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Arthroscopic Shoulder Stabilization Using Transglenoid Sutures

A Four-Year Minimum Followup

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ABSTRACT

Thirty-seven of 41 consecutive patients with recurrent anterior instability of the shoulder were retrospectively observed for a mean of 5.6 years (range, 4 to 10) after an arthroscopic stabilization procedure had been performed. The operative technique involved the use of transglenoid sutures to repair the capsule and labrum. According to the criteria established by Rowe, 27 patients (74%) had good or excellent results, and 3 patients (7%) were graded as fair. Seven patients (19%) developed recurrent instability after the procedure and had failed results. Failure rates were equal in patients with a history of recurrent dislocation and those with recurrent subluxation. Absence of a Bankart lesion at operation was associated with postoperative instability ($P = 0.03$). The presence or size of humeral head defects did not influence the result. Eight of 12 athletes who engaged in sports requiring repetitive overhead shoulder motion returned to full activity, and none of the 12 developed instability after operation. Four of the 13 patients who participated in contact sports or recreational skiing developed postoperative instability ($P = 0.21$). All failures occurred within 2 years of the procedure.

Arthroscopic shoulder stabilization techniques have stimulated a great deal of interest in the orthopaedic community since the introduction of arthroscopic staple capsulorraphy in the early 1980s. However, few long-term studies of the results of arthroscopic shoulder stabilization have been reported.[9,26]

In 1983, the senior author (RFW) began using a method of arthroscopic stabilization for the treatment of recurrent anterior shoulder instability that was derived from the pull out suture techniques described for open Bankart repair by Luckey[15] and by Viek and Bell.[25] Stabilization under arthroscopic control had some potential advantages over open techniques including a reduction of perioperative pain and complications and an increased ability to perform surgery on an outpatient basis. In the succeeding years, the arthroscopic procedure was offered as an alternative to conventional methods of open stabilization.

We undertook a clinical review of the initial group of patients treated by the arthroscopic transglenoid suture technique at our institution to determine the long-term results of the procedure. These patients have now been observed for a minimum of 4 years after operation. The purpose of the study was threefold: 1) to determine the outcome of the procedure in terms of restoring stability, motion, and function to the shoulder; 2) to assess if these results diminished with longer followup; and 3) to analyze factors associated with failure of the procedure. To our knowledge, this study represents the longest followup of arthroscopic shoulder stabilizations to date.

MATERIALS AND METHODS

During the 6 years from 1983 to 1989, 41 consecutive patients were treated for shoulder instability with an arthroscopic technique using transglenoid sutures. Four patients were lost to followup, leaving 37 patients as the subjects of this retrospective review. The indication for operative stabilization was recurrent, posttraumatic, unidirectional anterior instability that interfered with daily living or athletic activity. Patient selection for the arthroscopic procedure depended on several factors.

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Patient Selection

Only patients who had recurrent, unidirectional anterior instability were considered for the arthroscopic procedure. The alternative treatment for these patients at our institution would have been an open Bankart repair. The arthroscopic method we describe is, in essence, a modification of the Bankart repair. In patients with atraumatic or multidirectional instability, an open T-plasty capsular shift procedure is used. Because the arthroscopic method offers a limited opportunity to shift the capsule, it was not offered to patients with atraumatic or multidirectional instability.

Determination of the clinical diagnosis was based on patient histories, radiographs, and physical examinations. Passive glenohumeral motion was measured with allowance for free scapulothoracic motion. Passive flexion and rotation motions of the humerus were assessed without stabilization of the scapula and were measured using a goniometer.

Anterior translation was routinely assessed during the office examination. With the arm held in 90° of scapular plane elevation and neutral rotation, the degree of translation was noted in anterior and posterior directions. Translation was graded as grade 1 if there was increased translation compared with the opposite shoulder but if subluxation or dislocation did not occur. If the head could be subluxated over the glenoid rim but then spontaneously reduced, translation was recorded as grade 2. Frank dislocation without spontaneous reduction constituted grade 3 translation. In all cases, the opposite shoulder was tested for comparison.

Inferior laxity was determined by measurement of the acromiohumeral sulcus.[1] Grading of the sulcus sign was based on the distance between the inferior margin of the lateral acromion and the humeral head when a downward traction force was applied to the adducted arm. Less than 1 cm of distance represented a grade 1 sulcus, 1 to 2 cm indicated a grade 2 sulcus, and more than 2 cm reflected a grade 3 sulcus sign. If greater than grade 1 posterior or inferior translation was found, the patient was treated with an open technique.

