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Arthroscopic Treatment of Instability Attributable to Capsular Injury or Laxity

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Among the many causes of shoulder instability are traumatic capsular injury associated with the Bankart lesion and capsular laxity as seen in multidirectional instability. Previously, open surgical procedures were the most commonly accepted surgical treatment of these disorders. However, because of the foresight of surgeons such as Richard Caspari, arthroscopy rapidly is becoming the surgical treatment of choice. Current studies have shown a 97% satisfactory outcome of arthroscopic Bankart repair. Similarly, the arthroscopic treatment of multidirectional instability has produced a 93% satisfactory outcome. These results parallel the gold standard open surgical techniques of the past and subsequently have led to a change in the treatment of shoulder instability.

Traumatic anterior instability and multidirectional instability represent two of the more frequently made diagnoses in instability patterns of the shoulder. Originally corrected primarily through open procedures, current technique allows correction of the entire spectrum of instability patterns via arthroscopic techniques. Perthes[11] and Bankart[3,8] and Cantab originally described repair of the avulsed capsulolabral structures to the glenoid rim. Johnson[6] pioneered the use of arthroscopic techniques in the treatment of shoulder instability. Although some of his early techniques are no longer in use, his vision produced multiple new procedures and instruments used today to treat shoulder instability.

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Historic Perspective

In the early evolution of arthroscopic Bankart repair, metal staples and screws were used for fixation. Success rates ranged from 66% to 85%.[7,8] However, complications were encountered, including loose or migrated hardware, articular injury, persistent pain caused by hardware, and problems with recurrent instability. Neer and Foster[9] described using an open capsular shift for multidirectional instability, whereas McIntyre et al[8] formulated arthroscopic techniques to accomplish the same stabilizing vertical shift of the capsule. Snyder and Stafford[14] continued the evolution of arthroscopic techniques, describing the use of anchors and sutures to affect a direct repair of the capsule to bone, eliminating the need for transglenoid suturing. Snyder and Stafford[14] and Wolf[19] developed an all-inside suture technique for multidirectional instability. Thabit[16] initially investigated the use of thermal shrinkage via laser, and Fanton developed the unipolar temperature specific probe for more exact technique. (Fanton GS: Two-Year Outcome of Arthroscopic Bankart Repair and Electrother-

mal Assisted Capsulorrhaphy for Recurrent Traumatic Anterior Shoulder Instability. Presented at the Meeting of the Arthroscopic Association of North America, Miami, FL, April 2000.) Treacy et al[18] described interval plication as a supplement to instability surgery. The current authors describe a technique with results in patients with instability.

Indications

The authors' current criteria for arthroscopic treatment of traumatic anterior instability includes patients of all ages and all activity levels with recurrent anterior instability who are impaired functionally by their instability and in whom nonoperative treatment has failed. Revision stabilization procedures also are treated arthroscopically. Currently, arthroscopic stabilization procedures are not done on patients with first-time, acute shoulder dislocations.

The treatment of patients with multidirectional instability focuses on establishing the correct diagnosis and instituting proper physical therapy for the scapular stabilizing muscles and the rotator cuff. Rehabilitation of the larger muscles of the shoulder (deltoid, pectoralis major, and latissimus dorsi) is delayed until normal scapular and rotator cuff function is achieved. Patient education, activity modification, and patience on the part of physicians, therapists, and patients are necessary during this stage; but one can expect satisfactory results in 90% of patients or more with 6 months of rehabilitation. If extensive nonoperative treatment fails and symptoms of pain and functional instability persist, surgical intervention should be considered. However, the operative treatment of capsular laxity should not only address the primary area of disease, but also correct secondary changes from the continuing symptomatic subluxation and dislocation of the shoulder. Associated capsulolabral tears or avulsions also should be repaired.

Techniques

Bankart Reconstruction

The patient is placed in the lateral decubitus position for the arthroscopic treatment of multidirectional instability and Bankart lesions. The arm is suspended with 5 to 10 lb traction. A standard posterior portal is established and a diagnostic arthroscopy is done. With the recurrent anterior dislocation of a Bankart lesion a capsulolabral avulsion and a widened rotator interval usually are seen (Fig 1). An anterior portal then is established using an outside-in technique to ensure proper orientation and access to the inferior glenoid for reconstruction.

