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A study of functional outcome of arthroscopic bipolar repair in recurrent anterior shoulder dislocation

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Abstract
Background: The present study aimed to determine whether arthroscopic remplissage with Bankart repair (bipolar repair) is an effective treatment for improving outcomes for the young patient with Bankart and Hill-Sachs lesions
Materials and Methods: The study consisted of patients diagnosed with anterior shoulder instability treated with arthroscopic bipolar fixation (arthroscopic remplissage with Bankart repair) at BIRRD (T) hospital Tirupati. The study was a Prospective, Observational study with a minimum follow-up of 1 year. The study will be from October 2021 to November 2022 with a minimum sample size of 60 patients.
Follow-up included subjective evaluation of pain, return to sports activity and limitation of work etc. Physical examination included range of movements, instability testing including apprehension test. Functional outcome was evaluated with Walch-Duplay score at 3 months, 6 months and at 1 year and UCLA SCORE (the University of California at Los Angeles Shoulder Score) were done at 1 year of follow-up.
Results: The mean age was 28.9 years with a mean follow-up of 12 months. Predominately males, involving right side with 1-2 episodes of dislocations after 1st. All mean scores improved, 66.6% and 23.8 of patients had excellent and good ULCA score respectively. 95.2% of patients had Good to Excellent Walch-Dupley's Score. There was a mean deficit in external rotation at the side of 10. One patient had residual posterior discomfort but no apprehension. One patient had supraspinatus tear after 8 months of surgery following a traumatic episode.
Conclusions: This bipolar fixation technique demonstrated good outcomes, with lower recurrence rates. The slight restriction in external rotation does not significantly affect any clinical outcomes and return to play and daily routine.

Keywords: Bipolar repair, bankart repair, non-engaging Hill-Sachs, remplissage, shoulder instability

Introduction
Shoulder joint gives wide range of motion at various positions in three-dimensional space by using the glenohumeral joint as a fulcrum. Shoulder by virtue of its anatomy and biomechanics, is one of the most unstable and frequently dislocated joints in the body, accounting for more than 50% of all dislocations, with a 2% incidence in the general population [1].
Main complication of shoulder dislocation is recurrent instability and it accounts for an average of 70-90% recurrence rate in patients between 20-40 years of age. Following dislocation injuries occur to surrounding structure such as bone, cartilage and soft tissues, resulting in various pathological conditions which is less understood.
The Bipolar nature of the shoulder dislocation pathologies need to be understood, the anterior pole and the posterior pole. Anterior pole consists of Bankarts and capsular lesion. The posterior pole lesion consists of Hill-Sachs lesion, rotator cuff tear and capsulotendinous structures avulsion and stretches [2].
Surgical management is done either by open procedure or arthroscopically by reattaching the labro-ligamentous complex to glenoid. For recurrent instability arthroscopic repair has become the standard of care. Following isolated Bankart repair, numerous studies have reported more than 11% average failure rates in the recent years despite advanced technique and materials.

Along with anteroinferior capsulolabral complex (Bankarts lesion) etc, posterior musculotendinous structures will be stretched in recurrent episodes of instability.

By treating only anterior complex may not give expected results in all cases. To address this a " Bipolar Fixation " concept has come to woke. Bipolar fixation is a combined anterior capsulolabral structures stabilization along with posterior capsulotenodesis of infraspinatus on to the posterior- superior area of the humeral head with or without Hill-Sach's lesion [3].

The purpose of this study is to analyse the functional outcomes of arthroscopic bipolar fixation of anterior shoulder instability treated with suture anchors.

Aim and Objectives

Aim: To analyse the functional outcomes of arthroscopic bipolar fixation of anterior shoulder instability with a minimum of 12 months follow up.

Objectives

1. Understanding importance of posterior stabilizing structures (Dynamic / Static) in the pathology of shoulder instability
2. To address the pathogenesis of anterior shoulder instability both anterior and posterior pole
3. Analysing the functional outcomes of shoulder joint following Bipolar Fixation
4. Studying the criteria for Posterior Fixation after stabilization of anterior structures.

Materials and Methods

The study consisted of patients diagnosed with anterior shoulder instability treated with arthroscopic bipolar fixation at BIRRD (T) hospital Tirupati.

The study was a Prospective, Observational study with a minimum follow-up of 1 year. The study will be from October 2021 to November 2022 with a minimum sample size of 60 patients.

Method of collection of data

Patient diagnosed with anterior shoulder instability, operated with Arthroscopic Bipolar Fixation have been evaluated during the hospital stay, later on during the rehabilitation period and functional outcome were assessed. Necessary radiological and routine investigations were done. Intra-operative surgical details were noted. Intense post-operative rehabilitation was done at weekly interval for 6 weeks and later on follow-up evaluation were done at 3 months, 6 months and 1 year.

