An Arthroscopic Technique for Anterior Stabilization of the Shoulder with a Bioabsorbable Tack*

BY KEVIN P. SPEER, M.D.†, RUSSELL F. WARREN, M.D.‡, MICHAEL PAGNANI, M.D.‡, AND JON J. P. WARNER, M.D.§, NEW YORK, N.Y.

Investigation performed at The Hospital for Special Surgery, New York City

ABSTRACT: Arthroscopically assisted repair of the anterior aspect of the labrum with use of a bioabsorbable tack was performed in fifty-two consecutive patients who had chronic anterior instability of the shoulder. The average age of the patients was twenty-eight years (range, sixteen to fifty years). The etiology of the instability was a traumatic injury in forty-nine patients; twenty-six of those injuries were sustained during participation in a contact sport. Fifty shoulders had a Bankart lesion.

The patients were evaluated at an average of forty-two months (range, twenty-four to sixty months) after the procedure. Forty-one (79 per cent) of the patients were asymptomatic and were able to participate in sports without restriction. The repair was considered to have failed in eleven (21 per cent) of the patients. In four of them, the failure resulted from a single traumatic reinjury during participation in a contact sport, and three of these reinjuries were treated non-operatively. The remaining seven failures occurred atraumatically. Eight patients had an open glenoid-based capsulorrhaphy as a consequence of recurrent instability. At the reoperation, no evidence of the tack was found in any patient. In seven patients, the Bankart lesion had completely healed, and the anteroinferior aspect of the capsule was patulous.

Anterior stabilization of the shoulder with a bioabsorbable tack may be indicated for patients who have anterior instability but do not need a capsulorrhaphy or capsular imbrication to reduce the joint volume.

The application of arthroscopic techniques for the operative treatment of recurrent anterior instability of the glenohumeral joint has generated widespread interest[2,3,5,8-10,12,13,17,21,27,31]. The goal of all arthroscopic techniques for stabilization of the shoulder is the re-establishment of a functioning inferior glenohumeral ligament. This is achieved by reattaching the avulsed anteroinferior aspect of the labrum or capsule to the anterior aspect of the glenoid neck with one of a variety of methods[2]. In 1986, Johnson described an arthroscopic technique for doing this with a metal staple[16]. Subsequent reports on staple capsulorrhaphy have documented variable results, including complications such as a broken or migrated staple, articular injury, and a high rate of recurrence[10,13,26]. These complications and a desire to avoid the use of metal implants led to the proposal of a suture technique based on the open transosseous repair developed by Reider and Inglis[20]. The complications associated with metallic fixation devices were avoided, but the suture technique necessitated use of an additional posterior incision so that the sutures could be tied over the infraspinatus fascia or the posterior deltoid fascia[3,9,17].

The problems with metal implants, such as loosening and migration[32], led to the development of biodegradable materials for use about the shoulder[27]. The purpose of the current report was to present our initial experience with an arthroscopic technique for anterior stabilization of the shoulder with a bioabsorbable tack in fifty-two patients who had recurrent anterior glenohumeral instability.

Materials and Methods

We retrospectively reviewed the records of the initial fifty-two patients who had been managed with an arthroscopic technique for anterior stabilization of the glenohumeral joint with a bioabsorbable tack (Fig. 1) by the senior one of us (R. F. W.).

All of the patients in the series reported a history of recurrent anterior instability and had documentation of the instability by physical examination. Only one patient had had a previous operation for instability; it consisted of an arthroscopic débridement of the anterior aspect of the labrum. The series was consecutive in that no patient had the procedure abandoned as a result of a technical problem. During the period of the study, all patients who had recurrent anterior glenohumeral instability were managed arthroscopically with anterior stabilization of the glenohumeral joint with a bioabsorbable tack.

There were forty-seven male and five female pa-

*No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article. Funds were received in total or partial support of the research or clinical study presented in this article. The funding source was the Orthopaedic Research and Education Fund.

