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ORIGINAL ARTICLE

Gleno-humeral arthritis following latarjet procedure: Risk-factors, progression and its impact on clinical outcome.

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ABSTRACT… Objective: To assess the postoperative glenohumeral arthritis following latarjet procedure: in terms of its prevalence, risk-factors and role in functional recovery. **Study Design:** Descriptive Case Series. **Setting:** Ghurki Trust Teaching Hospital, Lahore. **Period:** 01/06/2022 to 30/11/2022. **Methods:** Forty-one patient who underwent latarjet procedure were retrospectively assessed Arthritis staging was done as per Samilson and Preito classification and outcome was assessed in terms of pain (VAS), UCLA score and Rowe score. **Results:** All the three aforementioned outcome score showed a statically significant ($p<0.001$) improvement in mean measurement from 2.9, 20.82 and 33.41 to 1.36, 31.09 and 85.97 respectively for pain, UCLA and Rowe score. Nine patients had arthritic changes before surgical intervention whereas five developed arthritis in non-arthritic joints. Improvement in all the three outcome measures was noted in both arthritic and non-arthritic shoulders: however, mean improvement in pain, UCLA and Rowe scores were significantly lower ($p<0.001$) in arthritic (2.428, 28.28 and 79.64) as compared to non-arthritic shoulders (i-e 0.814, 32.55 and 89.25 respectively). Not only this, but the postoperative scores were dependent on the stage of arthritis. Factors found associated with progression of arthritis included number of preoperative dislocations ($p=0.009$), age at time of the procedure ($p<0.001$) and coracoid graft's lateral overhang ($p=0.002$). **Conclusion:** Latarjet procedure has excellent clinical results: however, it predisposes to postoperative arthritis; where preoperative dislocations, age and coracoid-graft's lateral-overhang are risk factors for the complication.

Key words: Bone-block Procedure, Glenohumeral Arthritis, Latarjet Procedure.

INTRODUCTION

Glenohumeral joint has a construct that favors wide range of motion at expanse of stability. This results in joint instability; that has previously been reported to be 2%.[1,2] When it comes to management of the aforementioned complication both arthroscopic and open approaches are being practiced, with somewhat overlapping list of indications. Literature revealed that arthroscopic stabilization has been performed since 1990s, but has higher rates of recurrence:[3,4] ranging from 3% to 35%.[5-6] In comparison to this, open management of Bankart lesion with capsular repair has a documented failure rate of only 5%[7-9] and the latarjet procedure results only in 0-5 re-dislocations. [10-13] % Thus, bone block procedures as latarjet are favorable in patients with high recurrence risk or those presenting with significant glenoid loss after traumatic shoulder instability.[14-17]

The Latarjet procedure was first described by Dr Latarjet in 1954 as coracoid process transfer via subscapularis tendon and securing it to antero-inferior aspect of the glenoid (Figure-1).[18] Patte then described the "triple blocking effect" (Figure-2): that includes conjoint tendons sling effect over subscapularis, bony coverage by graft and ligamentous effect of coracoacromial ligamentous stump.[19] Substantial clinical improvement with low recurrence rate after latarjet stabilization has repeatedly been reported.[14,15,20,21] But despite good clinical outcome, the procedure has documented complication rate of 5-30%.[15,22-25]

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Among the complications are neurovascular insults, hematoma formation, infection, graft malposition, graft nonunion or fibrous union, loose implant and arthritis.

Among the above-mentioned complications, glenohumeral arthritis is important as it chronically reduces function of the joint. A prevalence of arthritis as high as 36-71% has been demonstrated[14,25-28], and it has been found associated with age at first dislocation and time of intervention, number of preop dislocations, intra-articular implant, lateral-overhang of the coracoid-process, anterior tissue over tightening as well as longer follow up period.[20,21,26,29]

Thus, we aim to look into the results of latarjet procedure with special emphasis on postoperative glenohumeral arthritis. Arthritis' prevalence will be computed and its effect on mid to long-term clinical outcome will be assessed. Furthermore, risk factors associated with the complications will be determined. This will not only help determine efficacy of the procedure but will also help formulate guidelines to avoid or at least slow down the progression of arthritis. Our hypothesis is that arthritis and its progression is a possible complication that occur over long term and adversely affects the clinical outcome of the latarjet stabilization: where factors as age, number of preop dislocations and procedural factors like graft placement etc. are factors associated with development and progression of arthritis.