The Bankart lesion and anterior capsule are evaluated from the anterior portal for associated midcapsular or humeral tears. The arthroscope then is returned posteriorly and the anterior portal is used for debriding and releasing the capsulolabral complex from the glenoid. The release is extended medially along the glenoid neck until the subscapularis muscle can be seen. The release also is done inferiorly to the 6 o'clock position (straight inferior) of the glenoid (Fig 2). The anterior and inferior glenoid then is abraded to a bleeding surface.

The anterior cannula is removed and a standard Linvatec suture punch cannula (Largo, FL) is inserted. The Mitek drill guide (Mitek, Johnson and Johnson, New Brunswick, NJ) is

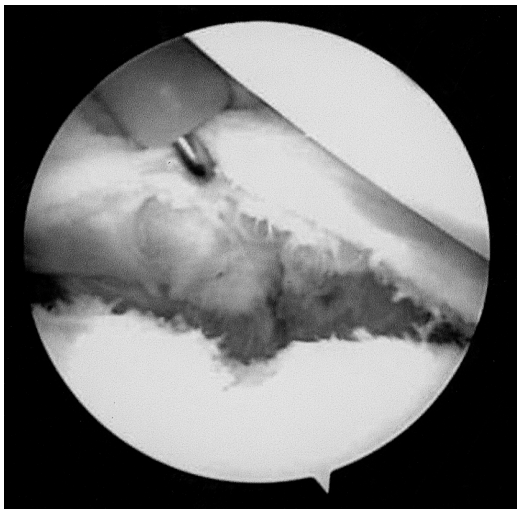

Fig 1. Arthroscopic view of Bankart lesion repair with second anchor in place.

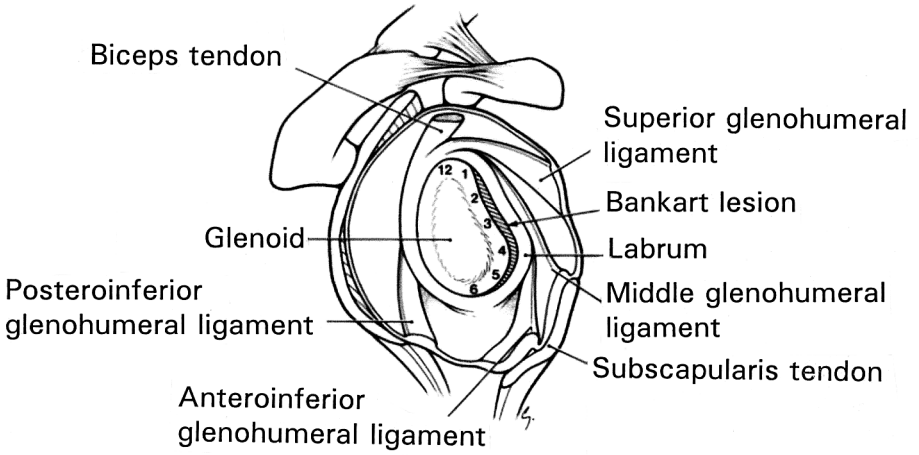

Fig 2. Drawing of glenoid with numbers for identifying anchor placement.

introduced and placed just at the edge of the glenoid articular surface at the 5 o'clock position. The drill should angle 45° from the articular surface and be perpendicular to the superoinferior axis. A Panalok anchor (Mitek, Johnson and Johnson) made of long-term absorbable polylevolactic acid with long-term absorbable suture then is inserted and the sutures are tagged. The suture material called Panacryl (Ethicon, Johnson and Johnson) is a braided, absorbable material that maintains 80% of its original strength at 3 months. Complete absorption likely occurs at 18 months after implantation.

