

ARTHROSCOPIC TREATMENT OF THE ACUTE AND CHRONIC ANTERIOR INSTABILITY OF THE SHOULDER-EARLY RESULTS

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SUMMARY

We are presenting the early results of the arthroscopic treatment of the anterior-inferior acute and chronic traumatic instability of the shoulder in a population of young, male patients. In this study 32 patients with symptomatic instability were included. Arthroscopic reattachment of the capsule and the labrum has been performed with 3-5 bone anchors. The follow up ranged between 4 and 15 months (mean 9 months). No recurrence has been noted. In all patients the apprehension sign disappeared. Four patients exhibited loss of external rotation less than 10°. One patient complained of mild pain with intense activity. One patient developed impingement syndrome and was treated conservatively with modification of the physiotherapeutic program with success. Intraoperative rupture of sutures occurred in the first cases. No infection or neurapraxia occurred. Stiffness more than 4 months was noted in 3 patients and was treated with physiotherapy. All patients displayed shoulder flexion more than 180° and internal rotation to the level of T6(T4-T12), similar to the normal shoulder. The loss of external rotation with the arm at the side was 5° and with the arm in abduction 7°. The functional result has been evaluated with the Rowe and Zarins scale. Twenty-five of the patients achieved an excellent result (score 90-100), five very good (score 70-89) and only two satisfactory result (score 69). The arthroscopic reconstruction of anterior traumatic instability is a very promising technique providing excellent results.

Keywords: arthroscopy, Bankart repair, instability, shoulder

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INTRODUCTION

Recurrent shoulder dislocation is a condition that frequently occurs in young patients, is the cause of significant morbidity and compromises the shoulder function, especially when occurs in the dominant shoulder of athletic persons [Tsai et al 1988]. The direction of the instability in 95% of the cases anterior [Goss 1988]. Surgical treatment is indicated when conservative treatment has failed. In young patients, under 25 years, the rate of recurrence ranges between 60% and 94% [Marans et al 1992, Zarins et al 1993, Arciero et al 1994]. More than 250 operations have been described for the treatment of the several types of shoulder instability. The surgical reconstruction after Bankart, as described by Rowe, has 95% success rate, when the principal outcome measure is the recurrence rate and is considered to be the gold standard [Rowe et al 1978, Rockwood 1988]. The first arthroscopic instability reconstruction was performed by L. Johnson in 1982. Arthroscopic techniques have been developed during the last 15 years, but the recurrence rate in the initially reported clinical series was generally higher compared to the open reconstruction and ranged between 10% and 20% [Laurencin et al 1996, Pagnani et al 1996, Speer et al 1996, Roberts et al 1999]. During the last years better understanding of the pathology of acute and chronic shoulder instability and improvement of arthroscopic techniques and devices resulted in significant improvement of the arthroscopic reconstruction procedures [Bacilla et al 1997, Jorgensen et al 1999, Cole et al 2000, Gartsman et al 2000].

The purpose of this study is to report the results of arthroscopic shoulder stabilization in patients with traumatic anterior shoulder instability.

PATIENTS - METHODS

Between September 1999 and August 2000 42 patients with acute and chronic shoulder instability underwent surgical stabilization. The number of dislocations or subluxations ranged between 1 and 20 (mean 8.7). Thirty-two patients underwent arthroscopic and the rest of them open reconstruction due to technical difficulties or due to the bad condition of the capsuloligamentous tissues. All patients were clinically examined preoperatively under anesthesia [Hawkins and Bokor 1990]. The preoperative evaluation included the performance of plain x-rays and in certain patients MRI. All patients have been preoperatively informed about the advantages and the disadvantages of the arthroscopic procedure and also about the reported higher rate failure rate of the arthroscopic reconstruction. All patients gave informed consent. No other shoulder operation had been performed in any patient in the past. All operations have been performed in the lateral decubitus position under general, hypotensive anesthesia. The goals of the surgical reconstruction of the anterior shoulder instability are (a) reattachment of the labrum, (b) restoration of the capsular tension, (c) improvement of the range of motion, (d) early rehabilitation, muscular strengthening and proprioceptive training. During the operation the surgeon must reduce the capacity of the axillary pouch, advance the capsule superiorly, augment the capsule using plication techniques and in certain cases close the rotator interval. During the operation the condition of the capsular tissues is examined. The capsule may be stretched (elastic deformation), elongated (plastic deformation), ruptured or detached. The arthroscope was introduced following the opening of the posterior portal. The performance of arthroscopic procedures mandates the insertion of instruments from two anterior portals, one placed anterosuperiorly and one anteroinferiorly. Diagnostic examination of the subacromial space always completes the operation. The exact procedure of instrument insertion and the performance of diagnostic shoulder arthroscopy are described in another report [Antonogiannakis et al. 2001]. The patients selected for arthroscopic stabilization had (1) traumatic, anterior instability, (2) Bankart lesion, (3) robust, well developed inferior glenohumeral ligament, (4) absence of anterior glenoid rim erosion, (5) no pear-shaped glenoid and (6) non-engaging Hill-Sachs lesion. The arthroscopic procedure has been abandoned in a few patients due to technical reasons or due to inappropriate condition of the glenohumeral ligaments. The surgical technique had as follows: the insertion of the arthroscope from the posterior portal was followed by opening of the anterosuperior and the anteroinferior portals, using the out-in technique, in order to maximize the width of the skin bridge between the anterior portals and to facilitate the insertion of arthroscopic instruments. Both portals are entering the space between the long head of the biceps and the upper limit of the subscapularis muscle. The arthroscope is alternated between the posterior and the anterior portals, depending on the progression of the procedure, in order to improve visualization. After identification of the intraarticular pathology the labrum is detached from the inferior part of the capsule to the 6th hour. The glenoid neck is debrided in order to facilitate soft tissue reattachment. The holes for the insertion of the bone anchors are made on the articular surface of the glenoid, 4 mm from its edge (Figure 2). The anchors are inserted in the 7, 9 and 10 hour in the left glenoid and in the 2, 4, 5 hour in the right glenoid (Figure 3). There have been inserted 84 anchors of several types. We have used eleven non absorbable, screw type mini Revo (Linvatec)

