Orthopedic Surgery in Korea

**ARTHROSCOPIC CAPSULAR SUTURE FOR ANTERIOR INSTABILITY OF THE SHOULDER**

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**ABSTRACT**

We assessed the results of arthroscopic transglenoid capsular suture in eight recurrent traumatic unidirectional anterior dislocations. At an average follow up of 11 months, ranging from eight to 18 months, assessment by Rowe's scoring system were excellent or good in all shoulders. There were no redislocations and all patients achieved near full, painless range of motion. There were no complications. We propose a new classification of anterior capsular lesions (Bankart lesion) and we describe the details of the arthroscopic suture technique. We conclude that arthroscopic suture is an effective method with low surgical morbidity and low cost in the treatment of recurrent anterior dislocation of the shoulder.

The shoulder is a highly mobile and complex joint. The minimally constrained shallow ball and socket design of the glenohumeral articulation is responsible for wide shoulder motion but provides little inherent stability. Most of the stability is provided by static soft tissue structures and dynamic muscular restraints. The static stabilizers consist of the joint capsule and its continuous thickening known as glenohumeral ligaments. These structures are attached firmly to the glenoid rim via the glenoid labrum. The labral lesions which result in disruption of these firm attachments are believed to be a major cause of shoulder instability. Bankart described this disruption as the essential lesion of recurrent anterior shoulder dislocation.

Turkel et al. described that the primary anatomic restraints to anterior dislocation vary with the position of the shoulder in abduction and, at 90° of abduction, the inferior glenohumeral ligament and anterior glenoid labrum together prevent dislocation. Galinat and Howell also suggested that the presence of a Bankart lesion renders the inferior glenohumeral ligament nonfunctional at 90° of abduction and also decreases the total concavity of the glenoid fossa anteriorly by 50%. The presence of the Bankart lesion has been reported in an extremely high percentage of traumatic unidirectional anterior recurrent shoulder dislocation. According to the concept of Turkel and Galinat and Howell, surgical repair of the Bankart lesion is the only method to resolve the instability.

Several methods including open Bankart repair, arthroscopic capsular fixation using metal devices—staple, screw and metallic pull-out wire, have been reported. Arthroscopic metallic stapling popularized by Johnson has been shown to cut the anterior capsular structures and staple migration, leading to recurrence.

The purpose of this paper is to report our results of arthroscopic suture in reattaching the Bankart lesion to the anterior glenoid rim and scapular neck in the recurrent traumatic unidirectional anterior dislocation of shoulder.

Bankart repair using this suture technique was used with patients who had traumatic...
unidirectional anterior shoulder instability, and who had a Bankart lesion with good capsular tissue for repair.

Advantages of this technique are an anatomic repair with the potential for capsular advancement with no open arthrotomy and no use of metal implants. Therefore, this is a technique with low cost and low surgical morbidity.

MATERIALS AND METHODS

Patients from January 1989 to August 1990, arthroscopic Bankart suture was performed on 10 shoulders with recurrent traumatic unidirectional anterior dislocation.

We excluded two cases with shorter follow-up less than 8 months. There were no history of atraumatic voluntary dislocations, and also there were no signs of psychiatric disorder and excessive joint laxity.

The mean age of the patient at operation was 31 (range: 18 to 60). Seven were male and one was female. The right shoulder was involved in six and left shoulder was involved in two. The dominant extremity was involved in six cases (Table).

All patients had a history of acute trauma in initial dislocation of the shoulder and three of the eight patients were able to reduce the recurrent dislocation by themselves.

Preoperatively, all patients had a full range of shoulder motion, with tenderness to deep pressure along the anterior glenoid region, and forced maximum external rotation with the arm held along the body elicited fear of instability. In all patients, we employed various methods of stress test, ie, drawer test, sulcus test, fulcrum test, jerk test and push-pull test, etc.

All patients were evaluated with routine AP and axillary radiographs and various special techniques including West Point view, Hermoddson’s view, Stryker-notch view, and apical oblique view. The arthrography and CT scan on the shoulder joint were taken in two patients.

Postoperatively, the patients were followed for a minimum of 8 months and a maximum of 18 months.

Each patient’s subjective opinion about the operation was graded arbitrarily as excellent, good, fair, or poor.

