

## Original Research Article

# Functional outcome of arthroscopic Bankart repair for anterior shoulder instability based on suture anchor configuration

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### ABSTRACT

**Background:** The objective of the study was to evaluate the functional outcome of arthroscopic Bankart repair for anterior shoulder instability to assess whether the number and position of suture anchors plays a role in determining the functional outcome.

**Methods:** This was a prospective study on 32 patients operated with arthroscopic Bankart repair between December 2017 to April 2019. Pre-op and regular follow-up scores were measured at 1 month, 3 months and 6 months post-op using Rowe score and American Shoulder and Elbow Surgeons score to assess functional outcome.

**Results:** Mean age of the study group was  $24.5 \pm 6.9$  years. Functional outcome as determined by Rowe score and ASES score at 6 months follow-up were found to be  $90.5 \pm 7.2$  and  $85.9 \pm 14.1$  respectively when compared to the pre-op scores of  $23.2 \pm 8.2$  and  $47.9 \pm 5.7$  respectively; all of which showed highly significant functional improvement with highly significant reduction in visual analog scale (VAS) pain score. Patients had no recurrent dislocations with mean external rotation limitation of  $5^\circ$ . 25 (78.1%) patients had two suture anchors inserted and 7 (21.9%) patients had multiple ( $>2$ ) anchors; and when analysis was done, there was no statistically significant difference between number of suture anchors used with respect to the functional scores.

**Conclusions:** We conclude that arthroscopic Bankart repair is a useful and successful procedure. Patient identification and selection remains the key in determining the success of repair. Meticulous surgical technique and correct positioning of suture anchors may help in reducing the number of anchors without compromising on the final functional outcome, thereby reducing the economic burden on patients.

**Keywords:** Anterior shoulder instability, Bankart repair, Arthroscopic repair, suture anchors, Rowe score, ASES score

### INTRODUCTION

Shoulder joint provides a wide range of motion by allowing the glenohumeral joint to be used as a stable fulcrum for placing the upper extremity at various positions in three-dimensional space. Shoulder by virtue of this anatomy and biomechanics, is the most unstable and frequently dislocated joint in the body, accounting for nearly 50% of all dislocations, with a 2% incidence in

the general population.<sup>1,2</sup> With recent enthusiasm for recreational and sporting activities, the incidence of glenohumeral instability is on the rise, especially in young athletes and active population. The most common type is anterior instability and the most common cause is trauma. Arthroscopic Bankart repair has become the standard of care in the treatment of recurrent anterior shoulder instability. It overcomes the drawbacks of the open Bankart repair such as postoperative pain, increased

blood loss, limitation of external rotation, and associated surgical complications like glenoid fractures.<sup>3,4</sup> The arthroscopic repair is also less time consuming, offers better range of movements post-op and is more cost effective.<sup>5,6</sup> There are various arthroscopic techniques described for shoulder stabilization which mainly focus on reconstruction of the capsulolabral complex by using intraarticular sutures with anchors.<sup>7-9</sup>

The purpose of this study is to evaluate the functional outcome and recurrence rate of shoulder instability following arthroscopic Bankart repair. We will also evaluate whether the number and position of suture anchors plays a role in determining the functional outcome and whether optimal positioning of suture anchors along with meticulous surgical technique will have an influence on the functional outcome of surgery rather than the use of multiple suture anchors.

## **METHODS**

### ***Study design***

This was a prospective study conducted between December 2017 to April 2019 at Sanjay Gandhi Institute of Trauma and Orthopaedics, Bangalore. Arthroscopic Bankart repair was done in 32 patients using suture anchors after obtaining approval from institution ethical committee.

### ***Inclusion criteria***

All shoulders which had dislocated atleast once with MRI showing Bankarts lesion of the affected shoulder with glenoid loss measuring less than 25%.

### ***Exclusion criteria***

Large Hill Sachs lesion and Bony Bankarts lesion representing >25% of glenoid. Associated rotator cuff tear, SLAP tears, paresis of deltoid or pericapsular musculature, ALPSA lesion, multidirectional instability, voluntary dislocators, epileptic patients, and patients with connective disorders such as Ehler-danlos, Marfan syndrome were excluded from the study.

### ***Study procedure***

Patients were taken into the study after obtaining MRI of the affected shoulder which confirmed the presence of bankarts lesion that satisfied the inclusion and exclusion criteria.