anchors, 6 metallic knotless anchors (Mitek) (Figure 4), 33 Fastak anchors (Arthrex) and 34 absorbable Panalok anchors (Mitek). The angle of anchor insertion must be as perpendicular to the glenoid as possible and not parallel to it, to avoid intraarticular prominence or dislodgment. After insertion of the anchor traction is exerted through the anchors and their stability is assured. The unhindered gliding of the anchors is also examined at that point. Non absorbable Ethibond # 2 sutures have usually been used and in a few cases PDS # 1 sutures. Using specially designed instruments, a suture is passed through the capsule, starting at the anterior inferior glenohumeral ligament. Traction is exerted on the capsule, which is shifted upwards. Arthroscopic knots are performed outside the joint and they are advanced into the joint using knot pushers, using the anterior portals. Gliding knots have been used (Hangman's knot and Tennessee slider) which have been secured with non gliding Revo knots. The same procedure was used with all anchors.

The fixation strength may be augmented in several positions: (a) in the labrum-capsule interface, (b) in the rotator interval and (c) using the method of capsular shrinkage. This technique relies on heating of the capsular collagen at 65^o C using radiofrequency devices (VAPR, MITEK and ARTHOCARE, ARTHREX), which leads to alteration of the links between the collagen fibers and to the creation of a visible scar. During the operation, the anatomic variations must be taken into account, having in mind that it is essential to ensure that the capsular tension is symmetrical, because unbalanced tension may lead to subluxation in the opposite direction. After completion of the operation the joint was thoroughly washed, 25 ml xylocaine were instilled intraarticularly and the portals have been also infiltrated to ensure postoperative analgesia. All patients recovered from anesthesia uneventfully. The postoperative pain was measured using a 100-mm visual analogue scale. Postoperatively NSAIDs have been administered intramuscularly. The position of the bone anchors has been verified in the postoperative anteroposterior shoulder radiograph (Figure 5).

POSTOPERATIVE REHABILITATION

Postoperatively the shoulder is immobilized for 3-4 weeks. For the first three weeks external rotation 0^o and flexion 90^o are allowed. Between the third and the sixth week external rotation 30^o and flexion above the horizontal are allowed. From the sixth to the eighth week internal rotation behind the back is allowed and shoulder rotators strengthening to the midposition is encouraged. From the 8th week the rotators are actively strengthened and return to athletic activities is allowed 3-6 weeks postoperatively, depending on the patients needs.

RESULTS

All patients, except one, who was lost to follow up, have been followed up postoperatively for 4-15 months (mean 9 months). In all patients the apprehension has been disappeared. Until the end of December 2000 no recurrence occurred. Seven patients reported mild pain after intense activity. One patient developed shoulder pain, 5 months postoperatively, due to impingement and was treated conservatively with success, by physiotherapy program change. Three to five anchors per patient have been used. Suture breakage occurred only in the first cases. No infection or neurapraxia was noted. Stiffness lasting more than 4 months was noted in 3 patients and was treated with intensification of the physiotherapy program. All patients had forward flexion 180^o and internal rotation to the level of T6 (T4-T12), similar to the normal shoulder. The functional result was evaluated with the Rowe and Zarins scale (Table 1). Excellent was rated the result of the surgical reconstruction, when the patient had good function, without significant complaints. Twenty-five patients had excellent result (score 90-100), five good result (score 70-89) and two satisfactory result (score 40-69).