†Sports Medicine and Shoulder Service, Division of Orthopaedic Surgery, Duke University Medical Center, Box 3371, Durham, North Carolina 27707.

‡Department of Sports Medicine, The Hospital for Special Surgery, 535 East 70th Street, New York, N.Y. 10021.

§Shoulder Service, Center for Sports Medicine, Department of Orthopaedic Surgery, University of Pittsburgh, 4601 Baum Boulevard, Pittsburgh, Pennsylvania 15213.

FIG. 1

Photograph of the bioabsorbable cannulated tacks, showing the broad flat head and the ribs on the shaft. (Reprinted, with permission, from: Speer, K. P., and Warren, R. F.: Arthroscopic shoulder stabilization. A role for biodegradable materials. Clin. Orthop., 291: 68, 1993.)

tients. The average age at the time of the operation was twenty-eight years (range, sixteen to fifty years). The dominant shoulder was involved in twenty-nine patients.

Before the traumatic injury, twenty-six patients had participated in a contact sport (football, hockey, wrestling, or rugby) for more than five hours a week. Thirteen patients had participated in a sport that required overhead action (baseball, softball, swimming, or tennis) for more than five hours per week. None of the patients in the present study were professional athletes.

The mechanism of injury was a traumatic dislocation for thirty-six patients, twenty-five of whom sustained the dislocation during participation in a contact sport. Thirteen patients had a traumatic subluxation without dislocation. Dislocation was defined as displacement of the humeral head into a locked position anterior to the glenoid necessitating manual reduction. Subluxation was defined as a less severe injury in which there was spontaneous relocation. Although three patients noted an episode of injury while throwing overhead or while serving in tennis, an unequivocal history of subluxation could not be elicited. One patient had had a previous operation for the anterior instability in which the labral tear had been excised with an arthroscopic shaver.

All patients had been managed initially with a comprehensive program of rehabilitation that emphasized strengthening of the rotator cuff and the periscapular muscles. The program had been initiated by the physicians who had managed the patients before they were referred to us. None of the shoulders had been immobilized for more than seven days after the injury.

Anteroposterior, axillary, West Point, and Stryker notch radiographs had been made of all shoulders before the arthroscopic stabilization procedure. Radiographic findings included anterior abnormality of the glenoid in fourteen patients and a Hill-Sachs lesion in twenty-four[22].

Operative Technique

The arthroscopic procedure was performed with the patient in a beach-chair position[25] and under interscalene block anesthesia with use of lidocaine and epinephrine. A complete glenohumeral arthroscopic examination, with the arthroscope in the posterior portal, preceded the arthroscopic stabilization. The arthroscopic examination revealed an injury of the anterior aspect of the labrum (a Bankart lesion) in fifty patients and a chondral Hill-Sachs lesion in forty-four. All of the instrumentation was inserted through dual anterior portals. The superior anterior portal was made just anterior to the biceps tendon and lateral to the joint margin, and the inferior anterior portal was made just proximal to the intra-articular portion of the subscapularis tendon lateral to the margin of the joint. The osseous glenoid rim was abraded anteriorly and inferiorly before attachment of the soft tissue. A grasper inserted through the superior anterior portal was used to reduce the detached anterior and anteroinferior aspects of the labrum (the Bankart lesion) and shift it to a more superior position on the anterior portion of the glenoid rim. The Bankart lesion could be shifted superiorly by a maximum of 0.5 to 1.0 centimeter in most patients. As no Bankart lesion was encountered in two patients, one was created with use of the arthroscopic knife and rasp[3] by detaching the anteroinferior aspect of the labrum and capsule from the anterior portion of the glenoid rim so that it could be reattached in a more superior position on the glenoid rim.