Pre-operative clinical evaluation was done and pain scores, Rowe, Instability Severity Index Score (ISIS), and American Shoulder and Elbow Surgeons (ASES) scores were assessed and patients were posted for surgery. Follow-up scores were assessed using the same parameters at 1 month, 3 months and 6 months post-op.

### ***Surgical technique***

All the surgeries were performed by the same surgeon and assistant. After inducing the patient under general anaesthesia, examination for shoulder instability was performed in all directions; and once anteroinferior instability was confirmed, the patient was put in the lateral decubitus position.

The arm is suspended in 45 degrees of abduction and 10 degrees of forward flexion with neutral rotation using a sterile shoulder traction and rotation sleeve with adequate padding. The lateral decubitus position creates a standard reference point which positions the glenoid parallel to the floor and allows for excellent visualization of the workspace during the procedure. It provides an easy access to the 6 o' clock position which allows easily reproducible return of the capsulolabral complex using anchors to its anatomical position.<sup>10,11</sup>

Diagnostic Arthroscopy was performed to confirm the character of the Bankart lesion, assessment of glenoid labrum, capsuloligamentous structures, articular surfaces, Hill-Sachs's lesion and any bone loss is evaluated following which standard Arthroscopic Bankart repair was performed by the author.<sup>12</sup>

### ***Glenoid neck preparation***

This requires complete mobilization and separation of the capsulolabral complex from the glenoid neck. After confirming the glenoid bone loss is <25%, a burr/shaver is used for preparing the neck upto the 6 o' clock position. This is one of the most important step of the surgery which allows for the best bone purchase for placement of suture anchors in the glenoid face allowing for near anatomical reestablishment of the labral bumper.

### ***Anchor placement and capsular imbrication***

A minimum of 2 single-loaded suture anchors were used to perform the repair. The pilot hole for the inferior most anchor is created by inserting a 2 mm drill bit with a self-stopper, through the Anteroinferior portal, on the face of the articular cartilage of the glenoid in the 5 o' clock position, down to the horizontal seating line.

A suture retriever (Suture Lasso) is passed under the Bankart lesion. A 45 degree curved spectrum suture hook loaded with a shuttle relay of 1 cm is inserted into the Anteroinferior portal, and a healthy plication stitch is created through the anterior-inferior capsule 1 to 2 cm below the anchor and 1 cm lateral from the labral edge. Adequate tissue must be sewn with the soft tissue grasper which not only offers anterior stabilization to the shoulder but also prevents inferior capsular shift.

Once the anchor is implanted, the suture limbs are retrieved. One limb is retrieved through the

anterosuperior portal and the other limb is ready to be used for soft tissue tensioning.

The mobility of the suture is tested to make sure the suture moves through the eyelet easily. The two suture strands are tied together using a Duncan loop sliding locking knot. The knot reinforced with multiple reversing half hitches to secure the knot. The suture tails are cut with a basket punch of micro scissors leaving a 2 mm tail.

The second suture anchor passed in similar fashion at the 3.30 to 4.30 positions and the suture passed through the capsule ‘tuck’ and under the labrum using the shuttle relay. The sutures are tied as before.

The need for third suture anchor around 3:30 position depends on the size and extent of detached labral tissue and when indicated, similar steps are followed as the second suture anchor to complete the repair.

A final evaluation of the joint is done from the anterosuperior portal and documented which shows the humeral head balanced in the centre of the glenoid.

**Post-operative rehabilitation protocol**

Rehabilitation was always customized based on tissue quality, stability of repair and varied depending on individual capability.

The arm is supported in a shoulder immobilizer for a period of 2 weeks.

At 2 weeks post-op, wean out of sling and passive pendulum exercises were started. Mobility exercises, mainly flexion with progress to active assisted movements and isometric cuff work were started.

At 6 weeks post-op, emphasis was on increasing muscle activity (cuff and scapula) with optimal movement patterning. Progressive cuff activity with proprioceptive muscle work was carried out. External rotation restricted to 50% of contralateral shoulder and combined abduction and external rotation was restricted.

At 3 months post-op, emphasis is on power, endurance & proprioceptive muscle work aiming towards functional activities. Aim was to achieve full muscle power in rotator cuff muscles and shoulder girdle muscles and recreational sport rehabilitation was started.

