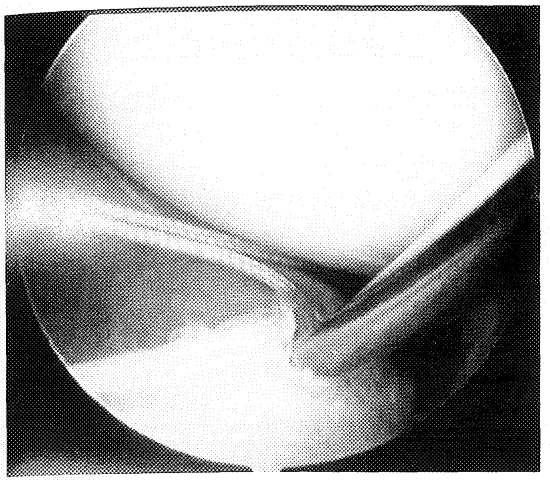


Figure 16–11 *A*, Once the nonabsorbable plication stitch has been shuttled through the labrum with the PDS, the limb exiting the posterosuperior cannula is retrieved with a crochet hook. *B*, The limb is pulled out through the posteroinferior cannula in preparation for knot tying. *C*, If the suture slides freely through the capsulolabral complex, a sliding knot may be used for stabilization. The knot-tying post should be the limb that pierces the soft tissue.



The arthroscopic anchor is placed on the glenoid rim, slightly on the articular surface. The anchor is angled 45 degrees to the plane of the glenoid surface. This location ensures restoration of the labral "bumper" when the arthroscopic knot is secured.

11. The number of suture anchors used depends on the size of the lesion. Proceed with anchor placement in a posterior to anterior direction.
12. Place the first anchor at the most posterior extent of the lesion through the 7 o'clock portal. Both suture ends are pulled with a crochet hook through the posterior portal. A suture hook is placed in the 7 o'clock portal and then through the capsulolabral complex. A number 1 PDS suture is advanced with the device into the joint and then pulled out through the superoposterior portal. Using the suture shuttle technique, a simple loop is thrown with the PDS, and this is tied around one of the ends of the anchor suture. Attempt to pull the suture end nearest the capsulolabral complex. This gives the surgeon the option of tying a sliding knot or alternating half hitches.
13. The suture hook is removed from the portal, and the PDS is pulled through the 7 o'clock portal. This brings one end of the anchor suture through the capsulolabral complex. The other end of the anchor suture is also pulled through the 7 o'clock portal with a crochet hook.
14. An arthroscopic knot is tied. If both ends of the anchor suture slide freely, a sliding knot may be used. If not, alternating half hitches should be thrown to secure the knot. In either case, the post will be on the side of the capsulolabral complex.
15. This sequence is repeated for the additional suture anchors. The anchors should be spaced approximately 5 mm apart, and there should be an anchor at the apex of the transition between the labral tear and normal labrum. In most cases, the site of injury extends from the 6 o'clock to 9 o'clock position. This is usually repaired with three suture anchors with plication stitches at either end. If subluxation persists, the rotator interval can be closed with a number 1 PDS suture to further decrease the glenohumeral joint volume and prevent subluxation of the humeral head (Fig. 16–13).

Pearls and Pitfalls

Our technique of reducing locked posterior dislocations uses traditional methods of reduction along with the assistance of an arthroscopic switching stick to separate the humerus from the glenoid, translate the articular surface laterally, and then gently reduce the humeral articular surface into the glenoid. The leverage is applied through the soft tissues, primarily the rotator cuff and capsule, not the articular surface. The advantage of this technique is that it eliminates the need for an open procedure to reduce the joint. One can proceed immediately with arthroscopy after reduction is achieved to address the capsulolabral complex.

One should work in an expedient manner. The longer the case progresses, the more difficult it becomes. Soft tissue fluid extravasation becomes greater as time progresses, decreasing the joint volume and limiting the amount of work space.

Suture management is also important. In general, one should progress from a posterior to an anterior direction, tying down one anchor at a time. Multiple anchor placement leaves too many sutures in the joint at one time, which may make knot tying unnecessarily difficult and increase case time.

Soft tissue dilators should be used when placing large-bore cannulas. The dilators are cannulated and slide easily over the switching stick at the site of the proposed portal. Care must be taken to keep the cannula pointing toward the posteroinferior glenoid, slightly lateral to the labrum. This allows the suture hook to gain purchase in the capsulolabral complex and also permits accurate anchor placement on the glenoid.