A cannulated drill provided for the six-millimeter tack was inserted in the inferior-anterior portal in order to create the bone tunnel for insertion of the implant[31]. The drill-bit is approximately two millimeters in diameter. The drill-hole was always placed at the chondral margin of the glenoid to ensure that the capsular reattachment would be at this site. A wire fits through the drill-bit and protrudes by a few millimeters so that it remains fixed within bone when the drill-bit is withdrawn (Fig. 2-A). The bioabsorbable tack is impacted over this wire by means of a cannulated impactor placed through the cannula (Fig. 2-B). The tacks are inserted in an inferior-to-superior direction (Fig. 2-C) under direct arthroscopic visualization so as to confirm proper placement. One, two, or three tacks were used, according to the anatomy and the available space. We placed as many tacks as possible, but we strictly avoided overlapping the tacks. The position of the portals also determined whether more than one tack could be inserted. As we gained experience in the technique, we could insert more tacks and now we routinely use two or three tacks.

The number of tacks that were used was not related to the capsular laxity or to whether or not the

Bankart lesion could be mobilized. The most inferior tack was inserted one to two centimeters distal to the anterior band of the inferior glenohumeral ligament on the anteroinferior aspect of the glenoid rim at the chondral margin[31]. There were no early complications of the procedure.

All of the patients were managed with a Suretac bioabsorbable implant (Acufex Microsurgical, Norwood, Massachusetts), a cannulated tack that is molded from a synthetic copolymer (polyglyconate), which is identical to that used in Maxon sutures (Acufex Microsurgical). The ribs on the shaft of the tack increase the pull-out strength, and a broad, flat head allows the tack to capture soft tissue and hold it to bone while the implant is being inserted[27]. All of the tacks had a six-millimeter-diameter head.

Initially, all patients spent two nights in the hospital. However, the duration of hospitalization was shortened to a single night, in accordance with experience with the technique and because of the evolving restrictions of the third-party payers. Sometimes, when there are special circumstances and when appropriate homecare is available, this procedure is performed on an outpatient basis.

The postoperative rehabilitative protocol for the patients involved use of a sling for four weeks. During that time, pendulum exercises for axillary hygiene were performed. Range-of-motion exercises of the elbow and isometric exercises of the forearm also were performed. At four weeks postoperatively, the patients were allowed passive forward flexion and elevation of the shoulder to 90 degrees as well as external rotation to 0 degrees with the arm at the side. In addition, isometric exercises of the deltoid and exercises of the periscapular muscles were begun. At six weeks postoperatively, progression to a full active range of motion was allowed. This program continued until twelve weeks postoperatively, at which time most patients had regained mobility of the shoulder. At twelve weeks, resistive training with use of isotonic and isokinetic modalities was performed, in a progressive manner but with no limitation on the patient. Participation in contact sports was not allowed until five months postoperatively. Intensive overhead activities in sports were restricted until eight months postoperatively.

Forty-nine patients returned for a follow-up evaluation for the purposes of the present study. All had a physical examination performed by one of us (K. P. S.). No radiographs were made. Three patients were unable to return, and they were interviewed by telephone. Two of the three had had a traumatic recurrence of anterior instability and were included in order to represent properly the over-all rate of recurrence. Notes from the orthopaedic surgeons who were currently managing these three patients were considered complete enough for these patients to be included in the over-all study.

Results

The follow-up evaluation was performed an average of forty-two months (range, twenty-four to sixty months) postoperatively. Forty-one patients (79 per cent) were asymptomatic, with no evidence of instability of the shoulder. There had been no complications from the procedure. All of the shoulders were fully functional, and the patients had no limitation in the activities of daily living. None of the thirteen patients who had participated in sports requiring overhead activity preoperatively had clinical evidence of instability of the shoulder. However, three of these patients had not been able to return completely to the preoperative level of function, with regard to overhead activity. Otherwise, they had no limitation because of the shoulder. When questioned, the three patients reported a subjective lack of strength in the shoulder and early fatigue with throwing. As a result, they had modified their overhead activity.

At the time of the most recent follow-up evaluation, the loss of elevation averaged 3 degrees, the loss of external rotation with the arm at the side averaged 3 degrees, and the loss of external rotation with the arm elevated 90 degrees averaged 6 degrees.

