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RESEARCH ARTICLE

RECURRENT ANTERIOR SHOULDER DISLOCATION TREATED BY OPEN INFERIOR GLENOHUMERAL LIGAMENT RECONSTRUCTION

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Abstract

The anterior capsulolabral complex repair with inferior glenohumeral ligament reconstruction has been encouraging predominantly in young active population, and heavy workers with traumatic anterior shoulder dislocation. The aim of this study was to assess the clinical outcome of patients who underwent inferior glenohumeral ligament reconstruction for recurrent traumatic anterior shoulder instability by the open method. A prospective study of 40 patients with a mean age of 30 years (20 – 50 years) who underwent open reconstruction of the inferior glenohumeral ligament (RIGHL) to treat traumatic recurrent anterior shoulder dislocation was conducted. All patients met the criteria for inclusion in the study. They had traumatic anterior shoulder dislocation with subsequent recurrent instability. All were males with no professional athletes among them. Detachment of the dominant shoulder from the glenoid margin was found in all cases . No patient had surgical intervention before. Twenty patients had the right shoulder affected. All patients were evaluated by physical examination and followed for a minimum of 6 months (15-80 months). Rowe score was used for the clinical assessment of patients. The mean modified Rowe score was 93.3% (65% -100%) with 92.3% good and excellent results. There were 14 excellent, 10 good, 5 fair, and 3 poor results due to redislocation after major trauma (RTA). There was no loss of range of motion compared to preoperative values. These observations point out that glenoid sided capsulolabral repair can reestablish shoulder stability in patients with recurrent traumatic anterior dislocation, and success rates comparable to those of other open anterior shoulder repair procedures can be achieved. Although arthroscopic repair for recurrent shoulder instability is a choice for most surgeons nowadays, open repair remains an excellent option and should not be forgotten especially with the lack of experience or arthroscopic availability.

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Introduction:-

The glenohumeral joint allows for 6° of freedom, making it the most mobile joint in the body, as well as the most likely to dislocate. Together with the elbow, it allows us to place our hands in space to perform activities of daily living to more complex movements seen in overhead sports. While the minimal bony restrictions allow the shoulder maximal mobility, the shoulder must rely upon static and dynamic stabilizers for stability¹. Static stabilizers include the glenohumeral ligaments and the glenoid labrum. Dynamic stabilizers comprise the rotator cuff, long head of the

biceps tendon, scapulothoracic muscles, and other shoulder girdle muscles such as the pectoralis major, latissimusdorsi, and serratus anterior². Shoulder instability can be caused by traumatic injuries, atraumatic injuries due to repetitive microtrauma, or pre-existing generalized ligamentous laxity. Athletes involved in contact sports are at particular risk for this injury. Symptoms range from recurrent dislocation to joint instability and activity-related pain. Anterior instability is the most common, usually due to a fall onto an outstretched arm with the shoulder in abduction and external rotation¹. A population study has estimated the incidence rate of anterior shoulder dislocation in the general population as 0.08 per 1000 person a year, however, this number is likely higher in the young athletic population with estimates of 1.69 /1000 person a year, in US military recruits³. A less common forms of shoulder instability are posterior and multidirectional instability^{4,5}. Posterior instability is most commonly caused by a traumatic event with the shoulder in flexion, adduction, and internal rotation⁴. Multidirectional instability is symptomatic instability in two or more planes, and usually has an insidious onset of ill-defined pain with activity in the second or third decade of life⁵. Anterior shoulder instability due to a traumatic cause is often associated with a Hill–Sachs and/or Bankart lesion. A Hill–Sachs lesion is a compression fracture of the posterolateral humeral head and usually results from anteroinferiorglenohumeral dislocation⁶. Many authors have evaluated the critical glenoid bone loss that is associated with recurrent instability, reporting it to be between 13.5% to 25%⁷⁻¹⁰. Evaluating patients with shoulder instability mandates an extensive history including dislocation episodes and previous treatments, mechanism of trauma, number of dislocations, occupations and vocational activities, and previous surgery¹¹. A thorough examination of both shoulders including palpation, range of motion (ROM), and neurovascular exam should be performed. Anterior instability tests include anterior load and shift, apprehension and relocation, anterior release, and anterior drawer test. Posterior instability tests include the jerk test, Kim test, posterior load and shift, and posterior drawer test. Inferior instability tests include sulcus and Gagey test^{1,11}. Calculating a Beighton score can help identify patients with generalized laxity. Radiographs including AP, lateral, and axillary views should be obtained in all patients. On assessing glenoid bone loss and Hill–Sachs lesions, a West Point axillary view and Stryker notch view, respectively, should be obtained⁶. Computed tomography (CT) scan is the best tool for evaluating bone loss and is important in decision making and preoperative workup. Conservative treatment of anterior shoulder dislocation includes immobilization followed by early rehabilitation¹. Typically, immobilization can last from one to two weeks. Rehabilitation entails strengthening the dynamic stabilizers of the glenohumeral joint. However, there is still debate about the treatment of first-time dislocations as conservative treatment results in a higher recurrence rate and may even increase bone loss over time¹².