Follow-up included subjective evaluation of pain, return to sports activity and limitation of work etc. Physical examination included range of movements, instability testing including apprehension test. Functional outcome was evaluated with Walch-Duplay score at 3 months, 6 months and at 1 year and UCLA SCORE (the University of California at Los Angeles Shoulder Score) were done at 1 year of follow-up. Rate of recurrence were noted.

Inclusion criteria

Patients with Age group between 13-50 years. Radiological evidence of glenohumeral dislocation, Recurrent anterior instability from a traumatic etiology, Initial traumatic anterior instability in a high- level athlete or high demand work activities or interfering with daily activities.

Exclusive Criteria

Patients Medically unfit for surgery, Patients with Large Hill-Sachs lesion > 30% bone loss and Bony Bankart's lesion representing > 25% of glenoid lesion, Habitual Dislocates, Uncontrolled Epileptic patients, Patients with psychiatric disorders, Patients with Multidirectional Instability -Connective disorders such as Ehlers-Danlos, Marfa Syndrome, Non-Complaint patients with post-operative rehabilitations & limitations, Patients with Paresis of deltoid, rotator cuff or pericapsular musculature, Patients with Axillary nerve injury.

Procedure

General anesthesia is preferred because hypotension is maintained better and patient positioning. Lateral decubitus position with traction was used for all patients. Lateral decubitus position is used because visualization of the posteriosuperior area is better in this position as the posterior space opens up and it is more comfortable to place the anchors on to this area in this position. The arm is positioned in 40-45 degrees of abduction and 10-15 degrees of forward flexion and neutral rotation using adhesive traction. (Figure 1) Following patient positioning and preparing of the surgical field, superficial skin markings of bony anatomical landmarks (acromion, spine of scapula, lateral end clavicle and coracoid process)is done to guide portal placement. (Figure 2). Posterior portal is the primary viewing portal and is the first one to be placed. Diagnostic Arthroscopy performed Visualization of Capsulo-labral complex for tears, labarum, Hill-Sachs lesion, biceps and Rotator cuff is evaluated for any articular sided lesions. Anteriosuperior portal and lateral portals made for performing repair. bankarts repair and hill sach's repair performed with help of all sutures anchors. (Figure 3, 4).

Fig 1: Position

Fig 2: Surface marking

Fig 3 4: Anchors in hillsach's area and bankarts repair

Results

Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5% level of significance. Majority of the patients were in the age group between 21 to30 years (57.14%). Mean age 28.9047619±10.13363. Most of the patients were males

(90.50%). (66%) patients had their Right shoulder involved reason may because of right side dominance. 66.7% of the people were playing recreational sports and rest had normal mobile lifestyle. (51.9%) patients had 2-3 dislocation episodes. UCLA TOTAL SCORE: 90% of patients had well to excellent results. 10% had average results (table 1). There was significant improvement in Daily Activity/Sports, Strength, Pain, Mobility and range of motion (rom) (shown in table 2 and 3 respectively). Walch duplays score at 1 year of follow up 95% of patients had good to Excellent Functional outcome. (table 4). There was a mean deficit in external rotation at the side of 10. One patient had residual posterior discomfort but no apprehension. One patient had supraspinatus tear after 8 months of surgery following a traumatic episode.

Table 1: UCLA Total Score distribution

Total Score	Patients(n)	%
0-20 (Poor)	0	0.0
21-27 (Average)	6	10
28-31 (Good)	14	23.4
32-35 (Excellent)	40	66.6
Total Score	60	100.0

Mean ± SD: 31.71±3.67

Table 2: Walch duplays score

Walch duplays score (out of 100)	Pre op	At 3 months	At 6 months	At 1 year	Difference @ 1Y	P value
Daily Activity/Sports	13.81±2.18	14.76±1.09	18.33±4.83	19.76±5.12	5.952	<0.001**
Strength (S)	15.71±5.07	24.05±3.01	24.52±2.18	24.52±2.18	8.810	<0.001**
Pain (P)	15.95±3.01	20.24±5.12	23.57±3.59	23.57±3.59	7.619	<0.001**
Mobility (M)	15.71±5.07	18.81±4.98	24.52±2.18	24.52±2.18	8.81	<0.001**
TOTAL	60.48±8.35	77.38±8.00	91.43±7.93	92.86±8.45	-32.381	<0.001**

Table 3: Range of Movements

Range of Movements	Pre op	At 3 months	At 6 months	At 1 year	Difference @ 1Y	P value
FE	138.10±15.04	149.52±10.71	158.09±6.02	158.10±6.02	20.000	<0.001**
CBA (cross body adduction)	40.95±4.36	48.57±4.78	49.52±2.18	49.52±2.18	8.571	<0.001**
ER	61.90±8.73	73.33±9.66	86.19±10.71	90.00±8.37	28.09	<0.001**
IR	47.14±7.84	58.10±7.50	64.76±7.50	65.24±6.02	18.095	<0.001**

Table 4: Walch Duplays Score (Out Of 100)