After placement of the suture anchor, a nonmodified (closed-ended) Caspari suture punch (Linvatec) is loaded with a doubled (two free ends in the punch), 48-inch long 2–0 prolene suture. The punch is placed through the anterior cannula and used to pass the doubled prolene through the capsule at the 6 o'clock position. As the suture punch is withdrawn from the cannula, the two free ends are grasped in one hand and the loop end is grasped in the other hand. One limb of the Panacryl suture is placed through the loop and the two free ends of the prolene are pulled, dragging the looped end and the Panacryl suture through the capsule and back out the same cannula. If a mattress stitch is desired, the steps are repeated with the other limb of the suture. Suture placement is critical at this portion of the procedure to allow for adequate tensioning of the capsule. A modified Roeder knot then is tied to secure the capsule (Fig 3).

Additional anchors are placed in a similar manner at the 3 and 1 o'clock positions. A retrograde suture retriever may be necessary above 3 o'clock to retrieve the sutures through

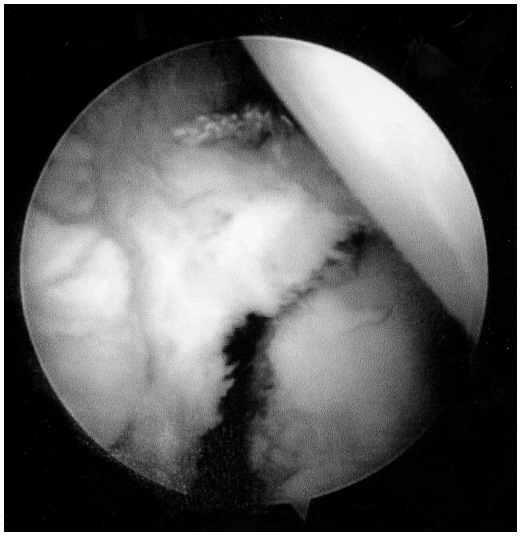

Fig 3. Arthroscopic view of partial repair of lesion.

the tissue. The complete repair is assessed from the posterior and anterior portals. The posterior capsule also is assessed and tightened if necessary. The rotator interval then is plicated, taking care not to incorporate the biceps tendon. The interval plication is accomplished by passing a spinal needle through the anterior edge of the supraspinatus tendon, incorporating the anterior capsule and occasionally the middle glenohumeral ligament. The suture limbs then are retrieved through the anterior cannula and tied blindly using a modified Roeder knot. This completes the Bankart reconstruction.

Thermal Capsulorraphy and Rotator Interval Closure for Multidirectional Instability

After induction of general anesthesia, examination of the affected shoulder and contralateral shoulder is done with the patient in the supine position. Then, similar to the treatment of Bankart lesions, the patient is placed in the lateral decubitus position. The affected arm is placed in 5 to 10 lb traction. A standard posterior portal is established and a complete arthroscopic evaluation of the glenohumeral joint is done. An anterior portal is created in the rotator interval, with caution used to ensure that the anterior and inferior aspects of the capsule are easily accessible. After a thorough examination of the anterior structures is done, the arthroscope is switched to the anterior portal and an examination of the posterior capsule and labrum is done. Small labral tears or avulsions are repaired, and partial thickness rotator cuff tears are debrided at this time.

Based on the examination with the patient under anesthesia and the arthroscopic appearance of the capsular structures, the location and extent of thermal capsulorrhaphy is determined. The authors use a unipolar Oratec probe (Oratec Inc, Menlo Park, CA) with the temperature setting of 67.5°C and power setting of 20 to 40 W. The probe is introduced through the anterior portal and placed across the joint to contact the posterior band of the inferior glenohumeral ligament. The tightening then continues across the inferior glenohumeral ligament and up the anterior capsule. Single radial passes of the probe are made from the glenoid side to the humeral side of the capsule. The middle and superior glenohumeral ligaments also are treated systematically. The arthroscope then is switched to the anterior portal and the probe is introduced through the posterior portal with the posterior capsule being treated in a similar fashion starting on the glenoid side and making radial passes while proceeding superiorly along the posterior capsule (Fig 4). The amount of capsular shrinkage frequently is reassessed during the procedure.