The objective results were graded according to the rating scale described by Rowe et al. In this scoring system, 50 points are given for stability: 30 for function, and 20 for motion. The result was graded as excellent (100 to 90 points), good (89 to 75 points), fair (74 to 51 points), or poor (50 points or less). The range of motion of the shoulder was calculated as a percentage of that of the normal (contralateral) side.

These subjective and objective evaluations were made for all patients at the time of the last follow-up.

After confirming that the instability pattern was anterior under general anesthesia, we proceeded with placing the patient into the lateral decubitus position. Also, we suspended the shoulder in a 60° abduction in a full internal rotation and a 15° flexion with skin traction on forearm by 16 to 18 pounds (Fig 1).

Standard arthroscopic portals for diagnostic arthroscopy were established (Fig 2). The arthroscope was placed in the posterior portal for visualization. A superior portal was established for saline inflow to maintain joint distension. An anterior surgical portal was established by retrograde fashion superior to the subscapularis tendon and inferior to the long head of biceps tendon under arthroscopy and was located anterior and lateral to the coracoid process. The Bankart lesion was identified anteriorly and was probed to assess its shape and degree.

The initial step was debridement of the Bank-
Fig 1: Posterior view of a patient in the left lateral decubitus position with the right shoulder suspended in abduction, internal rotation and flexion.

Fig 2: The portals of entry. A cannula is placed at the anterior surgical portal, and the superior portal is established for inflow of saline and then the arthroscope is placed in the posterior portal.

Fig 3A: A powered shaving device is seen decorticating the scapular neck and debriding the devitalized tissue.

Fig 3B: Bleeding is visible at the anterior glenoid rim and the scapular neck after decortication.

Our modified Beeth pin is a tapered sharp drill tip similar to the end of the spear and has an eye similar to the harpoon (Fig 5).

Through the anterior cannula, we inserted the pin and punctured and lifted up the labrum or ligament. Suture pins were then drilled through the scapular neck to exit in the infraspinatus fossa.

Generally, an O-PDS (monofilament absorbable suture) suture has been used, but other suture material may be used. We generally aimed the pins approximately 15° to 20° inferiorly and medially on the scapular neck from its midpoint of the anterior surface. The location of the second pin was chosen 1.5 cm cephalad to the first pin anteriorly on the scapular neck. We have not found the use of drill guides to be necessary.

After passing at least two pins with sutures through the scapular neck, the sutures were knotted anteriorly with multiple ties. These sutures were then drawn posteriorly back...
Fig 4: The suture material is placed in the detached labrum.

Fig 5: The modified Beeth pin. We grinded the tip of the drill bit in the shape of a harpoon (A). We spear labrum or ligament, advanced, pulled up, and drilled through the scapular neck directly (B).

through the scapular neck to secure the capsule against the bone of the anterior scapular neck with these knots of sutures.

In cases using the suture punch, all sutures punched with the suture were divided into two groups. The suture passers were passed through the cannula anteriorly and through the previously drilled holes in the scapular neck. All of the suture ends were fed through the eye of suture passers, and the suture passers were drawn posteriorly back through the scapular neck into the infraspinatus fossa.

After securing the capsule with anterior knots or sutures, the posteriorly drawn sutures were tied on the infraspinatus fascia. These sutures should be tied subcutaneously with the arm adducted, internally rotated, and with release of traction on the forearm. Although only two sutures were illustrated in Figure 4, more sutures could be easily used in a similar fashion. The anterior sutures were then cut either subcutaneously or intraarticularly after all posterior knots had been tied.

Arthroscopic inspection should reveal firm coaptation of the glenoid labrum to the glenoid rim with reconstitution of competency of the anterior inferior glenohumeral ligament. The shoulder is irrigated thoroughly with saline and drained.

Postoperatively, the shoulder was maintained in an internal rotation position with an immobilizer for a full 4 weeks. We used an immobilizer that allowed elbow flexion and extension exercise without changing the position of the humerus. At 6 weeks after the operation, the immobilizer was removed and range of motion exercises were begun. After the complete range of motion was established with active assistive and passive exercise, resistant exercises for deltoid and rotator cuff were initiated. At 4 months after the operation, motion was usually complete and strength was sufficient to allow return to light throwing or racket sports. Contact sports and unrestricted activity began at 6 months after the operation.