Currently most prevailing treatment for anterior shoulder instability remains arthroscopic Bankart repair, despite failure rates as high as 26% have been reported¹³⁻¹⁷. Risk factors for recurrence following arthroscopic method include multiple previous dislocations, glenoid bone loss, presence of an off-track Hill–Sachs lesion, and the duration the patient had been symptomatic¹⁸. In patients with these characteristics, open stabilization techniques including open Bankart repair, Latarjet capsular shift, and glenoid bone grafting can be considered as alternatives, that may afford more optimal long-term results. The purpose of this study was to assess the clinical outcome of patients who underwent inferior glenohumeral ligament reconstruction for recurrent traumatic anterior shoulder instability by the open method.

Material And Method:-

This interventional prospective study was conducted at Al Jalaa trauma hospital, a teaching hospital that belongs to the faculty of medicine, Benghazi University. A total of 40 patients with recurrent anterior shoulder dislocation were admitted to the orthopedic department in the period from 2004 to 2017. The patients' age ranged from 20 to 50 years (average 30 y.). Open anterior capsulorrhaphy by reconstruction of inferior glenohumeral ligament (RIGHL) was performed in all patients. All patients had traumatic anterior shoulder dislocation at the first episode then recurrent attacks ranged from 4 to 14 attacks of instability (average 4.5 incidents). All patients were males with the dominant shoulder was involved in 20 patients. The mean duration of symptoms was 3.9 ± 2.07 SD years (range 0.75 – 11 years). The study did not include professional athletes. All patients were subjected to preoperative evaluation for signs of instability. Positive apprehension and relocation tests were seen in all patients. The range of motion was clinically assessed preoperatively and post operatively. Active and passive forward elevation were measured, as well active and passive external rotation. All patients had the same procedure of open capsulorrhaphy with IGHIL reconstruction and were operated on by the same surgical team. The mean follow-up was 3.6 years (range 15-80 months).

Postoperative Rehabilitation

Postoperatively, the operated shoulder is put in a sling for 6 weeks. Phase I rehabilitation starts immediately with passive ROM up to 30° of internal rotation and 60° of external rotation for 6 weeks. Phase II lasts from 6-9 weeks and includes active-assisted ROM, isometrics, active ROM, and progression to low-load prolonged stretches. Phase III lasts up to 9 weeks with initial resistance and strengthening stage including strengthening and proprioception exercises in external rotation, internal rotation, initial closed-chain stability, and overhead activity. Phase IV lasts for 10-21 weeks with external rotation at 45° and reaching 90° at week 13. The criteria for a return to full activities include functional, pain-free active ROM; maximized strength; and proper scapulothoracic mechanics.