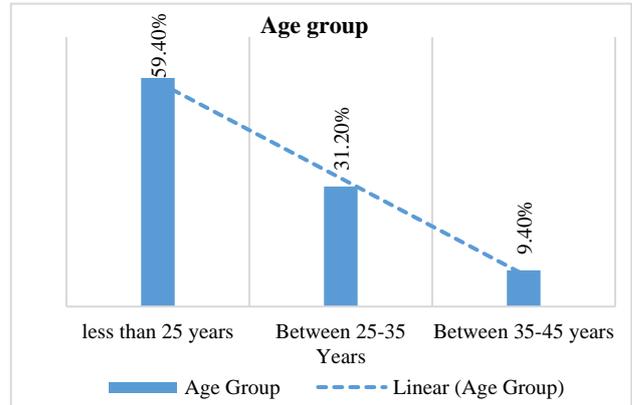
At 6 months post-op, return to contact sports was allowed if satisfactory rehabilitation was achieved.

Statistical analysis was performed using statistical package of social science (SPSS) version 20 software.

**RESULTS**

A total of 32 patients were evaluated in the study whose mean age was 24.5±6.9 years. 19 patients were less than

25 years (59.4%) who were majority; 10 were between 25-35 years (31.2%); and 3 were between 35 to 45 years (9.4%) (Figure 1).



**Figure 1: Age distribution.**

Majority of the patients in the study were males who constituted 90.6% (N=29), with only 3 females constituting 9.4%. 71.9% (N=23) of the patients had the Bankarts lesion on the right side and 28.1% (N=9) had the lesion on the left side and underwent repair for the same.

**Table 1: Type of sport activity.**

Type of sport	Count	%
Contact sports	11	34.3
Recreational sports	14	43.8
No sport	7	21.9

The occupational history of the patients showed that majority of the patients were involved in some form of sports activity with 11 patients (34.3%) playing contact sports (mostly kabaddi) and 14 patients (43.8%) playing recreational sports (badminton and volleyball). 7 patients (21.9%) had no history of any sporting activity (Table 1).

Pre-operative injury severity index score (ISIS) of the patients were determined. It was found that 50% of the patients (N=16) in the study had an ISIS score of 3. 1 (3.1%), 12 (37.5%), and 3 (9.4%) patients had an ISIS score of 4, 5, and 6 respectively. An ISIS score <3, between 3 and 6, and >6 predicts a recurrence rate of 5%, 10%, and 70%, respectively (Figure 2).

Range of movements as assessed are shown in Table 2. forward elevation (FE), cross-body adduction (CBA), external rotation with arm in adduction (ER1), external rotation with arm in 90 degree abduction and internal rotation (IR) were found to be 143.3±11.7, 43.4±4.8, 56.5±9.1, 72.5±8.4, and 53.1±6.8 respectively pre-operatively. There was a significant improvement (p<0.05) in range of motion with follow-ups at 1 month, 3 months and 6 months with all patients achieving atleast 80 degree of external rotation with arm in abduction by

the end of 6 months. At final follow-up at 6 months FE, CBA, ER1, ER2, and IR were found to be 159.1±3.9, 49.6±1.7, 68.5±3.4, 90.3±6.8, and 67.9±3.7 respectively (Table 2).

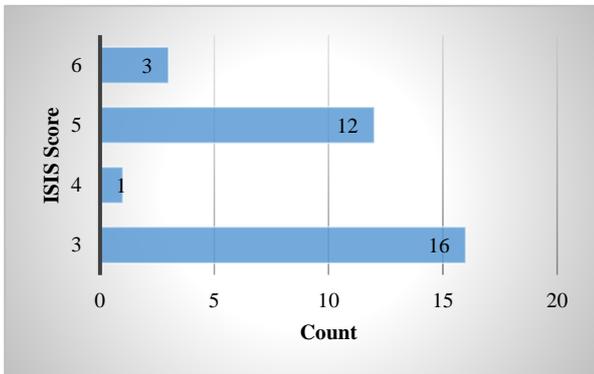


Figure 2: ISIS score.

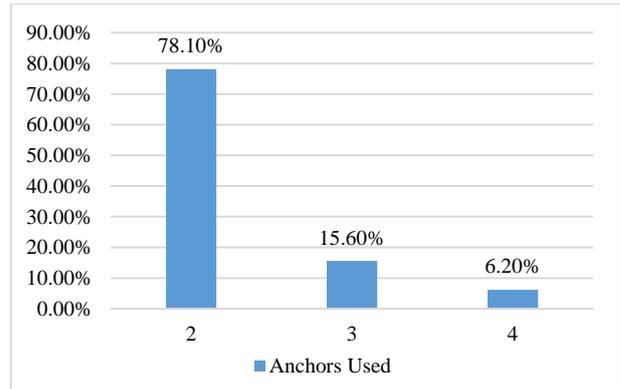


Figure 3: Suture anchors used.