The anterior apprehension test was performed with the patient's arm abducted and externally rotated. The examiner progressively increased the degree of external rotation and noted the development of patient apprehension. The posterior apprehension test was performed with the arm internally rotated and forward flexed to 90°. Apprehension was noted as the humerus was loaded in an anteroposterior (AP) direction and progressively adducted across the chest.

All patients included in this series had grade 1 to 3 anterior translation and a positive anterior apprehension sign. Patients with greater than grade 1 posterior or inferior translation or with posterior or inferior apprehension were not considered for the arthroscopic procedure. Because we and others[22,23] have noted that patients with unidirectional anterior instability may also have minor increases in inferior translations, posterior translations, or both compared with the uninvolved side, grade 1 translation in the inferior, posterior, or posteroinferior direction was not considered a contraindication to the arthroscopic procedure.

Patients with a history of a specific traumatic event that led to the development of instability were considered for the arthroscopic procedure. In patients with an injury of atraumatic origin, an open technique was used. Some patients with "microtraumatic" anterior subluxation associated with repetitive use were included in this series. Voluntary instability was considered an absolute contraindication to an arthroscopic stabilization procedure.

All patients underwent preoperative radiography including AP, transscapular lateral, West Point, and Stryker notch projections of the glenohumeral joint. The presence of bony abnormalities of the posterolateral portion of the humeral head (the Hill-Sachs lesion) or of the anterior glenoid margin were noted and were used to corroborate the clinical impression. The presence (or size) of Hill-Sachs lesions was not used as a criterion in determining the suitability for an arthroscopic stabilization procedure. Patients with large defects of the anterior glenoid were treated with open techniques. Other imaging modalities were not used routinely in the evaluation of patients with shoulder instability during this period.

Before surgery, all patients underwent an examination under anesthesia by the senior surgeon for evidence of abnormal glenohumeral translation. During the study period, all procedures were performed with the patient under general anesthesia. Translation was graded in the same fashion described for the office examination in the awake patient.

In most cases, arthroscopic examination of the shoulder did not play a major role in determining the diagnosis. However, it was useful in corroborating the clinical diagnosis, and the findings of the arthroscopic examination were also used in the selection process. The presence of Bankart and Hill-Sachs lesions and other intraarticular lesions were recorded to support the clinical impression. Under arthroscopic visualization, AP forces were delivered manually to displace the humeral head; evidence of anterior subluxation or dislocation of the head over the anterior glenoid margin when an anterior force was delivered was considered positive for anterior instability. We have noted that the arthroscope was easily passed into the anteroinferior joint cavity without the normal restraint of the anteroinferior capsular tissues in patients who demonstrate anterior instability. This phenomenon is referred to as the "drive-through" sign.

Patients with mobile, detached Bankart lesions were more likely to be considered for the arthroscopic method. If the Bankart lesion was absent, open techniques were more likely to be employed. If the glenohumeral ligaments were perceived to be of poor quality (i.e., frayed, patulous, or poorly defined), an open procedure was performed. Determination of the quality of these tissues was made by grasping the anterior band of the inferior glenohumeral ligament or anteroinferior labrum and assessing its appearance as the humerus was externally rotated. If a robust structure was not evidenced by this maneuver or if

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the arthroscopic grasper could not hold the tissue, an arthroscopic technique was not used.

Finally, technical considerations excluded a few patients from this series. If the capsular tissue was thought to be too weak to hold the sutures or if insufficient mobilization of the inferior and middle glenohumeral ligaments was thought to have been obtained, the arthroscopic procedure was aborted and an open procedure was performed. Three cases were identified in which the arthroscopic technique was attempted but was converted to an open method. In the latter portion of the study period, a bioabsorbable tack became available for use as a tissue fixation device for arthroscopic shoulder stabilizations. As a result, four patients who would have been candidates for the transglenoid suture technique during the study period were treated with an alternative arthroscopic method instead. None of the patients treated with this alternative fixation method are included in this review.

Preoperative Clinical and Radiographic Findings

The patients' ages at the time of operation ranged from 15 to 45 years (mean, 24.6). Thirty-three of the patients were men, and four were women. Mean followup was 5.6 years (range, 4 to 10).

In 21 patients, the diagnosis was recurrent posttraumatic anterior dislocation of the shoulder. The remaining 16 patients had recurrent anterior subluxation of the shoulder. The patients had between 2 and 30 episodes of instability before the operation. All of the patients continued to have instability despite a program of nonoperative treatment that emphasized strengthening of the rotator cuff and scapular rotator musculature. None of the patients had undergone previous surgical procedures on the affected shoulder. Other than limited debridement and removal of loose bodies, no concomitant surgical procedures were performed at the time of the stabilizing procedure. The dominant arm was involved in 33 of the 37 patients.