Surgical Technique¹⁹

Open Bankart repair with capsular shift was performed. The procedure was done under spinal anesthesia with the patient lying in a supine position with the injured side bolstered up by 40° - 50°. A limited deltopectoral approach begins with a skin incision 2-3 cm below the coracoid and extended vertically to the anterior axillary skin fold far enough to carry out the planned procedure. The cephalic vein with the deltoid is reflected laterally and a finger is bluntly pushed down to the subscapularis tendon overlaying the humeral head. Retractors are placed deep to the deltoid laterally and the pectoralis major medially. The loose film of tissue covering the subscapularis tendon is removed. The conjoint tendon is identified as it runs superiorly to its intersection on the coracoid process. The medial retractor is passed deep to the conjoint tendon for further medial retraction. The subscapularis is incised 1.5-2 cm medial to the bicipital groove and dissected off the anterior capsule then the anterior capsule overlaying the humeral head is exposed. The glenoid and scapular neck are adequately exposed. A vertical incision is made in the capsule midway between the bicipital groove and anterior margin of the glenoid, and the capsule is opened then the joint is inspected to determine the center of the capsular detachment from the glenoid. The focal point of instability may be anywhere on the rim, from the straight anterior (3 O'clock) to straight inferior (6 O'clock) but usually in between. The sites of the focal point determine the location of the next capsular cut. The capsule is incised from the mid-portion of the vertical incision in the medial direction to the focal point on the glenoid, creating a side-lying T opening in the anterior capsule. If the capsule is detached from the neck of the scapula, vigorously scarify this area with a curette. Capsular reattachment alone may be sufficient to reconstruct IGHL. First suture the lateral leaf of the capsule to soft tissue overlying the glenoid to the degree of tightness that will permit 20°-30° of external rotation. Then reflect the interior leaf of the T laterally and superiorly and suture it to the humeral stump of the subscapularis tendon. The capsular shift tightens or reconstitutes the IGHL and probably is the heart of the reconstruction. Then reflect the superior leaf laterally and distally and suture it to the subscapularis tendon stump. Reattach the free medial subscapularis tendon anatomically to its stump on the humeral head without overlap.

Results:-

All data were collected, tabulated and statistically analyzed using SPSS 22.0 (Statistical packages for social sciences) for windows (SPSS Inc., Chicago, IL, USA). Data were checked for normal distribution by Shapiro-Wilk test. Qualitative data were represented as frequencies and relative percentages. Chi square test (χ^2) and Fisher exact test were used to calculate difference between qualitative variables as indicated. Quantitative data were expressed as mean \pm SD (standard deviation) for parametric, and median and range for non-parametric data. Paired t-test was applied for comparison between two dependent groups of variables with normal distribution. All statistical comparisons were two-tailed with significance level of P value ≤ 0.05 indicates significant, P < 0.001 indicates highly significant difference while P > 0.05 indicates non-significant difference. All patients were males with middle-aged males are the most affected with an average age of 30 years (Range 30-50 y). The dominant shoulder was affected in 50% of cases. The time between the first episode and treatment ranged from 9 months to 132 months. The mean symptoms duration was 3.9 ± 2.07 SD years (range 0.75 - 11 years). The mean follow-up was 3.6 years (range 15-80 months). Eight patients were missed to follow up. No surgery-related death or incision-related superficial or deep infection were encountered in any case. No neurovascular complication was seen. The shoulder functional evaluation was done using modified Rowe score which consists of a total of 100 points divided into three domains: (1) stability, which corresponds to a total of 50 points; (2) mobility, which corresponds to 20 points; and (3) function, which corresponds to 30 points. Stability is tested by the absence of recurrent subluxation or absence of apprehension sign (50 points), apprehension sign in variable positions (30 points), presence of subluxation without the need for reduction (10 points), and recurrent dislocation (0 points). The results were rated as 14 excellent, 10 good, 5 fair, and 3 poor (Table 1), with mean modified Rowe score of 93.6 ± 9.41 SD (range 65 - 100). Patients with poor outcome had redislocation due to major trauma. There was a significant increase in active forward elevation up to 170° compared to the preoperative level of 160° degree (Table 2). No significant change was found in passive forward elevation (Table 3). There was a significant increase in active external rotation up to 60°

compared to the preoperative level of 50°, with an increase in passive external rotation from 60° preoperatively to 65° postoperatively with no statistically significant difference (Table 4). Figure (1) shows the clinical photos of one of the study group patients with excellent score after two years of surgery. As regarding demographic data of the studied population, smoking is the commonest comorbid among the patients (45%), then HTN (15%), and D.M (10%). No patient had a previous surgery .