Postoperative Management

Appropriate rehabilitation for traumatic and atraumatic posterior instability is extremely important for a successful surgical outcome (Tables 16–6 and 16–7). For the first 6 weeks after a traumatic posterior dislocation, the patient should be splinted in 10 degrees of external rotation with a brace. During this period, isometric abduction and internal rotation exercises are allowed. After 6 weeks, external rotation and forward flexion in the plane of the scapula, as well as internal rotation without assistance, are begun. At 3 months, the patient may progress to range of motion as tolerated and shoulder strengthening with a Theraband or springs. In 4 to 5 months, motion is continued, and weight strengthening is allowed. Return to noncontact, nonoverhead sports is permitted at 6 months after surgery. If function is greater than 85% that of the opposite shoulder at 9 months, the patient is allowed full range of motion without restrictions.

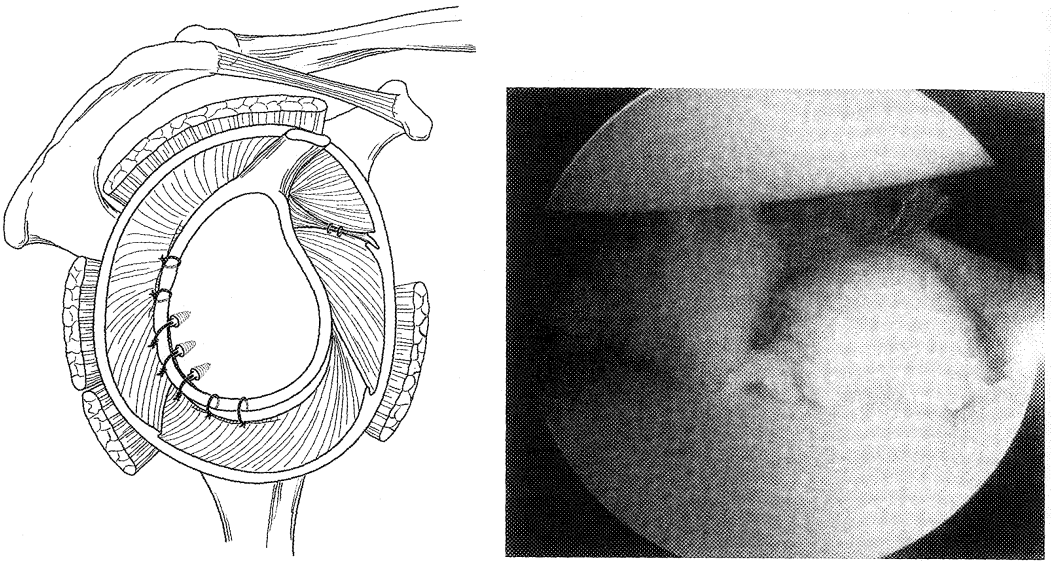


Figure 16-13 *A*, Diagram illustrating the final repair. Two plication stitches have been placed at either end of the labral repair. Three arthroscopic anchors were used to attach the capsulolabral complex to the glenoid. Note that the rotator interval was also closed with two absorbable sutures. *B*, Arthroscopic view of the completed repair at the posteroinferior glenoid.

Table 16-6 Rehabilitation Protocol for Traumatic Posterior Instability

Weeks 1-6

Patient splinted in 10 degrees ER in brace
Active ROM only to regain FF and ER at side as tolerated
IR in ABD permitted if active only
Begin isometrics with arm at side—ER, IR, ABD, ADD; no resisted FF or biceps motion until 12 wk postop
Start strengthening scapular stabilizers (trapezoids, rhomboids, levator scapulae)
No passive motion of posterior capsule
Physical modalities at physical therapist's discretion

Weeks 6-12

Increase posterior capsule ROM gently (active ROM)
Advance strengthening as tolerated: isometrics → bands → weights; 10 repetitions/1 set per rotator cuff, deltoid, and scapular stabilizers
Do strengthening only 3 times/wk to avoid rotator cuff tendinitis

Months 3-12

Advance to full ROM as tolerated
Begin eccentrically resisted motions, plyometrics, proprioception, body blade, and closed chain exercises at 16 wk
Resume sports and throwing at 9 mo postop

ABD, abduction; ADD, adduction; ER, external rotation, FF, forward flexion; IR, internal rotation; ROM, range of motion.

Rehabilitation after atraumatic posterior instability differs slightly. For the first 3 weeks, the patient remains in the abduction brace without any shoulder motion. At week 3, the patient begins active range of motion for forward flexion and external rotation, with limitations to prevent stress on the posterior capsule. More aggressive range of motion in all planes is started at week 8, including some shoulder strengthening. The goal is to return the patient to preinjury athletic participation at 6 months postoperatively.