Eleven patients (21 per cent) had instability in the postoperative period. Four of them had had a single traumatic reinjury during participation in a contact sport: two, while playing football, and one each, while playing rugby and hockey. Three of the injuries were dislocations, and one was a subluxation. After the reinjury, all four of these patients were managed initially with immobilization of the upper extremity in a sling. None of them needed an additional operation. The patient who had a traumatic resubluxation returned to participation in the contact sport five months after the reinjury. Two of the patients who had a traumatic redislocation modified their activities and had no instability associated with the activities of daily living. These patients declined an additional operation. Nonoperative management failed in the third patient who had traumatic redislocation, and an open anterior capsulorrhaphy was performed because he was unwilling to modify his activities.

Seven of the eleven patients had signs and symptoms of recurrent anterior instability that were not associated with a specific traumatic event. Four of these patients had a dislocation, and three had a subluxation. All seven of these patients had an open glenoid-based capsulorrhaphy. Neither of the two patients in whom a Bankart lesion had been created at the time of arthroscopic stabilization was in this group.

Seven of the eight patients who had a reoperation were found to have a completely healed Bankart lesion, which was well secured to the anterior aspect of the glenoid and did not allow for a probe to be inserted in the interface. The anterior-inferior aspect of the cap-

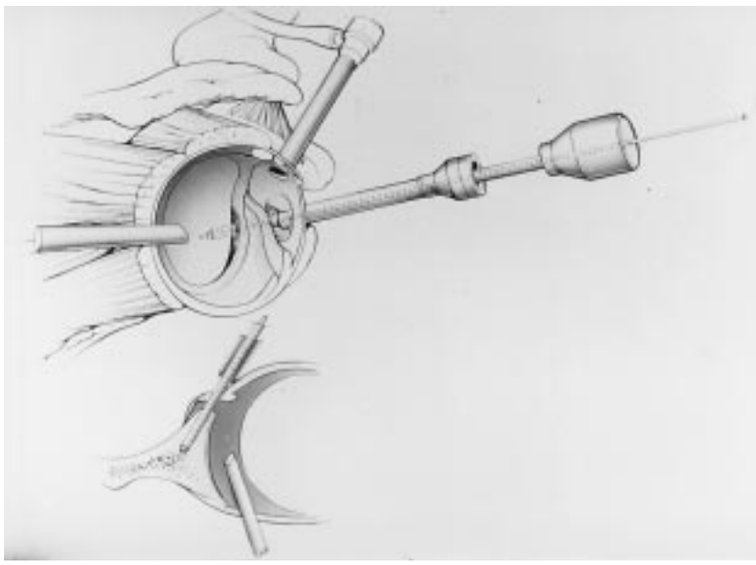

FIG. 2-A

Figs. 2-A, 2-B, and 2-C: Drawings depicting the arthroscopic procedure for anterior stabilization with a bioabsorbable tack. (Reprinted, with permission, from: Speer, K. P., and Warren, R. F.: Arthroscopic shoulder stabilization. A role for biodegradable materials. Clin. Orthop., 291: 71-72, 1993.)

Fig. 2-A: All instrumentation for the insertion of the tack is placed through a cannula in the inferior-anterior portal. A cannulated drill creates the bone tunnel, which is drilled both at the glenoid margin and obliquely away from the articular surface. A fine wire remains in the bone after the removal of the drill to guide the tack into proper position.