The group included four athletes who participated in contact sports, two swimmers, seven throwing athletes (including one professional pitcher), three recreational racquet sport athletes, and a professional golfer. Eleven patients were recreational skiers. Two of the skiers were also participants in contact sports. Several athletes participated in more than one sport.

Hill-Sachs lesions were noted on radiographs in 15 of the 21 patients with recurrent dislocation and in 5 of the 16 patients with recurrent subluxation. Radiographic evidence of erosion or ectopic calcification of the anteroinferior glenoid margin was found in three of the patients with anterior dislocation and in nine of those with subluxation.

On the examination under anesthesia, 11 patients were found to have grade 3 anterior translation, 20 had grade 2 anterior translation, and 6 demonstrated grade 1 anterior translation. Five patients were noted to have 1+ posterior translation and 11 had grade 1 inferior translation.

Operative Technique

A standard arthroscopic examination was performed. The arthroscope was introduced through a posterior portal located 3 cm inferior and 1 cm medial to the posterolateral edge of the acromion. An anterior portal was placed lateral and superior to the coracoid process; this portal was used for instrumentation. An anterosuperior portal was also created to assist in mobilizing tissue. The anterior glenoid neck was carefully debrided to bleeding bone using a bone rasp or a motorized arthroscopic burr. An arthroscopic grasping instrument was used to advance the capsulolabral tissue in a superior direction.

A specially designed pin (Biomet, Warsaw, Indiana) with a drill point at one end and small holes at the blunt, opposite end was used to facilitate the procedure. The sharp end of the pin was used to spear a robust portion of the capsulolabral tissue, and the pin was placed on the glenoid neck. The pin was then drilled in a posterior direction at an angle approximately 45° medial to the sagittal plane of the anterior glenoid and 25° inferior to its transverse plane (Fig. 1). Special attention was given to the medial orientation of the pin. If the pin exits too far laterally, the suprascapular nerve is at risk for damage. The entry point of the pin was 2 to 3 mm medial to the edge of the glenoid articular surface. Drill guides were not used. The drill was initially set at a low speed to gain purchase on the glenoid neck. After purchase was obtained, the speed of the drill was increased to allow the pin to penetrate the bony glenoid. The pin was drilled through the posterior cortex of the glenoid and was recovered after exiting posteriorly from the skin overlying the infraspinatus fossa.

A 5-mm incision was made at the posterior exit point.

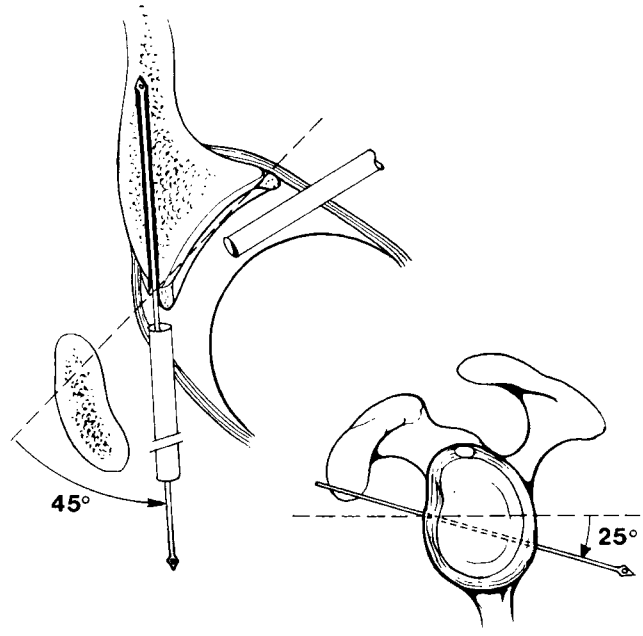

Figure 1. A pin was used to capture the displaced capsular and labral tissues and was drilled across the glenoid.

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The drill was detached from the tail of the pin, and two 0-gauge sutures were passed through the eyelet of the pin. One end of each suture was held anteriorly as the pin was advanced completely through to the posterior aspect of the shoulder (Fig. 2). The posterior halves of the sutures were tagged, and the anterior halves were brought out of an anterior portal.

The process was repeated such that at least one additional pair of sutures were placed at a more inferior site along the glenoid margin.

The anterior halves of the sutures were paired together so that each suture was coupled with a suture from the other drill hole. The sutures were then tied together anteriorly to form a loop (Fig. 3). Tension was applied to the posterior halves of the sutures to bring the capsulolabral structures into position on the glenoid neck. A subcutaneous tunnel was then created posteriorly from one group of sutures to the exit point of the other group. The posterior halves of the sutures were tied together in a subcutaneous location.