DISCUSSION

Shoulder dislocations comprise more than half of major joint dislocation, treated in the Emergency Department. In a Danish study it was estimated that the incidence of shoulder dislocations is 17/100.000 persons. It was observed that the shoulder dislocations present bimodal distribution, occurring predominantly in men aged 20-30 years and in women 60-80 years [Kroner et al., 1989].

Hippocrates studied the seriousness of the disorder in his work "About Joints", written around 400 B.C and blamed erroneous treatment." It must be known how to treat a shoulder that frequently dislocates. Many people due to this misfortune are obliged to quit gymnastics, even though they are capable for other activities. Due to this misfortune they have been unsuitable to fight and they have vanished. This disorder must be taken into account because I have never met a physician, who treated it properly. Some give up trying, while others know and act what is completely contradictory to what is right. Perthes [Perthes, 1906] wrote: "The anterior glenoid rim is found glazing and rounded without attachments and a blunt instrument is possible to be passed on the bare anterior surface of the

glenoid neck. Bankart [Bankart and Cantab, 1923, Bankart, 1938] wrote: "Someone who has seen this typical lesion during surgery cannot doubt that the only orthological treatment is the reattachment of the glenoid ligament ". A study in 1992 showed that only 16% of the 68 young athletes with traumatic anterior shoulder dislocation that have been studied presented good results after conservative treatment [Burkhead and Rockwood, 1992]. In young athletes arthroscopic stabilization is an effective, minimally invasive treatment, which positively modifies the unfavourable prognosis of the disease [Wheeler et al.1989, DeBerardino et al.1996, Valentin et al.1998]. More than 250 shoulder reconstruction techniques have been described. A surgical procedure must: a) correct the pathological lesion, b) minimize the recurrence rate, c) have few complications and a small percentage of reoperations, d) anticipate secondary complications, e) preserve range of motion, f) be simple to perform. No operation fulfils all criteria. The choice of the operation must be made weighing benefits and complications. Open reconstruction with staples must be abandoned due to the high incidence of failure and intraarticular migrations of staples. The transglenoid technique after Caspari has a reported 4-50% [Fleiss 1998] and the use of bioabsorbable tacks 8-41% recurrence rate [Laurencin et al 1996, Speer et al.1996]. The above mentioned techniques were not as successful because Bankart lesion is fixed in situ on the glenoid neck, without to take into consideration the capsular distension, transforming the Bankart lesion to an ALPSA lesion. Bone anchors have been introduced by Wolf [Wolf et al.1992], offering the advantage that makes possible the capsule plication. The initially reported results of the arthroscopic techniques were inferior to the results of open reconstructions due to incomplete knowledge of shoulder instability pathology and due to bad patient selection [Rowe et al.1978, Geiger et al.1997, Flatow et al. 1998, Hayashida et al.1998]. The initial reports of the transglenoid techniques were relatively disappointing with 44% failure rate [Grana et al. 1993]. The literature review revealed that the results fluctuate and the recurrence rate may be even smaller, even with the transglenoid technique [Morgan and Bodenstab 1987]. Recent clinical series, where bone anchors have been used, report excellent results with only 7% recurrence rate, which is equivalent to the open reconstruction [Bacilla et al., 1997]. Additionally certain open procedures, such as the capsular reattachment with staples after Du Toit have 22% recurrence rate [Du Toit and Roux 1956]. The better biomechanical evaluation of instability repair [Bigliani et al.1992, Rodovsky et al 1994, Speer et al.1994] and the improvement of arthroscopic techniques and instruments increased the efficacy of arthroscopic techniques. The efficacy of arthroscopic and open techniques is similar when their indications are kept [Bacilla et al.1997, Valentin et al 1998, Cole et al 2000, Gartsman et al 2000]. Furthermore even in those studies, where the arthroscopic technique seems to be inferior to the open one the discrepancy is limited only to the recurrence of the instability. Shoulder mobility in arthroscopic techniques is greater, the restriction of external rotation is minimal and the costs of the operation and the postoperative pain are less. [Green and Christensen 1993, Barber et al 1998, Higgins and Warner 2000].

The development of osteoarthritis is a complication of non-anatomic shoulder instability reconstruction procedures. The restriction of external rotation is one of the most important prognostic factors for osteoarthritis development. The incidence of instability arthritis increase with time from the operation and its presence has been described for almost every instability operation [Hawkins et al 1990, Konig et al 1997, Allain et al 1998]. In a study of 66 patients with a mean follow up of 22 years after Putti-Platt operation in more than 60% were evident radiographic signs of osteoarthritis, while the recurrence rate was only 3%. The patients developed osteoarthritis symptoms 20 to 30 years after the stabilization, and it was estimated that the risk for osteoarthritis was increased 1.8 times for every 5 years follow-up. [Kiss et al 1998]. The severity of the symptoms was related to the limitation of joint motion. [Kiss et al 1998, van der Zwaag et al 1999].