WD	Pre-op	At 3 months	At 6 months	At 1 year	% change
<50; Poor	6(10%)	0(0%)	0(0%)	0(0%)	-9.5%
Average: 51-75	54(90%)	20(33.4%)	3 (5%)	3(5%)	-85.7%
Good: 76-90	0(0%)	40(66.6%)	37(61.6%)	28(46.7%)	46.7%
Excellent:91- 100	0(0%)	0(0%)	20 (33.4%)	29(48.3%)	48.3%
Total	60(100%)	60(100%)	60(100%)	60(100%)	-

Discussion

Glenohumeral /Shoulder Instability results from varying levels of applied stress (a single traumatic event v/s cumulative micro-trauma), the relative risk of injury associated with an activity, the quality, integrity & strength of stabilizers. With recent enthusiasm for recreational and sporting activities, the incidence of Shoulder instability is on rise, especially in young athletics & active population. Because of complexity of shoulder joint and young population to treat, shoulder stability has assumed importance. Previously, according to Perthes & Bankart it was believed that a Single Essential Lesion creates instability. Now the current belief is that multiple mechanisms & anatomic variations combine to give an unstable shoulder.

In spite of all recent advances and techniques, still the recurrence rate remains high. The role of posterior lesions in shoulder instability have been well documented in the literatures. Hill-Sachs lesion prevalence ranges from 45%-93% [7, 8, 9]. Only the Engaging Hill-Sachs [5] lesion is treated, even though the Hill-Sach's lesion has to be engaged at least once in order to produce instability. Failure to quantify and treat these lesions, may lead to recurrences.

In presence of capsular laxity, treating anterior lesions alone have more recurrence rate [12, 13, 14]. Neer *et al*. [6], have proposed capsular shift and closure of rotator interval along with anterior repair. Posterior lesions form an important part of pathology of recurrent instability. Whenever there is anterior dislocation, there has to be tear and stretching of posterior structures. As a result, treating anterior lesions alone and neglecting posterior structures lead to failure of isolated Bankart repair.

Posterior capsuloligamentous structure undergo plastic deformation along with laxity. Hence along with anterior Bankart's repair posterior tenodesis of infraspinatous and posterior capsule is done on to the bare area inferior and lateral to Hill-Sachs lesion. Irrespective of presence or absence of Hill-Sach's lesion tenodesis is done.

Addressing both anterior and posterior structures, provides a stable fixation and centering of humeral head over glenoid when compared to anterior Bankarts fixation alone.

This procedure not only makes this bipolar fixation of Hill-Sach's extra-articular, it also prevents it from engaging and by creating of posterosuperior sling which acts as a restraint in anterior inferior dislocation. Overall effective volume of the shoulder is decreased which is difficult to quantify.

The shortening of the infraspinatus tendon decreases the external rotation strength in the initial days before the muscle adjusts to the new lengthening. Indirectly increasing the internal rotation force couple leading to decreased rate of recurrence.

The main principal in fixing the instability in two planes (anterior and posterior planes) is in accordance with the injuries identified (Anterior-Bankart; Posterior Hill-Sach's)

In 2009 Bipolar Fixation concept was developed by Dr. A Hemanth Kumar along with Dr. Kany Jean in Toulouse, France. The concept is mainly laid on logical thinking that once shoulder has dislocated it has engaged and the concept of deciding the lone of treatment whether to fix the Hill-Sachs based on the engaging and non-engaging concept stands doubtful [14, 15].

Bipolar fixation concept started not only to address the visible Hill-Sachs lesion but also to treat non- quantifiable posterior capsule tendinous laxity, stretching.

It is well understood that the amount of bony lesions of glenoid and humeral head or soft tissue are not in correlation with the recurrence rate. The severity of these injuries increases with number of dislocations. These injuries in one way or the other are pointing at the friction generated by the musculotendinous force couple which is the primary cause for these injuries.

The atraumatic painless dislocation where the lesions are bare minimally identifiable on MRI is contradiction for any surgical intervention. Voluntary dislocation also falls under the same group where there is loss of synchronization of shoulder proprioception (Most of these injuries have underlying psychological problems).

Results of our study were compared Gartsman *et al*. [10] and Amit Mishra *et al*. [11], performed arthroscopic Bankart repair, capsular plication, and if necessary thermal capsuloraphy in 53 patients with antero-inferior shoulder instability. After 2 years follow-up good and excellent results were 92%, and 7.5% of them had recurrence. Amit Mishra *et al*. had 72% excellent and 14% good results by UCLA scoring scale in 50 patients.

Conclusions

This bipolar fixation technique demonstrated good outcomes, with lower recurrence rates. The slight restriction in external rotation does not significantly affect any clinical outcomes and return to play and daily routine.

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Ethical Review and Patient Consent

All patients gave their agreement prior to enrolment and the study was approved by the local hospital institutional review board.

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