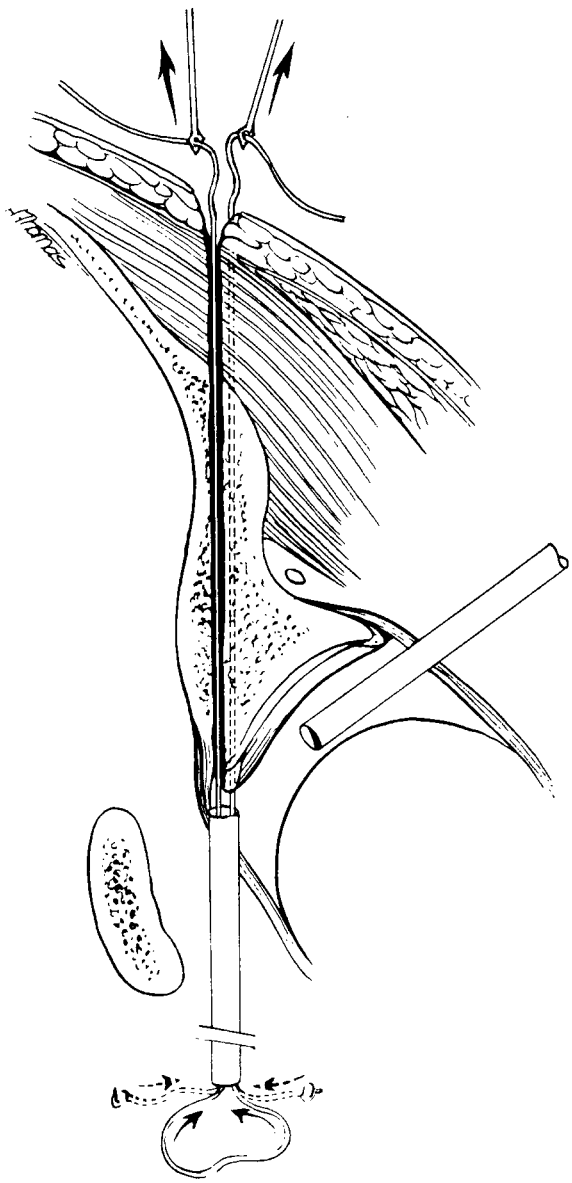

Figure 2. The pin was recovered as it exited through the skin at the posterior aspect of the shoulder. Sutures were then passed from anterior to posterior through the drill hole.

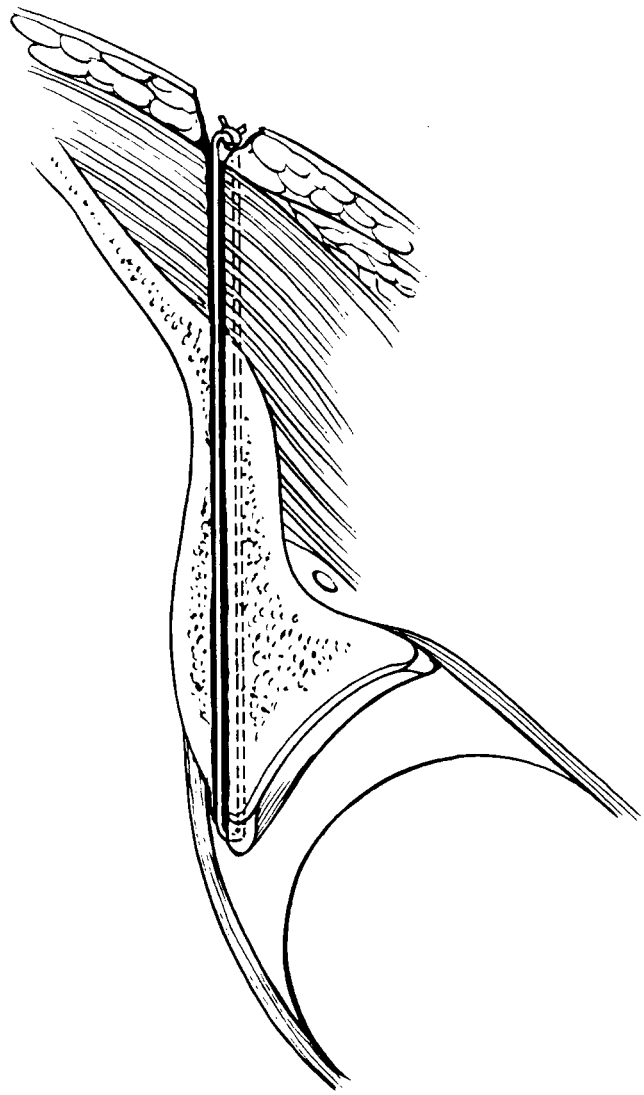

Figure 3. After the anterior halves of the sutures were tied together, tension was placed on the posterior halves to bring the damaged tissues into place on the glenoid neck. The posterior portions of the sutures were then tied over a fascial bridge.