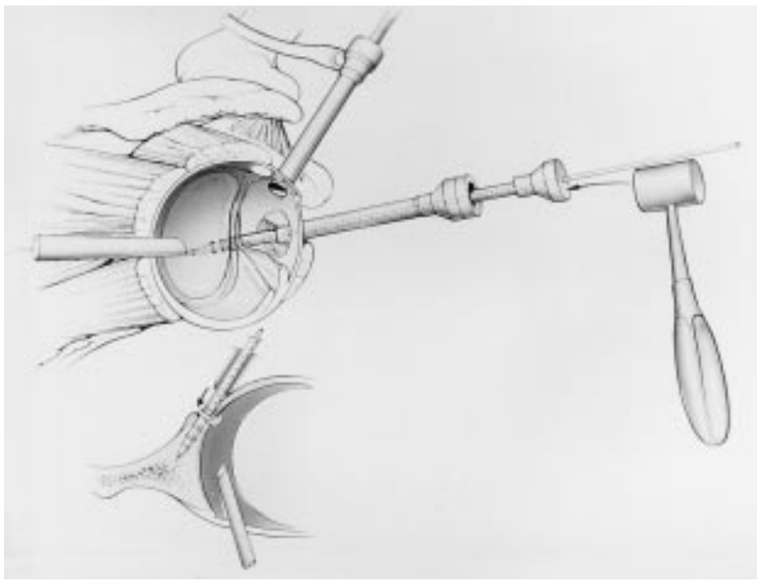

FIG. 2-B

The apposition of soft tissue to bone is confirmed by arthroscopic visualization. The upper extremity is generally in neutral rotation and full adduction during the insertion of the implant.

sule was patulous in each of these patients, and an open lesion of the rotator interval was seen in five. These seven patients had a laterally based capsular-shift procedure with closure of the interval. No tacks were found at the time of the operative procedure. In addition, there was no evidence of any reactive synovitis associated with the implant. In the eighth patient, we found evidence of technical failure of the arthroscopic stabilization procedure, as the Bankart lesion had not healed. There was no evidence of the tack or any visible abnormality where the tack had been applied. A medially based capsular-shift procedure with use of bone-suture anchors[4] was performed in this patient.

The influence of other variables on the outcome of

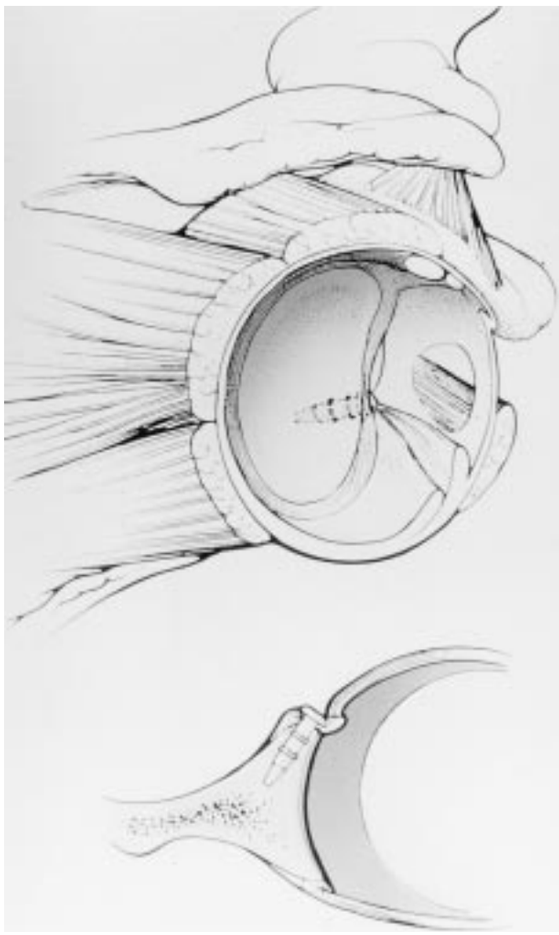

FIG. 2-C

The final construct must adequately re-establish the anterior portion of the inferior glenohumeral ligament.

the arthroscopic stabilization procedure was assessed. The average age, at the time of the operation, of the eleven patients who had a failed outcome was twenty-three years (range, sixteen to thirty-three years), which was not substantially different than the over-all average. The number of tacks that were inserted had no bearing on the occurrence of postoperative instability. Seven of the eleven procedures that had failed were in a dominant shoulder. All twenty-six patients who had been involved in a contact sport preoperatively attempted to return to participation postoperatively; four of them were among the eleven patients who had instability postoperatively. Therefore, the rate of recurrence for the patients who attempted to return to participation in a contact sport was 15 per cent (four of twenty-six shoulders). The finding of a Hill-Sachs lesion on the Stryker notch radiograph had no relationship with the clinical outcome.