Table 1:- Outcome of the study group.

Outcome	(N=32)
Excellent	14 (35%)
Good	10 (25%)
Fair	5 (12.5%)
Poor	3 (7.5%)

Table 2:- Range of elevation of the study group.

Range of elevation	(N=32)
140° – 149°	2 (5%)
150° -159 °	3 (7.5%)
160° – 169 °	7 (17.5%)
170° – 180 °	16 (40%)
>180°	4 (10%)

Table 3:- Active and passive forward elevation of the study group.

Active and passive forward elevation	(N=32)		(P) value
	Preoperative	Postoperative	
Active forward elevation Mean ± SD	160.21° ± 12.34°	170° ± 11.29°	0.001*
Passive forward elevation Mean ± SD	169.78° ± 10.65°	170.1° ± 11.18°	0.871

Table 4:- Range of external rotation of the study group.

Range of external rotation	(N=32)
30° – 39°	3 (7.5%)
40° – 49°	3 (7.5%)
50° – 59°	5 (12.5%)
60° – 70°	15 (37.5%)
> 70°	6 (15%)

Fig.(1) Post op. photos with scar at Lt. shoulder (A), active abduction and external rotation (B and C), active forward elevation(D), active abduction (E), and active extension and internal rotation (F).

A



B



C



D



E



F

**Discussion:-**

Successful surgical treatment of anterior glenohumeral instability traditionally was measured in terms of postoperative maintenance of stability. A variety of open stabilization techniques were used with an excellent result concerning recurrent instability. This study was conducted to assess operative management of recurrent anterior shoulder dislocation by open inferior glenohumeral ligament reconstruction (RIGHL). All patients reported traumatic anterior shoulder dislocation with subsequent recurrent instability. In 95% of all anterior shoulder dislocations patients' age at the time of injury is the most important predicting factor for recurrence. Other risk factors include an early return to competitive contact sports and poor compliance to rehabilitation program²⁰. Regarding clinical characteristics of the studied population, side affection was equal on both sides also the dominant shoulder was equal. The treatment of anterior shoulder instability is determined by the type and extent