After the procedure, the patients' shoulders were maintained in internal rotation in immobilizers for 4 weeks postoperatively. This period of immobilization was longer than that used for open repairs. Shoulder motion was initiated at 4 weeks using active-assisted and passive techniques. When approximately 160° of forward flexion was obtained, resistive exercises were instituted. At 4 months, patients were allowed to resume light throwing

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and underhand racquet sports. After 6 months, contact sports and unrestricted activity were permitted.

Operative Findings

Thirty-four of the 37 shoulders demonstrated Bankart lesions with detachment of the anteroinferior labrum and inferior glenohumeral ligament from the glenoid neck. Bankart lesions were found in 20 of the 21 patients with anterior dislocations and in 14 of the 16 patients with anterior subluxations.

The three shoulders that did not have Bankart lesions were thought to have mild redundancy of the axillary recess and evidence of slight anteroinferior capsular laxity. All patients treated in this series had positive drive-through signs before the stabilization procedure.

Hill-Sachs lesions were noted on the arthroscopic examination in 36 of the 37 patients. The lesions were somewhat arbitrarily graded according to their size. Five of the patients were found to have large lesions, 16 had moderate lesions, and 15 had small lesions. The lone patient without a Hill-Sachs lesion did demonstrate a Bankart lesion.

Three patients were noted to have partial-thickness rotator cuff tears that were debrided at the time of the stabilizing procedure. Two other patients had synovitis involving the tendon of the long head of the biceps brachii muscle. One patient had loose bodies that were removed. No other pathologic changes were noted.

The stabilization procedure was thought to be technically satisfactory in all of the patients at the time of surgery. Specifically, the Bankart lesion was satisfactorily repaired or the lax capsule was shifted to a satisfactory degree. The drive-through sign was noted to have been eliminated in each case after placement of the transglenoid sutures.

Data Collection and Followup

At a 4-year minimum followup, the patients were subjected to a complete shoulder examination that included the tests described in the preoperative evaluation. The patients completed a detailed questionnaire regarding the function and stability of the shoulder including the ability to perform daily tasks and athletic activities. Preoperative office notes and radiographs were reviewed. The results of the examination under anesthesia and details of the pathoanatomy were obtained from operative notes and from special forms completed at the time of operation by the attending surgeon. These forms were routinely used for all arthroscopic procedures on the shoulder to detail the pathoanatomy at the time of operation.

Four patients were lost to followup, leaving 37 patients as the subjects of this retrospective review. Each of the four missing patients had been doing well with no evidence of recurrent instability at 3 to 22 months after operation.

RESULTS

Rowe Shoulder Score

The shoulder rating system of Rowe et al.[22] was used to evaluate the clinical outcome of the procedure. This 100-point system dedicates 50 points for stability, 20 points for motion, and 30 points for function.

Twenty-two patients had excellent results (90 or more points), and five were rated as good (75 to 89 points). There were three fair results (51 to 74 points), and seven failures (50 points or less).

Stability

Seven of the 37 patients (19%) had at least one episode of instability after the operation. All of the recurrences occurred in male patients. Recurrent postoperative instability occurred in 4 of the 21 patients (19%) with a history of dislocation and in 3 of the 16 patients (19%) with a history of subluxation. Thus, the preoperative diagnosis did not predict the success or failure of the procedure (chi-square = 0.0005, $df = 1$, $P = 0.98$). Frank dislocations occurred in only two of the seven patients with postoperative instability. Both of these patients had recurrent dislocations preoperatively. The remaining five patients complained of one or more episodes of "slipping" in the shoulder, but none had complete dislocation.

Five of the 34 patients (15%) with Bankart lesions had postoperative instability. Two of the three patients (66%) who did not have demonstrable Bankart lesions had postoperative instability. Absence of a Bankart lesion was a statistically significant predictor of recurrent instability (chi-square = 4.9, $df = 1$, $P = 0.03$).