RESULTS

Preoperative Findings. All patients had a traumatic event when the initial dislocation had occurred and had a history of multiple recurrences. By the physical examinations, all patients were positive in the apprehension test and various stress tests.

On plain roentgenograms, three shoulders revealed Hill-Sachs lesion on the humeral head and one revealed fracture on the anterior glenoid rim, two revealed subluxation of the shoulder joint by stress test. A Large Hill-Sachs’s lesion on the humeral head was visible at CT scan but negative on arthrography (Fig 6).

Arthroscopic Findings. All affected shoulders had various degrees and various shapes of Bankart lesion. Of the eight humeral heads, six had medium or large sized Hill-Sachs’s lesions and two had small sized lesions. Two cases had posterior labral tear, but there was neither rotator cuff tear nor lesion of the biceps tendon.

We found four different types of Bankart lesion even in these small series of patients. We could classify the anterior capsular lesion into type I (four cases), separation of labrum and inferior glenohumeral ligament from the glenoid rim and scapular neck, that is a typical Bankart lesion; type II (two cases), separation of labrum with glenoid rim fracture; type III (one case), whole separation of labrum to superior pole of the glenoid including long head of biceps tendon; type IV (one case), deficient labrum with detached loose inferior glenohumeral ligament from scapular neck (Fig 7).
Fig 6A: The CT film reveals a large bone defect on the humeral head at the posterolateral area.

Fig 6B. The plain radiograph of the West Point view reveals a bony fragment at the anterior glenoid rim.

Fig 7. Four different types of Bankart lesion. Type I is a separation of the labrum and inferior glenohumeral ligament from the glenoid rim and neck (typical Bankart lesion) (A). Type II is a separation of the labrum with a glenoid rim fracture (B). Type III is a whole separation of the anterior glenoid labrum to the superior pole of the glenoid including the long head of biceps tendon (C). Type IV is deficient anterior labrum with detached loose inferior glenohumeral ligament (D).

Postoperative Results. The patients rated their results as excellent in six shoulders and good in two. All but one patient resolved the preoperative apprehension sign, and all returned to their preoperative occupation.

The 60-year-old laundryman, who had had a large Hill-Sachs’s lesion at operation, was afraid to resume ironing postoperatively, but there was no redislocation during follow-up of 1½ years.

Objective Assessment. Six shoulders were objectively rated as excellent; two as good. All shoulders were clinically stable and had a full, pain-free range of abduction, flexion, and internal rotation. Six shoulders had normal external rotation and two had 85% and 87% of external rotation respectively (normal range, 0° to 80° with the arm abducted) (Table).

Postoperative follow-up radiographs showed no evidence of pathologic findings, ie, subluxation or osteoarthritic changes. At last follow-up, the mean score by Rowe et al

Fig 7A.

Fig 7B.

Fig 7C.
was 90.5, so the results were excellent.

**DISCUSSION**

In the management of recurrent glenohumeral instability, perhaps the greatest challenge is to be sure of what condition is being treated. At the risk of oversimplifying, most authors have found it useful to recognize that most patients with recurrent instability fall into one of two large groups. The first is characterized by a history of definite trauma initiating a problem of unidirectional shoulder instability. These shoulders usually have definite structural damage. When the direction of traumatic instability is anterior, the shoulders commonly have ruptures of the glenohumeral ligaments at their glenoid attachments, referred to as Bankart (Perthes') lesions. These shoulders frequently require surgery to achieve stability. The second group of patients have no history of significant trauma; thus instability is atraumatic and these patients are much more prone to be multidirectional and bilateral. In this type, rehabilitation, especially rotator cuff strengthening and coordination exercises, is the first line of treatment. If surgery is performed, laxity of the inferior capsule must be managed with an inferior capsular shift.6

Many investigators have discussed the shoulder joint constraints, which consist of static and dynamic elements. The static contribution may be further subdivided into articular and capsular ligamentous components. Early investigators focused on one element or the other. Hence, Saha emphasized the articular component of shoulder stability.7,8 Moseley and Overgaard9 and Townley10 focused on the capsular ligamentous complex, and others emphasized the dynamic contribution of the interrelationship between the dynamic and the static capsular ligamentous constraints.11-13

The inferior glenohumeral ligament is considered important to anterior shoulder stability. The origin of the ligament is found to consist of almost the entire anterior glenoid labrum. It then courses laterally and inferiorly to insert on the inferior margin of the humeral articular surface.