of instability, besides factors like age, episodes of dislocations, activity level, and the presence or absence of other injuries in the glenoid and/or humeral head. The postoperative interval should be followed up early by a physiotherapist to control pain, restore range of motion and muscle strength, as well as to correct balance between the forces that act on the shoulder girdle, to get maximum functionality of the shoulder²¹. Various measuring tools can be used to safely evaluate the functional results in the postoperative period of anterior shoulder instability. These include the Rowe Score, initially described in 1978 to evaluate postoperative results of Bankart repair²². The Rowe and Walch-Duplay scores are most frequently used to assess shoulder instability²³. In our study, the mean modified Rowe score was $(93.6 \pm 9.41 \text{ SD})$, and ranged between (65 – 100%). Nasef, et al. evaluated arthroscopic management of acute traumatic primary anterior shoulder dislocation and found overall average modified Rowe's score of 41 points pre-operatively and 92.8 post-operatively out of 100 points in 30 patients which is comparable to our results and reflects the success of that procedure in controlling shoulder instability, though, in that study, all patients were operated by arthroscopy²⁰. In our study, 40% of the patients achieved $170^\circ - 180^\circ$ range of elevation, followed by $160^\circ - 169^\circ$ (17.5%), $> 180^\circ$ (10%), $150^\circ - 159^\circ$ (7.5%), and finally $140^\circ - 149^\circ$ (5%). Eight patients lost to follow-up. The active forward elevation showed a significant increase postoperatively ($P \leq 0.001$), but no significant change in passive forward elevation postoperatively ($P = 0.871$). Nasef, et al. in their study showed the range of elevation was $140^\circ - 180^\circ$, and the average postoperative forward elevation was 170° which is compatible with our results²⁰. Sang-Jin et al, in their study, had 33 patients who underwent arthroscopic Bankart repair after first episode dislocation before the age of 30 years and 89 age-matched patients who were treated arthroscopically for recurrent dislocation included as a comparison group. Their results showed increased anterior glenoid erosion in the recurrent dislocation group and a significant difference in the failure rate between the 2 groups. In the first-time dislocation group, one patient had redislocation and none showed a positive apprehension test. In the recurrent dislocation group, 6 patients had redislocation and 10 patients had positive apprehension tests. Among patients who showed positive apprehension eight had either anterior labral avulsion lesions or anterior glenoid bony erosion. The first-time dislocation group patients were significantly better satisfied with daily activities (93.0 ± 5.2) than recurrent dislocation group patients (82.7 ± 7.2 ; $p < 0.001$)²⁴. In our series, range of external rotation of $60^\circ - 70^\circ$ was achieved in 37.5%, followed by $> 70^\circ$ in 15%, $50^\circ - 59^\circ$ in 12.5%, $40^\circ - 49^\circ$ in 7.5%, and $30^\circ - 39^\circ$ in 7.5%. There was a significant increase in active external rotation postoperatively. Moreover, there was an increase in passive external rotation postoperatively without a statistically significant difference. Regarding functional outcome 14 patients (35%) had excellent, 10 patients (25%) had good, 5 patients (12.5%) had fair, and 3 patients (7.5%) had poor score. These results were satisfactory for most of our patients. Although open stabilization was reported as more effective than arthroscopic stabilization for post-operative recurrence rates in the 1990s, clinical outcomes have become similar with time. Technological improvements in arthroscopic instrumentation, as well as the development of innovative surgical techniques as a result of the cumulative experience with an improved understanding of the factors leading to failure in such patients, have played a key role²⁵. Fabbricani, et al in a prospective randomized trial, showed equal results between arthroscopic and open surgical repair of Bankart lesion for recurrence²⁶. In a recent prospective randomized clinical study comparing open and arthroscopic repairs, the difference in the life quality between the patients in the two groups was neither significant nor clinically important at two years follow-up; however, a significantly lower risk of recurrence was seen in patients with open repair²⁷. The surgical treatment of athletes participating in contact sports is still controversial. Rhee, et al in a comparison study of arthroscopic and open techniques in young contact athletes showed recurrent instability as 25% in the arthroscopic group and 13% in the open surgery group¹³. Athletic activity plays a significant role in post-operative recurrence more than the surgical method used for stabilization²⁸. In another study published in 2016, a systematic review of fifteen articles included a total of 693 patients with 705 shoulders aged 18 years or younger was done. A nonoperative approach was used in 411 shoulders, 293 (71.3%) experienced a redislocation compared with 55 of 314 shoulders (17.5%) that received surgical treatment. The results showed that the recurrence rate was significantly lower in the surgical group compared with the non-operative group²⁹.

Conclusion:-

The clinical outcome of open RIGHL was encouraging. Although three patients sustained significant trauma which lead to recurrence of dislocation, the other twenty nine had a good or excellent clinical result. Thus, this technique seems to be good treatment for recurrent anterior shoulder instability caused by soft tissue pathology which typically affects the young population.

Primary clinical approach should be the combination of a careful medical history, a detailed physical examination, and appropriate imaging studies to recognize changes leading to recurrence. Although many techniques have been

described, no consensus as to which one is superior therefore, surgeons should choose the most effective procedure tailored to every patient in a specific manner.

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