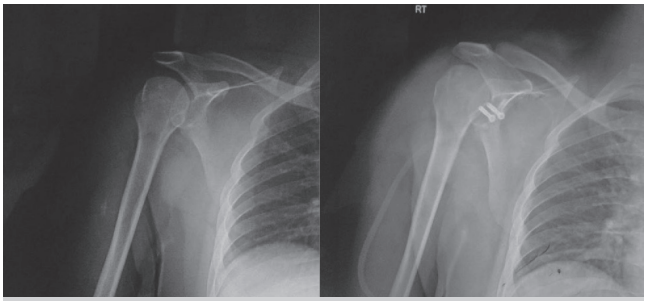

Figure-1. (Left) Preop & (Right) Postop X-rays illustrating transfer of coracoid process to anteroinferior glenoid and fixation with screws: the latarjet procedure

METHODS

The patients who underwent latarjet procedure for recurrent shoulder instability at Ghurki Trust Teaching Hospital, Lahore were retrospectively assessed over a six months study-period (from 01/06/2022 to 30/11/2022) after approval from institutional ethical committee (Ref. 2022/06/R-25). All the consecutive patients who underwent the procedure at the aforementioned institute were included in the study: provided they had documented postoperative follow-up of at least 3 years and had complete clinical and radiological data as per study requirements. Accordingly, a final sample of 41 patients was studied, where follow-up period was of 10.9±4.18 years.

Data collected from the patients included basic demographic details, level of activity, number of preop dislocations, age in years at the time of first dislocation as well as age at time of latarjet procedure.

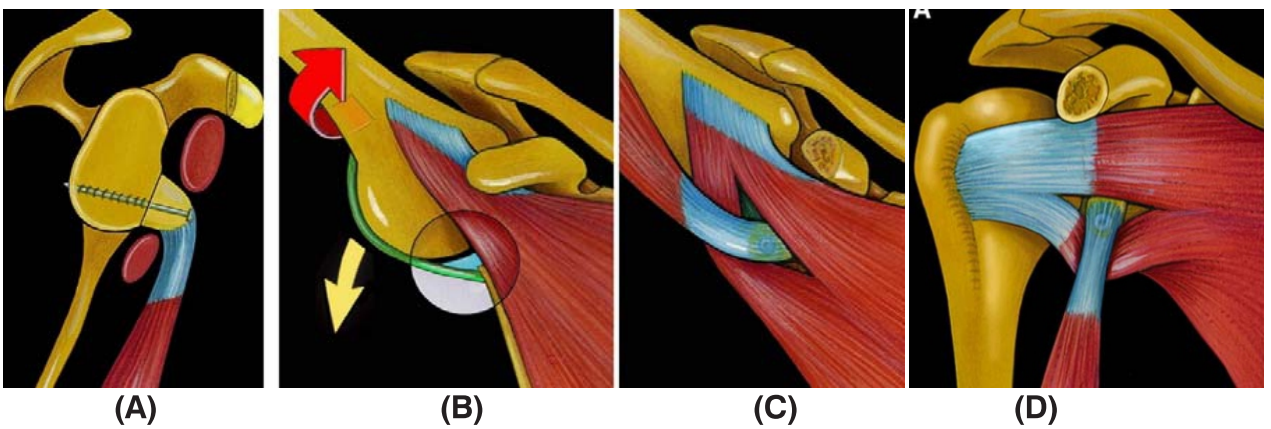

Figure-2. The triple blocking phenomenon (A) Implanted coracoid restores glenoid bone deficit by bone block effect. (B) Sling of conjoined tendon effectively limits anterior slippage in external rotation and abduction (C & D) Ligamentous restraint is provided by attachment of coracoacromial ligament stump to the medial aspect of the joint capsule.

Clinical assessment comprised of pain assessment as per visual analogue scale (VAS), Rowe score as well as UCLA score. At our setup patients are reviewed at 3-weeks, 6-weeks, 12-weeks (3-months) and 6-months; post operatively and undergo thorough clinical and radiological assessment alongside rehabilitation (done in collaboration with a fully equipped physiotherapy department).

Arthritis was graded on radiographs by the primary researcher as per Buscayret et al. modified Samilson and Prieto classification. In the aforementioned classification, <3mm humeral and glenoid osteophytes constitute stage 1, 3-7mm osteophytes with slight irregularity of the joint surfaces makes stage 2, osteophytes of >7mm size alongside joint space narrowing with sclerosis constitute grade 3; whereas complete glenohumeral joint space loss constitutes stage 4. Preoperative and postoperative arthritis was staged as explained; and progression, if any, was noted. Radiographic assessment also gave details regarding preoperative glenoid fracture and anterior bone loss whereas postoperative radiographs were assessed to determine position of coracoid process and graft union status. Graft position was defined flush if its lateral border was within 1mm of the glenoid surface. Where medial or lateral overhang signifies that the lateral edge of the grafted coracoid is fixed >1mm either medial or lateral to the surface of glenoid respectively.