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Fig 7D.

Fig 8A.

Fig 8B.

Fig 8C.

Fig 8: Various sizes of Hill-Sach's lesion.
and then down and around the anatomical neck of the humerus. This anatomical arrangement is consistent with the emerging data suggesting the central role and function of this ligament in anterior and inferior glenohumeral instability.\textsuperscript{14} The clinical significance of a detached labrum leading to recurrent anterior dislocation is explained in view of the fact that this lesion leads to an incompetent inferior glenohumeral ligament complex.\textsuperscript{15}

Dynamic shoulder stability during activity occurs by the action of the shoulder musculature. Of the 26 muscles controlling the shoulder girdle, only the four components of the rotator cuff are thought to play a significant role in the dynamic stability of this joint.\textsuperscript{16} The contribution of the cuff muscles to joint stability may be due to: passive muscle tension from the bulk effect of the muscle itself\textsuperscript{17,18}, contraction causing compression of the articular surface; joint motion that secondarily tightens the passive ligamentous constraints; and the barrier effect of the contracted muscle.

The presence of a “Bankart lesion,” defined as a separation of the inferior glenohumeral ligament–anterior labral complex from the anterior glenoid rim and scapular neck, has been reported in an extremely high percentage of traumatic anterior recurrent shoulder dislocators treated operatively. Rowe et al reported its presence in 90% of such cases treated primarily\textsuperscript{5} and in 84% of cases at reoperation\textsuperscript{19} for failed initial surgical repair. Based on the collective work of Turkel, Galinat and Howell, and Rowe and colleagues, it appears logical that the presence of a Bankart lesion renders the inferior glenohumeral ligament nonfunctional at cavity of the glenoid fossa anteriorly by 50% due to loss of fixation of the anterior glenoid labrum to the anterior glenoid rim.\textsuperscript{2,3,5,19} In this setting, surgical repair of the Bankart lesion, when it is the only pathology, should be all that is required to resolve the instability. This concept clearly accounts for the widely accepted success of the Bankart procedure.\textsuperscript{5,19}

Although the efficacy of the open Bankart repair is widely accepted, its technical difficulty has limited its popularity.\textsuperscript{20} Technical problems related to exposure and creation of the anterior glenoid drill holes for capsular fixation have led to alternative methods of capsular fixation using metal devices: screws, plates, staples, and even metallic pull-out wires that protrude through the skin both anteriorly and posteriorly.\textsuperscript{21–25} Inherent in the use of these metal devices are the well-known complications of breakage, loosening, migration, and improper placement, resulting in pain and arthrosis.\textsuperscript{4,26} Furthermore, metallic staples have been shown to cut the anterior capsular structures, leading to recurrent instability.\textsuperscript{4,26}

In 1982, Reider and Inglis reported excellent results in 29 cases using an open modified Bankart-type of anterior capsular fixation in which Prolene pull-out sutures tied posteriorly over buttons were placed through small transglenoid drill holes.\textsuperscript{24} More recently, Morgan and Bodenstab\textsuperscript{12} published their good results of arthroscopic suture of the Bankart lesion in
The procedure described in this article was developed in an attempt to secure arthroscopically the anterior capsular structures of a Bankart lesion anatomically back to the glenoid rim and scapular neck without use of internal metallic fixation devices, thus obviating the known complications inherent in their use. The clinical results of this series to date appear to have achieved this goal. Although the results of this procedure with regard to postoperative stability are very encouraging, we can't compare this with standard open anterior procedures due to the short follow up. What is valid is that all these shoulders gained full, painless range of motion, particularly external rotation. This represents a significant advantage over most standard open anterior procedures that result in some loss of external rotation. If the long-term results of this procedure compare favorably with standard open surgery, then and only then will this procedure be more efficacious due to better postoperative shoulder motion and the advantages of less surgical morbidity, lower cost, and less postoperative pain inherent in an arthroscopic surgery.

REFERENCES