Results

At 24 months' follow-up, the patient described earlier had full range of motion compared with his contralateral shoulder. There was no evidence of posterior laxity or subluxation, and the patient had returned to his presurgical level of recreational athletic participation.

Arthroscopic stabilization of posterior instability has had favorable results. Most series have included only small groups of patients without long-term follow-up. Further, some series have included patients without any signs of posterior instability, some of whom may be more appropriately classified as having multidirectional instability.

Antoniou et al.[1] reviewed 41 consecutive patients with primary posteroinferior instability for an average of 28 months. Their goal was to describe the pathologic morphology of the posteroinferior aspect of the glenolabral

Table 16-7 Rehabilitation Protocol for Atraumatic Posterior Instability

Weeks 0-3

No motion! Patient in handshake orthosis (gunslinger brace) at all times
Grip strengthening and supination, pronation of forearm

Weeks 4-7

Active ROM only to regain FF and ER at side as tolerated
IR-ADD limited to stomach or active cross-body ADD without pain
IR in ABD permitted if active only
Begin isometrics with arm at side—ER, IR, ABD, ADD; no resisted FF or biceps motion
Start strengthening scapular stabilizers (trapezoids, rhomboids, levator scapulae)
No passive motion of posterior capsule

Weeks 8-12

Increase posterior capsule ROM gently (active ROM)
Advance strengthening as tolerated: isometrics → bands → weights; 10 repetitions/1 set per rotator cuff, deltoid, and scapular stabilizers; no resisted FF or biceps motion yet
Do strengthening only 3 times/wk to avoid rotator cuff tendinitis

Months 3-12

Advance to full ROM as tolerated
Begin eccentrically resisted motions, plyometrics, proprioception, body blade, and closed chain exercises at 16 wk
Resume sports, throwing at 6 mo postop

ABD, abduction; ADD, adduction; ER, external rotation, FF, forward flexion; IR, internal rotation; ROM, range of motion.

fossa and to prospectively examine the efficacy of managing this instability with an arthroscopic capsulolabral augmentation procedure. Thirty-five patents had improved stability, and all patients had significant improvement of physical examination findings. Twenty-eight patients had a perception of residual stiffness.

Similarly, Wolf and Eakins[19] performed a retrospective study of 19 patients who had undergone arthroscopic repair of the posterior capsule and labrum. Posterior capsular laxity was present in all cases and was believed to be the primary pathology. Twelve patients showed some form of labral pathology as well. Twelve patients had excellent results, and two had fair results. There was one recurrence. All 14 were satisfied with the results of their surgery.

Savoie and Field[16] described five arthroscopic techniques to address various lesions associated with posterior instability. The preliminary results among 61 patients with 1- to 7-year follow-up indicated a 90% success rate.

There are limited data to support the use of thermal capsulorrhaphy at this time. Results are limited to a few non–peer-reviewed articles and unpublished reports.[7] These reports had short-term follow-up, and the results of patients with posterior instability were grouped with those of patients with anterior and multidirectional instability.

Savoie and Field[17] reported on 30 patients with multidirectional instability treated with thermal capsulorrhaphy and arthroscopic suture plication of the rotator interval. At a follow-up of 22 to 28 months, the patients were assessed using the UCLA and Rowe and Neer rating scales. They reported 28 patients (93%) with satisfactory results and 2 (7%) with unsatisfactory results. Both patients with unsatisfactory results had recurrent instability that required open capsular repair.

Thabit[18] reports on 41 shoulders with multidirectional and unidirectional instability treated with laser-assisted capsulorrhaphy. There were 27 patients with anterior instability, 12 with multidirectional instability, and 2 with posterior instability. Follow-up ranged from 2 to 12 months. Results were assessed with the Rowe instability scale, with an average postoperative score of 88.2 out of 100 points.

Complications

Complications are similar to those encountered with any other surgical procedure involving the shoulder. These include infection, neurovascular injury, pain, stiffness, and recurrence of instability. Preoperative antibiotics should be administered to prevent infection. Accurate placement of the 7 o'clock portal avoids damage to the axillary nerve, which is near the inferior glenohumeral capsule. A well-supervised postoperative physical therapy regimen decreases the chance of shoulder stiffness. A premature return to sporting activities may compromise the repair and place the patient at an increased risk of recurrent dislocation.

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