Majority of the patients had 2 bioabsorbable suture anchors inserted (N=25; 78.1%), with 3 and 4 suture anchors inserted to 5 (15.6%) and 2 (6.2%) patients respectively (Figure 3).

Table 2: Range of movements.

Range of movements	FE		CBA		ER 1		ER 2		IR	
	Mean±SD	P value	Mean±SD	P value	Mean±SD	P value	Mean±SD	P value	Mean±SD	P value
Pre op	143.3±11.7		43.4±4.8		56.5±9.1		72.5±8.4		53.1±6.8	
Post op 1 month	150.9±8.9	Sig	47.2±4.5	Sig	61.7±7.8	Sig	74.5±7.4	Sig	59.8±4.8	Sig
Post op 3 months	158.4±5.1	Sig	49.6±1.7	Sig	66.2±5.4	Sig	84.4±7.4	Sig	66.4±4.6	Sig
Post op 6 months	159.1±3.9	Sig	49.6±1.7	Sig	68.5±3.4	Sig	90.3±6.8	Sig	67.9±3.7	Sig

Table 3: Rowe score.

Rowe score	Mean value	Standard deviation	P value
Pre op	23.9	8.2	
Post op 1 month	51.6	9.1	<0.001
Post op 3 month	68.4	7.3	<0.001
Post op 6 month	90.5	7.2	<0.001

Table 4: ASES score comparison with number of anchors.

ASES score comparison	Anchors used				P value
	2 anchors		More than 2 anchors		
	Mean	Standard deviation	Mean	Standard deviation	
Preop	48.24	5.55	47.07	6.73	0.64
1 month	68.50	10.63	72.07	5.75	0.40
3 months	80.07	12.80	83.73	1.85	0.46
6 months	84.60	15.62	90.64	4.16	0.32

Table 5: ISIS score comparison with number of anchors.

ISIS score comparison	Anchors used				P value
	2 anchors		More than 2 anchors		
	Mean	Standard deviation	Mean	Standard deviation	
ISIS pre op	4.12	1.16	3.85	1.06	0.59

Mean VAS score among the patients in the study also reduced from pre-op value of 5 to 3, 2, and 1 at 1 month, 3 months and 6 months post-op respectively and this reduction in pain was found to be highly significant ( $p < 0.001$ )

Rowe score which takes into account the stability, motion and function of the patient was found to have a highly significant ( $p < 0.001$ ) improvement with follow ups at 1 month, 3 months and 6 months with scores of  $51.6 \pm 9.1$ ,  $68.4 \pm 7.3$  and  $90.5 \pm 7$  respectively. Majority of the patients ( $N=29$ ; 90.6%) had excellent functional outcome and 3 patients (9.3%) had fair outcome (Table 3).

The ASES shoulder score which is both a physician-rated and patient-rated scoring system showed a highly significant improvement ( $p < 0.001$ ) at post-op follow ups as determined by Wilcoxon signed rank test. The post-op scores at 1 month, 3 months and 6 months were  $69.3 \pm 9.8$ ,  $80.8 \pm 11.4$ , and  $85.9 \pm 14.1$  respectively. The mean pre-op ASES score was  $47.9 \pm 5.7$  (Figure 4).

To compare the findings with no. of suture anchors used, patients were stratified into 2 groups; 1 group were patients in whom two- suture anchors were used and the

other group were patients in whom more than 2 suture anchors were used.

ASES score showed no significant difference between the 2 groups at all post-op follow-ups (Table 4). Similarly, ISIS score at pre-op showed no significant correlation to the number of suture anchors used (Table 5). The mean Rowe score at 6 months follow-up also did not show any significant correlation to number of suture anchors used (Table 6).

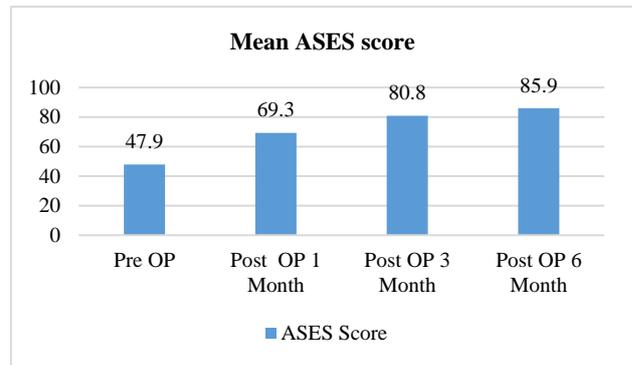


Figure 4: ASES score.

