

## Comparison of Open and Arthroscopic Stabilization for Anterior Shoulder Instability

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### Abstract

It is accepted that surgical management is the standard of care for anterior shoulder instability in young active patients because of superior functional results when compared to non-operative treatment. There is a debate however as to whether or not open surgery is superior to arthroscopic treatment. Open treatment historically has superior recurrence rates but others argue that arthroscopic techniques have superior functional results. The decision to proceed with either techniques ought to be individualised and based on patient preference, surgeon experience, patient age, the number of dislocations and if applicable, the nature of the sport that the individual engages in.

**Keywords:** Shoulder; Instability; Arthroscopic; Open; Stabilization

**Abbreviations:** ROM: Range of Motion

### Introduction

The surgical options in managing anterior shoulder instability may be broadly divided into open or arthroscopic approaches [1]. Despite advocates for both approaches, the evidence regarding the relative effectiveness of open and arthroscopic treatment of anterior glenohumeral instability remains unclear [1]. Open approaches have yielded consistently low rates of recurrent instability [2-4]; while proponents of arthroscopy describe benefits such as improved function, higher patient satisfaction and superior Rowe scores [1].

### Discussion

In the early 1900's, many surgeons had postulated several different mechanisms for the unstable shoulder. Early reports suggested that the capsule and glenohumeral ligaments played a significant role in shoulder stability [5]. The Bankart lesion is classically described as the detachment of the anteroinferior labrum with its attached inferior glenohumeral ligament complex. Bankart initially noted this detachment of the labrum in four patients with recurrent glenohumeral instability and dubbed it the essential lesion [6]. He later reported very good results of labrum reattachment (Bankart procedure) in 27 patients [7].

In the middle 1900's, numerous non-anatomic operative procedures were performed because of the time consuming nature and technical difficulties associated with the original Bankart procedure [5]. Unfortunately, numerous studies demonstrated high complication and recurrence rates [5].

Turkels' classic 1981 biomechanical study returned the focus to the pathologic processes responsible for the unstable shoulder [8]. This study demonstrated the significant contribution of the glenohumeral ligaments. Turkel, *et al.* [8] stated that there was no single

structure primarily responsible for stability. As the arm is abducted, the support function of the muscles, capsule and ligaments is shifted from the superior to the inferior structures. In the dependent position, stability is maintained by the deltoid, supraspinatus, superior glenohumeral ligament and coracohumeral ligaments. Subscapularis, middle glenohumeral ligament and the superior band of the inferior glenohumeral ligament are the stabilisers in the middle ranges of abduction. The axillary pouch of the inferior glenohumeral ligament prevents anterior subluxation or dislocation in the upper range of abduction [8]. The understanding of the pathophysiology of shoulder instability has improved over the last several decades. The primary abnormality is related to the labral detachment with associated loss of tension in the glenohumeral ligaments and injury to the capsular mechanism itself [5]. When non-operative management fails, regardless of whether an open or arthroscopic technique is chosen, treatment should be directed at these pathologic processes [5]. Many authors have reported better results with operative than non-operative treatment for recurrent anterior shoulder instability and surgery is now considered standard treatment [4,9,10]. The optimal surgical technique remains a controversial topic because both open and arthroscopic repair demonstrate good results [11].

The open Bankart procedure is regarded by numerous surgeons as the gold standard for shoulder stabilisation surgery [2,4,12,13,14,15,16]. The general consensus is that a Bankart lesion in isolation is insufficient to allow the humeral head to dislocate. Thus, surgical procedures which simply repair the labrum to the glenoid, but ignore tension restoration of the inferior glenohumeral ligament complex are doomed to fail. This may be why several arthroscopic studies vary widely in their success rates [5].