Recurrent instability occurred in 4 of the 20 patients with Hill-Sachs lesions seen on radiographs and in 3 of the 17 patients without radiographic evidence of a humeral head defect (chi-square = 0.03, $P = 0.86$). In reference to Hill-Sachs lesions seen at arthroscopic examination, instability recurred in 1 of the 5 patients who was thought to have a large lesion, 3 of the 16 who had moderate defects, and in 3 of the 15 who had small lesions (chi-square = 0.004, $P = 0.998$). Thus, the presence (or size) of the humeral head defect did not correlate with the postoperative result.

Based on the examination under anesthesia, 2 of the 11 patients with 3+ anterior translation, 4 of the 20 with 2+ anterior translation, and 1 of the 6 demonstrating 1+ anterior translation developed recurrent instability (chi-square = 0.09, $df = 2$, $P = 0.96$). Postoperative instability was noted in 1 of the 5 patients who were noted to have 1+ posterior translation (chi-square = 0.02, $P = 0.88$) and in 3 of the 11 with 1+ inferior translation (chi-square = 0.7, $P = 0.4$). The degree of translation on the examination under anesthesia did not predict postoperative recurrence.

Four of the initial 19 patients treated with this method developed recurrent instability, compared with 3 of the 18 patients treated in the latter part of the study ($P \cong 1$).

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Each of the three patients who did not have a demonstrable Bankart lesion were in the latter group of patients.

All recurrences developed within 2 years (8 to 22 months) of the procedure.

Analysis of Patients with Recurrent Instability

Two patients, both with preoperative diagnoses of recurrent subluxation, had postoperative recurrences in their sleep. Neither of these patients had demonstrated a Bankart lesion at the time of the arthroscopic procedure. In both cases, an attempt had been made to shift lax capsular tissue using the arthroscopic technique. These patients underwent reoperation with open stabilization. In both cases, the shifted capsular tissue had healed to the glenoid neck, but residual capsular laxity was noted. One of the two patients was doing well after open stabilization. The second patient continued to have instability, despite an attempt at open stabilization, and he refused further operative treatment.

A third patient with a history of recurrent subluxation continued to have one to two episodes of subluxation per year. These episodes were associated with overhead activity. The patient thought he was greatly improved compared with his preoperative status and that his instability was controlled with rehabilitation. He did not desire further surgical treatment.

The remaining four patients had postoperative recurrences associated with episodes of significant trauma. Each of these patients had a preoperative diagnosis of recurrent anterior dislocation. Three of the four traumatic events were associated with skiing; the fourth patient was injured in a lacrosse game. Each of these patients was noted to have a Bankart lesion at the time of the initial operation.

Two of the four patients with traumatic postoperative recurrences suffered frank dislocations. Both patients did well after reoperation with open stabilization. At the time of the open repair in one of these patients, a Bankart lesion was noted, indicating failure or disruption of the arthroscopic repair. In the other patient, the Bankart lesion appeared to have been satisfactorily repaired, but laxity of the anteroinferior capsule was encountered.

Two of the patients with preoperative histories of dislocation reported painful slippage of the shoulder without frank dislocation. One underwent open stabilization at another institution. The intraoperative findings in this patient were not well documented. He continued to have instability after the open procedure. The remaining patient reduced his activities and controlled his instability with rehabilitation. He expressed satisfaction with the procedure and reported overall improvement in function compared with his preoperative status.

In all, open stabilizations were performed in five of the seven patients with postoperative instability. The arthroscopic procedure appeared to be satisfactory from a technical standpoint in three of the four patients in whom this information was available. In one patient, failure of the repair was noted, although it was unclear if this failure was due to technical error or traumatic reinjury. Pathologic anteroinferior capsular laxity was thought to be present in three of the four patients. Two of these three patients did well after open stabilization with capsular shift. Interestingly, two of the five patients who underwent reoperation continued to have instability (subluxation), despite attempts at open stabilization.

Apprehension

Of the 30 patients who had no clinical symptoms of instability, one patient had apprehension in the anterior direction with abduction and external rotation of the arm. None of the other 29 patients in this group had positive apprehension tests.

In the group with postoperative instability, one of the two patients who did not undergo reoperation had a positive apprehension sign. The other patient did not. Apprehension was not assessed in the patients who had additional stabilization procedures.

Motion

Mean preoperative and postoperative ranges of passive glenohumeral motion were analyzed. Mean forward flexion decreased 2° after the operation. Mean scapular plane elevation was diminished by 3°. The mean loss of external rotation was 4° at both 0° and 90° of scapular plane elevation. Loss of internal rotation was less than one spinal segment on average.