Table 6: Rowe score comparison with number of anchors.

Rowe score comparison		Anchors used			
		2 anchors		More than 2 anchors	
		Count	Column (N%)	Count	Column (N%)
Rowe at 6 months postop	Excellent (90-100)	22	88.0	7	100.0
	Good (75-89)	0	0.0	0	0.0
	Fair (51-74)	3	12.0	0	0.0
	Poor (< 50)	0	0.0	0	0.0

\*Pooled Chi square = 0.9,  $p=0.32$ .

None of the patients in the study had any recurrent dislocation or other associated complications, and all patients reported excellent satisfaction following the surgical procedure with an average limitation of  $5^\circ$  external rotation.

From the statistical analysis it is seen that all patients had similar functional outcome irrespective of the number of suture anchors used indicating that, proper patient selection for the appropriate procedure and good surgical technique with proper placement of anchors can give satisfactory results to the arthroscopic Bankart repair.

**DISCUSSION**

The high dislocation rate statistics during earlier days of arthroscopic repair, have gradually reduced and have now become comparable to open procedures due to the development of newer surgical techniques and better patient selection.<sup>13</sup> The meta-analytic study conducted by Hobby et al also concluded that arthroscopic surgery using suture anchors is on par with open surgery in terms of long term failure rate and functional outcome.<sup>14</sup>

The failure rate following arthroscopic Bankart repair was reported to be 7% when combined with thermal capsulorrhaphy according to Mishra et al.<sup>15</sup> Similarly, Ide et al reported failure rate of 7% on performing arthroscopic Bankart repair in young, athletic patients.<sup>16</sup> Erkoçak et al reported a 2.5% failure rate.<sup>17</sup> In 2012, Sharma et al reported no dislocations following their procedure which was in comparison with our study where none of the patients had recurrence.<sup>18</sup>

Mean limitation of external rotation movements of the shoulder post op was found to be reported as  $3^\circ$  by Arciero et al,  $4^\circ$  by Kim et al,  $5^\circ$  by Gartsman et al, and Synder et al.<sup>19-22</sup> Similarly, mean external rotation limitation in our study was  $5^\circ$  in our patients postoperatively.

The ISIS was unable to predict the risk of failure after arthroscopic Bankart repair as none of the patients in the study showed recurrence of instability which was in agreement with other studies conducted by Bouliane et al and Chan et al.<sup>23,24</sup>

According to Boileau et al, the number of fixation points were found to be a factor in determining the success of the arthroscopic repair and they recommended a minimum of 4 suture anchors to be used.<sup>25</sup> Suture anchors must be placed in appropriate number and position. Capsulo labral repair was performed using at least three anchor insertion by Karlsson et al, Kim et al, Fabriciani et al and Ide et al.<sup>3,4,16,20</sup>

In our study, for majority of the patients 2 suture anchors were used (78.1%), and depending on the size of the Bankart lesion, 3 (15.6%) and 4 (6.2%) were also used and we found that the number of suture anchors did not determine the final functional outcome as majority of the patients in our study were operated using 2 suture anchors. This was in agreement with the study conducted by Yan et al who concluded that type of anchors, number of anchors, and presence of bony Bankart lesion did not influence functional outcome.<sup>9</sup> Lagen et al, with 4 years follow-up found that successful shoulder stabilization can be achieved with fewer than 3 anchors, and a single anchor is usually sufficient when placed using the purse string technique is usually sufficient.<sup>26</sup> Levy et al reported success with use of a single purse-string suture anchor in a series of 36 patients treated arthroscopically.<sup>27</sup>

Thus, we hypothesize that proper patient selection and adequate positioning of the anchors with meticulous surgical technique is more important in determining the functional outcome rather than the number of anchors used for fixation.

## CONCLUSION

In conclusion, this study shows that arthroscopic Bankart repair for anterior shoulder instability is a useful and successful procedure. Patient identification and selection remains the key in determining the success of the repair. Meticulous surgical technique and correct positioning of suture anchors play a crucial role in determining the final functional outcome and may also help in reducing the number of suture anchors, thereby reducing the economic burden on the patient.

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