The arthroscope then is returned to the posterior portal and the area of the rotator interval is evaluated. Thermal tightening of the superficial and deep layers of the interval is attempted, but in most cases, the authors think that shrinkage of the interval is ineffective, in part because of the presence of the operative portal. Interval plication sutures then are placed using the technique described by Treacy et al[18] (Fig 5).

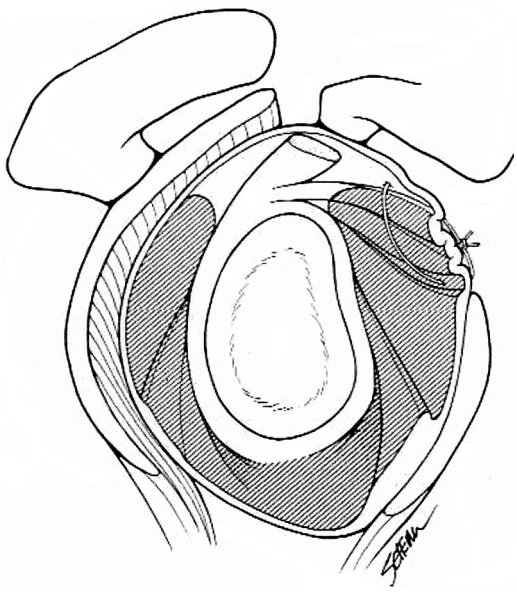

Fig 4. Drawing of interval plication with capsular shading for thermal plication.

Fig 5. Arthroscopic view of interval plication stitch in place.

Postoperative Treatment

Bankart Repair

For the first postoperative week, the shoulder is maintained in a sling with a small abduction pillow. The patient then is started on a home exercise program comprised of shoulder shrugs, passive forward flexion of the shoulder, and passive external rotation taking care not to cause pain with exercising. These exercises are continued for 2 weeks. At 3 weeks, active internal and external rotation are commenced at the waist level with a theraband and continued for another 3 weeks. At 6 weeks, physical therapy is started, emphasizing active range of motion (ROM) with rotator cuff strengthening, without stretching. Plyometric exercises may begin at 2 months followed by return to low velocity throwing at 3 months. Return to contact sports and aggressive sports specific drilling is determined on an individual basis and usually is delayed until 4 months postoperatively, if possible.

Capsular Shrinkage and Rotator Interval Closure

The patient's shoulder remains in a sling with a small abduction pillow for 3 to 4 weeks. These patients begin active external rotation exercises with the arm adducted and scapular rotation exercises on the fourth week postoperative. Six weeks after surgery, a more extensive active rotator cuff and periscapular program is initiated. The exercises are progressed to proprioceptive neuromuscular facilitation patterns as tolerated, usually approximately 8 weeks after surgery. These are combined with progressive resistance exercises at 8 to 12 weeks after surgery. Twelve to 16 weeks postoperatively, the plyometric program and sport-specific conditioning for athletes is started and continued until normal function is achieved.

Patients are evaluated postoperatively at 1 week, 3 weeks, and each month thereafter until their shoulder is considered stable enough to return to unrestricted activity. Patients are allowed to return to unrestricted activity when ROM and strength are equal to the contralateral shoulder, usually by 3 to 6 months postoperatively. Because of the uncertainty of the recovery of normal proprioception, no passive ROM or capsular stretching by the physical therapist or trainer should be allowed.

RESULTS

Bankart Repair

In a previous study by Noojin et al,[10] 35 consecutive patients with traumatic anterior instability were selected prospectively to be part of a study on long-term absorbable anchor sutures. All patients in this study had sustained two or more dislocations, were impaired functionally in their activities of daily living, and an aggressive rehabilitation program to alleviate their symptoms had failed. The average age of patients in this series was 27 years. At arthroscopy, all patients had a Bankart lesion and underwent an arthroscopic repair using a minimum of three Panalok anchors with Panacryl suture. Followup consisted of clinical and radiographic evaluation at a minimum of 2 years (range, 24–30 months). The average postoperative Bankart score was 93 points (range, 50–100). All patients regained a minimum of 170° frontal flexion and abduction. In

90° abduction, the average external rotation was 110° (range, 95°–135°). One patient sustained a repeat traumatic dislocation 11 months postoperatively and was classified as having failed results. Using this technique, a 97% success rate at short-term followup was obtained.[10] None of the other patients in the study have reported a postoperative dislocation at the time of this report. Thirty of 34 patients were reevaluated radiographically at 2 years. No patient had evidence of osteolytic lesions in the glenoid.