Nine (25 per cent) of the thirty-six patients who had a history of dislocation preoperatively had postoperative instability. Six of these nine patients had a dislocation and three had a subluxation postoperatively. Four patients who had a dislocation and three who had a subluxation postoperatively had an open capsulorrhaphy.

Two of the thirteen patients who had a history of traumatic subluxation preoperatively had postoperative instability. One of the two patients had a postoperative subluxation and was managed non-operatively. The other had a postoperative dislocation and was managed with an open capsulorrhaphy. The only non-healed Bankart lesion found at reoperation was seen in this patient.

Discussion

The rate of recurrent instability after treatment with the arthroscopic technique in the present study (21 per cent) greatly exceeded the rates of recurrence of 0 to 5.5 per cent that have been reported for open capsulorrhaphy[1,6,11,14,15,18,22-24,29,30]. The wide discrepancy in the rates is a result of the fundamental technical differences between the two strategies of operative treatment. Reattachment of the detached anteroinferior portion of the labrum or capsule to the anterior aspect of the glenoid rim seems to be possible with both the open capsulorrhaphy and the arthroscopic technique. The difference between the procedures is that open capsulorrhaphy permits repair of the stretched anterior aspect of the capsule. In addition, the technique offers the potential advantage of reinforcement of the capsular repair by scar formation in the overlying subscapularis muscle[4].

The issue of the coexistence of capsular injury or plastic deformation with a Bankart lesion has been addressed in the literature[28]. In a study of normal cadaveric shoulders, it was shown that the Bankart lesion is not solely responsible for the amount of anterior translation that is necessary to produce an anterior glenohumeral dislocation[28]. This finding suggests that an additional factor such as the anterior aspect of the capsule could be responsible for persistent anterior glenohumeral instability[19]. Bankart himself noted that capsular injury oc-

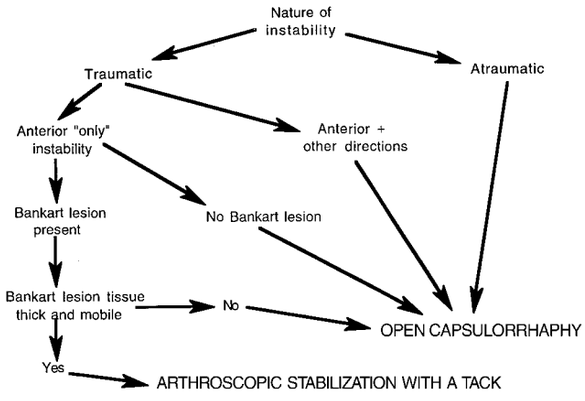

FIG. 3

Diagram showing variables that should be considered when selecting patients for arthroscopic stabilization with a bioabsorbable tack.

curs at the time of an anterior dislocation[6]. However, it was his impression that the injured capsule always maintained its original length on healing. Bigliani et al.[7] investigated the properties of the inferior glenohumeral ligament and found that a considerable degree of capsular stretching occurred before the ultimate failure of the ligament, regardless of where the failure occurred (although it is usually off the glenoid).

It is difficult to compare the results from the present study with those from other reports on arthroscopic techniques of anterior stabilization[3,5,8-10,12,13,21,31] because of variation among the indications, the techniques, and the implants that were used.