Fifteen of the 30 patients who did not develop postoperative instability had no loss of glenohumeral motion. Internal-external rotational motions of the humerus were decreased in the remaining 15 patients. Twelve patients had losses of external rotation of less than 10°. Losses of external rotation in excess of 10° were noted in three patients (10%). In two of these three patients, these losses of external rotation were found at both 0° and 90° of abduction. In the other patient, external rotation was diminished only at 90° of abduction. Two patients lost one to two spinal segments of internal rotation. Both of these patients also demonstrated some loss of external rotation.

Of the seven patients who developed recurrent instability after surgery, five had subsequent open stabilization procedures. Motion was not assessed in these five patients. The remaining two patients had full motion.

Pain

Two of the 30 patients who did not develop postoperative instability reported moderate pain with vigorous overhead activity. Seven others reported mild exertional pain. The remaining patients did not have pain with any activity. No patient had pain with activities of daily living.

Four of the seven patients with postoperative instability reported pain. In two of these patients, the pain was mild and associated with activity. The other two patients reported moderate pain with activities of daily life.

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Return to Athletic Activity

Three of the four contact athletes returned to their sports without difficulty. Each of these three was a football player. One patient, a lacrosse player, was forced to give up his sport because of recurrent instability. Three of the 11 recreational skiers developed postoperative instability. In total, 4 of the 13 individuals involved in contact sports or recreational skiing developed postoperative recurrence ($P = 0.21$). (Two patients participated in both types of activities.)

Twelve athletes who used their shoulders in the overhead position were included in this series; none developed postoperative instability. Two swimmers returned to full activity. Three racquet sport athletes returned to their sports, although one of the three had to compete at a lower level. Of the seven throwing athletes, four returned to their preinjury levels of function. Two throwing athletes, including the professional pitcher, were able to return to throwing at a decreased level. One patient could not throw because of pain associated with overhead activity.

Complications

One patient developed a synovial cyst that extended posteriorly from the glenoid drill holes along the path of the sutures.[17] This patient required reoperation for excision of the cyst. Nonabsorbable sutures were used in this case.

None of the 37 patients had evidence of suprascapular nerve injury. There were no infections.

DISCUSSION

Most reports on the clinical results of arthroscopic shoulder stabilization have suffered from a lack of long-term followup.[2,5–8,10,11,14,16,17,19,21,26,28,30,31] The group in this study was observed for a minimum of 4 years after arthroscopic stabilization. To our knowledge, this represents the longest duration of followup on arthroscopic shoulder stabilization that has been reported to date.

The Rowe shoulder scoring system results in severe reductions for any evidence of postoperative instability. As a result, all patients who had instability symptoms were considered to have failed results. We attempted to assess function as well as stability after the procedure. When both factors were considered, 74% of the patients were found to have good or excellent results. Although our results are disappointing, they appear to be somewhat better than two other recently published studies with relatively long followups. Grana et al.[9] reported that only 55% of their 27 patients had good or excellent results at a 3-year average followup after arthroscopic Bankart suture repair. Walch et al.,[26] at a 4-year average followup after arthroscopic suture stabilizations, found good or excellent results in only 42% of their 59 patients.

Because of the less invasive nature of the arthroscopic technique, we were concerned that a less exuberant fibroblastic response compared with open techniques could result in late recurrences that would be noted as the time of followup increased. In this series, however, all recurrences were evident by 2 years after the operation; the followup was as long as 10 years in some patients.

Our long-term recurrence rate of 19% is similar to the short-term rates reported for procedures done in the same time period. Several of these early studies revealed recurrence rates of between 15% and 20%.[5,11,29]

After an arthroscopic stabilization procedure, consistently poor outcomes in terms of postoperative instability have been noted in patients with capsular laxity, absence of a Bankart lesion, or poorly defined glenohumeral ligaments, and in patients involved in contact sports.[6,8,9,26,28] Two of the failures in this series occurred in patients who did not have Bankart lesions on arthroscopic examination. An arthroscopic shift of the anterior capsule was attempted in these patients. In the three patients without Bankart lesions in this series, external rotation of the humerus demonstrated a well-developed inferior glenohumeral ligament. Despite the presence of this finding, the drive-through sign was positive, and the axillary recess appeared to be enlarged. These patients were treated arthroscopically because the degree of capsular laxity was thought to be mild and a limited amount of mobilization was possible. At the present, we would not attempt an arthroscopic stabilization in patients who do not demonstrate a Bankart lesion. An open capsular repair would be performed instead.

Even in patients with Bankart lesions, our recurrence rate of 15% is unacceptably high. It remains to be determined if recurrence can be diminished with improved patient selection and newer techniques of arthroscopic stabilization.