One of the most important modifications of the Bankart technique was the introduction of suture anchors which make the procedure technically easier without negative effect on the results in terms of shoulder stability [17]. Magnusson, *et al.* [18] looked at the four to nine years experience post open Bankart repair in 54 shoulders and found a higher dislocation rate than the previous studies he reviewed. These dislocations were all secondary to significant trauma. Berendes [19] commented that dislocations post trauma in this case is not a surgical failure. The outcomes at ten to fifteen year follow up in his study, demonstrated a recurrent dislocation rate of 6.7% which were all secondary to further trauma. The incidence of radiological glenohumeral osteoarthritis was 32% and this was likely due to glenohumeral instability, however the mechanism is unclear [19]. It has been theorised that cartilage loss may occur post over tightening of the capsule [19]. Magnusson [18] felt that the choice of reconstruction method should be based on the surgical experience and the patient's choice rather than long-term prospective randomised studies. After looking at outcomes post modified open Bankart repairs at a mean of 11 years postoperatively, Berendes [19] concluded it was a safe and effective procedure with good subjective and objective long term results with a high degree of patient satisfaction. The patients returned to their regular work activities three to six months postoperatively. Lenters' meta-analysis examined arthroscopic versus open repair of anterior shoulder instability and the pooled data showed rates of recurrent instability of 18% and 8% arthroscopic and open approaches respectively [1]. Redislocation rates were 12% and 5% for arthroscopic and open approaches respectively [1]. Good to excellent results using postoperative Rowe scores have been associated with open repairs [11]. Unfortunately, open techniques are associated with decreased ROM in external rotation with subsequent osteoarthritis due to capsular tightening [12].

Arthroscopic techniques were developed in an attempt to avoid wide dissection and scarring associated with open techniques [20]. The arthroscopic stabilising procedure was described in 1993 and involved the use of a metal staple [21]. 16% of the 24 patients had recurrence and there was a high risk of complications due to loose staples. Early results of arthroscopic stabilisation were significantly worse than open in terms of recurrence rates (15 - 40%) [11,13,22]. Subsequent arthroscopic techniques have included the use of transglenoid sutures [23], bioabsorbable tacks [24] and suture anchors [25]. Suture anchors and bioabsorbable tacks had similar failure rates and staple capsulorrhaphy had higher failure rates than anchors [20]. Transglenoid sutures are no longer recommended due to unacceptably high failure rates including a 17% dislocation rate and 60% rate of instability [20,26]. Freedman [11] found that open techniques were associated with lower recurrence rates than the above mentioned arthroscopic techniques (3.4% versus 12.6%). Arthroscopic Bankart repairs for anterior shoulder instability are becoming increasingly popular [16] because they are less invasive, with decreased post operative stiffness and subscapularis deficiency is minimised [27,28]. Other potential advantages include decreased post operative pain,

increased rate of return to throwing activities in athletes and improved range of motion [11]. The development of arthroscopic stabilisation has undergone significant evolution over the past two decades [11,27]. With increasing popularity of arthroscopic techniques, surgeons are now striving for equal results with open and arthroscopic techniques [11,27,28]. Arthroscopic techniques are associated with a learning curve which may affect recurrence rates [11].

Recurrent instability is the main complication of anterior shoulder stabilisation [29] however using recurrence rate alone would over estimate the success of the outcome of stabilisation surgery [19]. Open techniques are associated with low recurrence because of capsular tightening [12]. Carreira, *et al.* [27] did arthroscopic Bankart repairs in 85 patients with a minimum of two years follow-up. Four patients had redislocations and three experienced recurrent dislocations. He attributed his low recurrence rate via using a 5'O clock portal which allowed improved access to the inferior labrum which allowed precise placement of suture anchors and a more anatomic reconstruction. Associated injuries may be treated prior to capsular tightening, followed by rotator interval closure if necessary [27].