The indications that we currently use to select patients for arthroscopic stabilization with a bioabsorbable tack were influenced considerably by the results of the present study (Fig. 3). Specifically, the anterior instability should be the result of a traumatic injury and a thick mobile Bankart lesion should be present. Clearly, we underestimated the degree of over-all capsular laxity at the time of the initial arthroscopic procedure in the seven patients who had an atraumatic recurrence of instability. Thus, the degree of capsular laxity is central to the success or failure of arthroscopic stabilization with a tack and perhaps to all arthroscopic techniques for anterior stabilization. Arthroscopic stabilization with a tack is best suited for repair of traumatic detachment of the anterior aspect of the labrum. The procedure is not a substitute for an open capsulorrhaphy. Instead, it represents another operative option for properly selected patients who have recurrent anterior instability. If anatomical reattachment of a displaced Bankart lesion is all that is needed to restore stability to a shoulder, then use of this arthroscopic procedure should be successful. However, if an open capsulorrhaphy or a capsular shift-type procedure is necessary, then the arthroscopic procedure will fail in a high percentage of patients.

References

1. **Adams, J. C.:** Recurrent dislocation of the shoulder. *J. Bone and Joint Surg.*, 30-B(1): 26-38, 1948.
2. **Altchek, D. W.; Skyhar, M. J.;** and **Warren, R. F.:** Shoulder arthroscopy for shoulder instability. In *Instructional Course Lectures, The American Academy of Orthopaedic Surgeons.* Vol. 38, pp. 187-198. Park Ridge, Illinois, The American Academy of Orthopaedic Surgeons, 1989.
3. **Altchek, D. W.; Warren, R. F.;** and **Wickiewicz, T. L.:** Arthroscopic capsular shift: a retrospective analysis of 21 patients. *Arthroscopy*, 8: 411-412, 1992.
4. **Altchek, D. W.; Warren, R. F.; Skyhar, M. J.;** and **Ortiz, G.:** T-plasty modification of the Bankart procedure for multidirectional instability of the anterior and inferior types. *J. Bone and Joint Surg.*, 73-A: 105-112, Jan. 1991.
5. **Arciero, R. A.; Wheeler, J. H.; Ryan, J. B.;** and **McBride, J. T.:** Arthroscopic Bankart repair vs. nonoperative treatment for acute, initial anterior dislocation of the shoulder. *Orthop. Trans.*, 17: 488, 1993.
6. **Bankart, A. S. B.:** The pathology and treatment of recurrent dislocation of the shoulder-joint. *British J. Surg.*, 26: 23-29, 1938.
7. **Bigliani, L. U.; Pollock, R. G.; Soslowsky, L. J.; Flatow, E. L.; Pawluk, R. J.;** and **Mow, V. C.:** Tensile properties of the inferior glenohumeral ligament. *J. Orthop. Res.*, 10: 187-197, 1992.
8. **Cash, J. D.:** Recent advances and perspectives on arthroscopic stabilization of the shoulder. *Clin. Sports Med.*, 10: 871-886, 1991.
9. **Casperi, R.,** and **Savoie, F.:** Arthroscopic reconstruction of the shoulder; the Bankart repair. In *Operative Arthroscopy*, pp. 507-516. Edited by J. McGinty. New York, Raven Press, 1991.
10. **Detrisac, D.:** Arthroscopic staple capsulorrhaphy for traumatic anterior instability. In *Operative Arthroscopy*, pp. 517-528. Edited by J. McGinty. New York, Raven Press, 1991.
11. **Dickson, J. W.,** and **Devas, M. B.:** Bankart's operation for recurrent dislocation of the shoulder. *J. Bone and Joint Surg.*, 39-B(1): 114-119, 1957.
12. **Gross, R. M.:** Arthroscopic shoulder capsulorrhaphy: does it work? *Am. J. Sports Med.*, 17: 495-500, 1989.
13. **Hawkins, R. B.:** Arthroscopic stapling repair for shoulder instability: a retrospective study of 50 cases. *Arthroscopy*, 5: 122-128, 1989.
14. **Hovelius, L.; Thorling, J.;** and **Fredin, H.:** Recurrent anterior dislocation of the shoulder. Results after the Bankart and Putti-Platt operations. *J. Bone and Joint Surg.*, 61-A: 566-569, June 1979.
15. **Jobe, F. W.; Giangarra, C. E.; Kvitne, R. S.;** and **Glousman, R. E.:** Anterior capsulolabral reconstruction of the shoulder in athletes in overhand sports. *Am. J. Sports Med.*, 19: 428-434, 1991.
16. **Johnson, L. L.:** Shoulder arthroscopy. In *Arthroscopic Surgery: Principles and Practice*, p. 180. Edited by L. L. Johnson. St. Louis, C. V. Mosby, 1986.
17. **Morgan, C. D.,** and **Bodenstab, A. B.:** Arthroscopic Bankart suture repair: technique and early results. *Arthroscopy*, 3: 111-122, 1987.
18. **Neer, C. S., II; Fithian, T. E.; Hansen, P. E.; Ogawa, K.;** and **Brems, J. J.:** Reinforced cruciate repair for anterior dislocation of the shoulder. *Orthop. Trans.*, 9: 44-45, 1985.
19. **Reeves, B.:** Experiments on the tensile strength of the anterior capsular structures of the shoulder in man. *J. Bone and Joint Surg.*, 50-B(4): 858-865, 1968.
20. **Reider, B.,** and **Inglis, A. E.:** Brief note. The Bankart procedure modified by the use of Prolene pull-out sutures. *J. Bone and Joint Surg.*, 64-A: 628-629, April 1982.
21. **Resch, H.; Golser, K.;** and **Sperner, G.:** Die arthroskopische Labrumrefixation mit resorbierbaren Staples. *Arthroskopie*, 5: 89-95, 1992.
22. **Rowe, C. R.:** Prognosis in dislocations of the shoulder. *J. Bone and Joint Surg.*, 38-A: 957-977, Oct. 1956.
23. **Rowe, C. R.,** and **Zarins, B.:** Recurrent transient subluxation of the shoulder. *J. Bone and Joint Surg.*, 63-A: 863-872, July 1981.
24. **Rowe, C. R.; Patel, D.;** and **Southmayd, W. W.:** The Bankart procedure. A long-term end-result study. *J. Bone and Joint Surg.*, 60-A: 1-16, Jan. 1978.
25. **Skyhar, M. J.; Altchek, D. W.; Warren, R. F.; Wickiewicz, T. L.;** and **O'Brien, S. J.:** Shoulder arthroscopy with the patient in the beach-chair position. *Arthroscopy*, 4: 256-259, 1988.
26. **Small, N. C.:** Complications in arthroscopy: the knee and other joints. Committee on Complications of the Arthroscopy Association of