We attempted to eliminate all patients with clinical evidence of multidirectional instability from treatment with this method. Although it has not been conclusively documented in the literature, we believe that patients with larger increases in inferior or posterior translation would fare poorly with an arthroscopic procedure. We excluded patients with more than grade 1 posterior or inferior translation from the arthroscopic method, even if they had no clinical symptoms associated with translation in these directions.

Although we did not find a statistically significant increase in the recurrence rate in patients with mildly increased degrees of glenohumeral translation as judged on the examination under anesthesia, we believe the findings at reoperation for our failures indicate that capsular laxity may occur without clinical evidence of global instability. Recent biomechanical studies have indicated that capsular deformation accompanies detachment of the anteroinferior capsule and labrum.[3,24] Repair of the Bankart lesion alone may be insufficient to restore stability to the shoulder. Unfortunately, identification of patients with extensive capsular deformation is difficult. Neither our clinical nor our arthroscopic impressions of laxity appeared to be completely accurate. We now believe that our clinical examinations for laxity may have been incomplete. In particular, inferior translation should be assessed with varying degrees of shoulder elevation. The inferior capsular structures appear to gain in importance with increasing elevation of the shoulder.[4,20,27] During

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this study, we tended to assess inferior translation only with the arm at the side. We currently stress the shoulder in multiple positions of scapular plane elevation to detect abnormal capsular laxity. If there is even a mild increase in posterior or inferior laxity in any position compared with the contralateral shoulder, an open technique is used.

We found no overall differences in postoperative recurrence rates when patients with a history of dislocation were compared with those with a history of subluxation. These results are contrary to those found by Coughlin et al.,[7] who noted an increased recurrence rate after arthroscopic metal staple capsulorraphy in patients with a preoperative diagnosis of subluxation. Some surgeons believe that an arthroscopic method should not be used in the presence of a large Hill-Sachs lesion. The presence of a Hill-Sachs lesion on radiographs (or its size as demonstrated arthroscopically) did not appear to influence the result in our patients.

Morgan[19] has reported a recurrence rate of only 5% after 1 to 7 years of followup in a group of 175 patients who had undergone an anterior stabilization using a slightly modified transglenoid suture technique. Morgan[19] and Grana et al.[9] state that athletes who are involved in contact sports are poor candidates for arthroscopic stabilization procedures. In this series, one of the four athletes who participated in contact sports developed instability after the operation. Three cases of failure (including both cases of postoperative dislocation) were related to recreational skiing injuries. In this series, participation in contact sports or skiing did not significantly influence the rate of recurrence.

Because of reports suggesting an increase in postoperative recurrence with shorter periods of immobilization,[11] we believe that patients who undergo arthroscopic stabilization should be subjected to a longer period of postoperative immobilization than those treated with open techniques. Although this may be considered a disadvantage in terms of the initiation of therapy, we have noted no untoward effects in regaining motion. Rowe et al.[22] reported that 69% of their 161 patients treated with an open Bankart procedure regained full motion in the postoperative period. In our series, no or only minimal losses of motion were noted in 90% of the patients. Similarly, Morgan[19] reported recovery of full range of motion in 87% of the 175 patients he treated with an arthroscopic method.

Seventy-five percent of the athletes who participated in sports requiring repetitive overhead activity were able to return to their preinjury levels of activity for at least one season. Few of these athletes were of elite caliber. Maintenance of motion may be a relative advantage of the arthroscopic method in overhead athletes who require such motion to return to full athletic activity. However, Jobe et al.[13] have recently reported a high degree of success in the treatment of anterior instability in elite overhead athletes using a modified open technique. Despite the restoration of stability to the shoulder, some overhead athletes will have difficulty returning to their sports after a stabilization procedure.

In this series, an unusual complication occurred; a synovial cyst developed along the path of the nonabsorbable sutures.[18] As a result, absorbable sutures were used in all subsequent cases. Deformation of these sutures due to excessive loads as the shoulder is moved could be related to subsequent failure if such deformation occurs before soft-tissue attachment.

We found it surprising that two of the five patients who underwent reoperation with open stabilization continued to have instability after the open procedure. This finding may indicate a diagnostic error, but in both cases the characteristic signs and symptoms of anterior instability were present. Relatively high postoperative recurrence rates have been noted after reoperation for failed open stabilizations.[12,23] Loss of tissue planes and scarring of the capsule and subscapularis tendons have been associated with failure after a reoperation for a failed open stabilization. However, we did not note any deleterious effect on the anterior capsular structures or the subscapularis tendons in the four patients who were treated with an open revision procedure at our institution.

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