Capsular Shrinkage and Rotator Interval Closure

In a study by Savoie and Field,[13] 30 patients with symptomatic multidirectional instability were treated with arthroscopic thermal capsular shrinkage and rotator interval closure. All patients were reexamined 22 to 28 months (average, 25 months) postoperatively using the rating scales of the University of California Los Angeles,[5] Rowe et al,[12] and Neer and Foster.[9] Each patient also was evaluated for his or her ability to return to participating sports.

Twenty-eight of 30 patients were rated as having satisfactory results on all scales used. The remaining two patients were rated as having unsatisfactory results. One patient had recurrent instability and was unable to return to playing softball. This patient initiated a full rehabilitation program on her own 3 days after surgery, including aggressive capsular stretching by a personal trainer in an attempt to hasten her return to sport. Although this patient returned to playing softball 4 weeks postoperatively and was able to complete the season, her symptoms of instability returned the following season. Her examination at that time revealed recurrence of the instability. This patient was rated as having an unsatisfactory result on all scales. She subsequently had an open capsular shift in another hospital without regaining the ability to return to playing sports.

The second patient did well for approximately 18 months before recurrent posterior subluxation spontaneously developed. Revision surgery in this patient revealed a tightened interval and robust anterior capsular structures but posteriorly the capsule seemed abnormal. Arthroscopic suture plication of the posterior capsule incorporating the infraspinatus and teres minor tendons in the plication has resulted in a stable shoulder. This patient did not participate in sports. The overall satisfactory outcome in this series was 93%.[13]

DISCUSSION

Both series of patients undergoing arthroscopic shoulder stabilization had satisfactory outcomes of greater than 90% at relatively short-term followup. Although the 96.5% success rate described by Rowe et al[12] remains the gold standard that must judge all instability results, there are several factors to consider. In that study, only ⅔ of the patients were reexamined, and only ⅓ of those involved in sports returned to a competitive level of participation. Torchia et al[17] showed that the incidence of recurrent instability increases for as many as 7 years postoperatively. Thus, although the 2-year results remain promising, excitement over a high initial success should be tempered by these data revealing that the success will decrease with time. The previously mentioned technique has produced a 97% satisfactory result in short-term followup. This compares favorably with the open procedure. Another study by Bacilla et al[2] on the use of arthroscopic Mitek suture anchor placement and capsular repair also provided results comparable with the open technique with a 93% satisfactory outcome.

Similarly, Altchek et al[1] treated multidirectional instability with an open capsular shift procedure. Four of 42 patients had episodes of instability leading to a 90% satisfactory outcome from the procedure. Subsequent attempts at arthroscopic stabilization by Duncan and Savoie[4] were successful at preliminary followup and initiated a trend of surgically treating multidirectional instability arthroscopically. McIntyre et al[8], Snyder and Stafford,[14] Wolf,[19] and Tauro and Carter[15] all have described arthroscopic techniques for treating

multidirectional instability. Today, surgeons have the option of doing capsular shrinkage with a laser, bipolar probe, or unipolar probe. Likewise, capsular shifts also are being done arthroscopically with the use of sutures. Savoie and Field[13] explored all of these modalities in a comparative study with each procedure providing at least a 90% satisfactory result.

Caspari pioneered many of the currently accepted arthroscopic techniques of shoulder stabilization. His expertise in evaluating the shoulder and in developing techniques and the instrumentation to make these techniques useful is unparalleled. More importantly, his incredible ability to instruct surgeons how and when to use them advanced the understanding of shoulder surgery exponentially. Any discussion of the shoulder must, of necessity, include and recognize his contributions in this area. As arthroscopists continue to build on what he taught us, arthroscopic shoulder stabilization has evolved into the gold standard for the treatment of shoulder instability.

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