North America. *Arthroscopy,* 2: 253-258, 1986.
27. **Speer, K. P.,** and **Warren, R. F.:** Arthroscopic shoulder stabilization. A role for biodegradable materials. *Clin. Orthop.,* 291: 67-74, 1993.
28. **Speer, K. P.; Deng, X.; Borrero, S.; Torzilli, P. A.; Altchek, D. A.;** and **Warren, R. F.:** Biomechanical evaluation of a simulated Bankart lesion. *J. Bone and Joint Surg.,* 76-A: 1819-1826, Dec. 1994.
29. **Thomas, S. C.,** and **Matsen, F. A., III:** An approach to the repair of avulsion of the glenohumeral ligaments in the management of traumatic anterior glenohumeral instability. *J. Bone and Joint Surg.,* 71-A: 506-513, April 1989.
30. **Townley, C. O.:** The capsular mechanism in recurrent dislocation of the shoulder. *J. Bone and Joint Surg.,* 32-A: 370-380, April 1950.
31. **Warner, J. J. P.; Pagnani, M.; Warren, R. F.; Cavanaugh, J.;** and **Montgomery, W.:** Arthroscopic Bankart repair utilizing a cannulated absorbable fixation device. *Orthop. Trans.,* 15: 761-762, 1991.
32. **Zuckerman, J. D.,** and **Matsen, F. A., III:** Complications about the glenohumeral joint related to the use of screws and staples. *J. Bone and Joint Surg.,* 66-A: 175-180, Feb. 1984.