Open Bankart reconstruction, compared to the arthroscopic technique, lasts 1.8 times more operative time, 10 times increased blood loss and 2.5 times increased analgesic consumption. The visibility of the arthroscopic technique is better, tissue violation is minimal and the integrity of the subscapularis is preserved. The length of the immobilization is similar for both techniques, because it seems that closed techniques do not accelerate soft tissue healing. Open technique demands more operative and anesthesia time as well as longer stay in hospital. The insurance costs are greater when the patients stay in hospital. The occurrence of postoperative fever was less frequent in closed technique. The stay in hospital was 3.1 days for the open and 1.1 days for the arthroscopic technique. The absence from work was 25.5 and 15.3 days respectively. The aesthetic result of the closed technique is also superior. In the USA the performance of open Bankart repair on an outpatient basis is also performed, resulting in 50% reduction of the cost [Levy and Mashoof 2000].

The complications of shoulder stabilization procedures may be due to preoperative wrong diagnosis or false interpretation of the patient's needs, to intraoperative wrong decision making, such as inappropriate placement of the patient and use of improper techniques or materials and due to postoperative occurrences, such as recurrence of the instability, limitation of motion, development of osteoarthritis and neurovascular complications. Significant complications, such as haematoma formation or presence of infection must be recognized early and treated properly. Certain complications can be prevented while the frequency of others can be reduced. Only few complications are not preventable [Wall and Warren 1995].

A few studies have described the findings and the surgical treatment in revision shoulder stabilization operations, open and arthroscopic [McAuliffe et al 1988, Mologne et al 1997, Flatow et al 1998, Zabinski et al 1999]. The causes of instability recurrence are the inappropriate preoperative diagnosis, the insufficient performance of the stabilization procedure, a new injury and the inappropriate postoperative rehabilitation. In a detailed study of instability recurrence following arthroscopic procedures the cause of the recurrence was the inability to restore the Bankart lesion and the cause for the subluxations was the persistent capsular laxity[Mologne et al.1997]. In a recent report of revision operations more than 60% of the primary operations failed within the first postoperative year [Zabinski et al.1999]. Instability in the opposite direction, osteoarthritis and soft tissue shrinkage, requiring surgical release, followed the failure. In certain patients arthrodesis was mandatory to control the instability.

Arthroscopic shoulder stabilization surgery, although technically demanding with flat learning curve, is successful and when performed in selected patients has similar results to the open reconstruction, combining reduced morbidity and costs for the insurance system. The ideal patient for arthroscopic reconstruction is the young patient, less than 30 years old, with acute traumatic dislocation, with discrete Bankart lesion, well develop capsule without significant laxity and with normal articular cartilage. Contraindication for the performance of an arthroscopic reconstruction are considered the absence of Bankart lesion, the significant capsular laxity, the presence of significant Hill-Sachs lesion and the presence of an inverted pear shaped glenoid. The success of arthroscopic procedures is limited in patients with multidirectional or voluntary instability and in patients who are willing to follow the postoperative physiotherapy program.

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LIST OF FIGURES

Figure 1.

Arthroscopic appearance of the Bankart lesion from the anterior-superior portal in the right shoulder. (a) humeral head, (b) glenoid, (c) detached labrum

Figure 2.

Diagrammatic representation of the reattached labrum and capsule. Purpose of the reconstruction is to reattach the labrum on the articular cartilage, 3-4 mm from the glenoid edge.

Figure 3.

The final arthroscopic appearance of the reattached labrum on the glenoid from the anterior-superior portal. (a) humeral head, (b) glenoid, (c) detached labrum

Figure 4.

The insertion of a bone anchor in the predrilled hole in the glenoid. In this case this is a knotless anchor (Mitek).

Figure 5.

Radiologic appearance of a labral reconstruction. Three screw type mini Revo anchors are showed.

Table 1. The Rowe and Zarins shoulder instability evaluation scale

| FUNCTION | SCORE |
|---|--------------|
| No restriction in sports and work | 50 |
| No restriction in work | |
| Mild restriction in certain athletic activities | 35 |
| Mild restriction in activities above shoulder level | 20 |

and in certain athletic activities
Inability to work above the shoulder level
and significant restriction of throwing activities 0

PAIN

No 10
Mild 5
Severe 0

STABILITY

Negative apprehension test, no subluxation 30

Negative apprehension test, no subluxation 15

Discomfort in abduction-external rotation

Positive apprehension test, subluxation 0

RANGE OF MOTION

Full range of motion 10

25% loss of ROM in every direction 5

More than 25% loss of ROM in every direction 0

Excellent result = 90-100

Good result = 70-89

Satisfactory result = 40-69

Bad result = < 39