Various arthroscopic interventions had coincided with important biomechanical studies which demonstrated the glenohumeral ligaments to be discrete critical structures which must be addressed [5]. Some authors have suggested that the best candidates for arthroscopic repair are those with instability due to a discrete Bankart lesion without any capsular laxity or injury [24]. Cole, *et al.* [15] stated that few investigators had attempted to compare arthroscopic and open repair methods and that the method of patient selection was unclear. He selected patients with capsular laxity and a Bankart tear for open repair, while those with a Bankart tear associated with well formed glenohumeral ligaments were chosen for arthroscopic repair. This selection process was based on both biomechanical observation of factors leading to instability and a clinical impression of the importance of capsular laxity and labral detachment in the aetiology of instability [15]. Karlsson, *et al.* [14] stated that the degree of capsular laxity may be the crucial factor in determining success in either open or arthroscopic techniques. Cole, *et al.* [15] found that his recurrence rates following arthroscopic Bankart repair was lower than rates seen in the literature. He concluded that consistent selection based on examination under anaesthesia of the capsulolabral injury to optimise the indications of open versus arthroscopic stabilisation contributed to successful treatment.

The decision to proceed with either technique must be individualised and based on patient preference, surgeon experience, patient age, number of dislocations and the interval between the original dislocation and surgery [14]. Patient selection has been deemed to be a source of bias [20]. Age, gender, activity level, participation in contact sports, and severity of preoperative instability are factors which influence success of surgical stabilisation [20]. Hubbell, *et al.* [26] utilised an arthroscopic capsular shift technique, however this did not improve his clinical results. He found that imbricating a redundant capsule was difficult to do accurately and precisely [26]. Freedman, *et al.* [11] stated that the failure rate of arthroscopic techniques was in part due to short post operative immobilisation, failure to address capsular injury plus inability to anatomically repair the labrum and poor tissue integrity.

Appropriate patient selection is the second most important factor with the actual surgical technique being the most critical for good reproducible results to be achieved for arthroscopic Bankart repair [29]. Balg and Boileau [29] identified risk factors which predicted increased recurrence rates: age less than 20 years at the time of surgery, contact or overhead sports at a competitive level, shoulder hyperlaxity, Hill-Sachs lesion visible on the anteroposterior radiograph in external rotation and less contour of the inferior glenoid on x-ray. Their simple scoring system helped to distinguish who would benefit from arthroscopic stabilization [29].

Lenters, *et al.* [1] looked at the results of authors who performed arthroscopic stabilization of patients with: osseous defects greater than or equal to 25% of glenoid length, contact sports athletes and patients with multiple recurrences. The results indicated that when these exclusion criterions are used, improved arthroscopic outcomes are more likely.

It is known that the risk of recurrence is increased in young active athletes [14,15,30]. Increased recurrence rates have been noted in collision athletes as these are high demand patients [3,23]. It has been reported that a Bankart repair in an athletes' produces worse

results than the same repair in non-athletes [10,22] however most studies looked at a heterogeneous group of collision athletes [3]. Hubbell, *et al.* [26] stated that the open technique has been recommended for collision athletes. Rhee, *et al.* performed the first randomized study in term of comparing arthroscopic and open methods in collision athletes. He found no difference in ROM and functional scores. Most patients returned to preoperative function, however there was a significant difference in recurrence rates (25% in the arthroscopic group versus 12.5% in the open group). They therefore recommended open repair for collision athletes. Idle, *et al.* studied selected high risk patients, including patients younger than twenty five years old actively participating in sports and patients involved in contact sports. 93% of 55 athletes in this prospective cohort, who all underwent arthroscopic stabilisation, had a good result with their Rowe scores moving from 30.1 to 92.3 [16]. Uhorchak [4] had a 15% recurrence rates in collision athletes with open repair. Pagnani and Dome reported that 3% of American football players with open repairs developed postoperative subluxation which suggests that open repair in this population offers advantages that current arthroscopic techniques cannot duplicate [3]. Cole, *et al.* [15] had higher recurrence rates in his studies than other studies in his literature search. This was due to the fact that other authors did not utilize the apprehension test as a sign of recurrence. Some of his patients who had a positive apprehension sign lacked a subjective sense of instability.

Comparison of both techniques generally used redislocation rates as the outcome measure [9,32]. Although there are several reports of open Bankart repairs using recurrence rate of dislocation as a measure of success, there are factors other than stability and ROM in determining outcome [20,32]. In reviewing the literature, Lenters [1] found that shoulder function analysis was limited by data which lacked parameters such as a scoring system, return to activity, ROM and subscapularis dysfunction. Subscapularis dysfunction post open repair has recently received increased attention [33]. Subscapularis is detached in an open procedure after which the function is frequently compromised even when repaired anatomically [28]. Cho, *et al.* [28] found that revision open Bankart after failed arthroscopic Bankart repair may provide a satisfactory outcome in terms of decreased recurrence rates and reliable function; however the surgeon must be prepared to accept the possibility of decrease ROM especially external rotation. In comparing the recovery of muscle strengths in both open and arthroscopic techniques, arthroscopic repair has been found to minimise damage to soft tissues without dissecting the subscapularis tendon [34]. There may be weakness in internal rotation following open repair due to scarring and shortening of the subscapularis tendon post surgery [34]. Utilizing postoperative MRI, Rhee, *et al.* [34] and Scheibel, *et al.* [33] noted that the takedown and repair of the subscapularis during the open repair leads to fatty infiltration of the tendon resulting in postoperative subscapularis muscle insufficiency.

The reason for the fatty infiltration is unclear [33]. Scheibel, *et al.* [33] found that none of the patients in their arthroscopic group had subscapularis dysfunction even when using sensitive clinical testing. Hubbell, *et al.* [26] recommended arthroscopic repair when preservation of ROM is very important e.g. swimmers or volleyball players, to prevent compromising of their performance. Karlsson, *et al.* [14] found a significant difference in ROM between arthroscopic and open techniques, with the arthroscopic group showing significantly better functional results, which was the main advantage of the arthroscopic technique. Sachs, *et al.* [32] performed an open Bankart repair in 30 patients with traumatic anterior instability with a mean follow up of 4 years. 23% had an incompetent subscapularis muscle as evidenced by a positive lift off test. Rhee, *et al.* [24] speculated that their results were different from Scheibel, *et al.* [33] and Sachs, *et al.* [32] because of a different patient population, surgical technique and rehabilitation protocol. In his randomised prospective study, they found that muscle strength recovered faster with an arthroscopic procedure where the patients were 80% of normal at 6 weeks and 90% at 3 to 6 months. This may be attributed to the minimal additional inflammatory response in the surrounding parts of the shoulder associated with arthroscopic repair [34]. Muscle strength during forward flexion showed slow recovery in the open Bankart group because of the deltopectoral approach and takedown of the scapularis tendon. Muscle strength will not improve until these structures are completely healed [34]. Although the open group had significantly weaker muscle strength than the arthroscopic group at three months post surgery, there was no significant difference at one year [34].

Scheibel, *et al.* [33] stated that in cases of successful open repair including labral repair and capsular shift procedures, a moderate to severe subscapularis dysfunction needs to be present before functional scores become significantly affected. Sachs, *et al.* [32] reported that post open surgery, there was no statistical decrease in ROM however, and the failure of the subscapularis repair based on a positive

lift off test was associated with decreased patient satisfaction. They concluded the integrity of the subscapularis repair was the only factor that correlated with the outcome. Hiemstral, *et al.* [9] in his randomized controlled study found no difference in the internal rotation between open and arthroscopic groups. He attributed this lack of strength defect in the open group because of the use of a subscapularis split surgical approach as opposed to the historical method of detaching the tendon. Although there are recent studies which have shown that arthroscopic Bankart reconstruction using suture anchors or tacks may be equivalent to an open procedure [20], the predominant view is that the open techniques are superior in terms of stability [1,11]. Newer arthroscopic techniques now need to be directly compared with open stabilisation to demonstrate its efficacy [11].

### Conclusion

Open repair produces a stable shoulder with a low recurrence rate but is affected by subscapularis dysfunction and loss of external rotation. Arthroscopic repair is still in evolution and has a high learning curve. Results appear to be poorer in terms of recurrence rates in contact athletes but may be improved if Rowe scores are utilised to guide patient selection.

### Conflict of Interest

Nil.

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