Latarjet procedure has been explained in detail in literature. Procedure is being done here as per previously described technique. Patient is fixed in beech-chair position. A 5-6 cm vertical incision is used: that extend from tip of coracoid to the axilla. Through further dissection deltopectoral groove is identified and dissected to view coracoid process. Then coraco-acromial ligament is incised 1 cm lateral to the attachment at coracoid and pectoralis minor is dissected off the coracoid as well. A 3 cm coracoid graft is taken with help of an osteotome and graft's base is flattened with use of an oscillating saw to expose bleeding cancellous portion of the bone. Then a couple of 2.5mm drill holes are created in midline of the graft: 1 cm apart. Glenohumeral joint is approached by splitting subscapularis between upper two-thirds and lower one-third; followed by a vertical clean arthrotomy about 1cm medial to the anterior rim of the glenoid. After exposing the anteroinferior aspect of the glenoid, it is prepared by removing the labrum and periosteum, thus exposing bleeding cancellous bone. Then the grafted process of coracoid is fixed via two 3.5mm screws of adequately measured length. Here, medial or lateral overhang is avoided. This is followed by closure of the capsule and then layered closure of the wound.

Postoperative rehabilitation was carried out in collaboration of a fully equipped physiotherapy department. Rehabilitation protocol was usage of shoulder sling in "shaking hands" position and allowing pendulum exercises 1 day after the procedure. Then passive forward flexion was permitted after 3 weeks of the procedure; whereas, at 6-week follow-up active movement of flexion and passive external rotation were advised. At three-month visit, shoulder strengthening was initiated. While, sports and high-risk activities were only allowed after confirmation of satisfactory healing on clinical and radiological assessment.

IBM SPSS (23) was used for data entry and its analysis. Clinical outcome of latarjet procedure was determined in terms of improvement in pain, UCLA and Rowe scores by application of dependent sample t-test. This clinical improvement was stratified in terms of arthritic and non-arthritic shoulders as well as on the basis of stage of arthritis on last follow-up. t-test, chi-square and Fischer's exact test were applied to look into the association between various quantitative and categorical variables with progression of arthritis respectively.

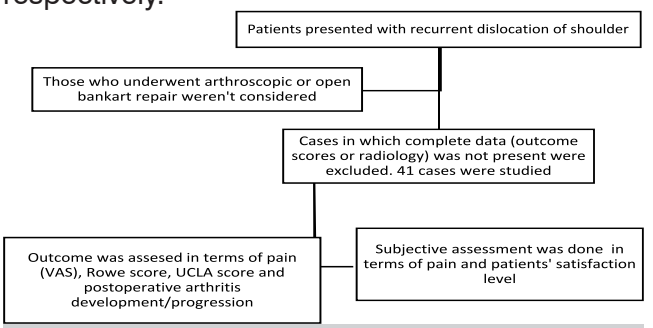

Figure-3. Study methodology

RESULTS

Preoperative Parameters

A total of 41 patients were studied to evaluate outcome of latarjet procedure. 80.5% (33) patients were male and 85.4% (35) got operated on their dominant side. Major presenting complaint was recurrent dislocation in 53.7% (22), recurrent subluxation in 7.3% (3) and combination of both in 39% (16) patients. Mean age at date of surgery was 30.95±8.5 yrs. where number of preop dislocations was 8.43 (ranging from 4 to 17). Number of interventions before this procedure were 3.2±1.87. Radiological analysis revealed bony bankart lesion in 41.5% (17), glenoid bone defect in 26.8% (11) and hill-sach's lesion in 63.4% (26). Preoperatively glenohumeral joint arthritis was evident in 9 (22%) patients: eight were graded as stage 2 while one as stage 1.

Postoperative Parameters

On radiologic assessment, graft even hang was noted in 73.2% (30) while medial and lateral overhang were evident in 12.2% (5) and 14.6% (6) patients.

Clinical Outcome

Three clinical parameters were considered in the study to evaluate clinical outcome of the latarjet procedure. (Table-I) Pain (VAS) improved significantly ($p<0.001$) from a mean of 2.90 to 1.36 with $t=10.09$. Similarly, highly significant ($p<0.001$) improvement in UCLA and Rowe scores were noted from preoperative values of 33.41 and 20.82 to 85.97 and 31.09 ($t=-35.44$ and -13.49) respectively.

Arthritis Progression

As mentioned above, preoperatively glenohumeral arthritis was evident in 9 (22%) shoulders: eight stage-1 and one stage-2. On the last follow-up, arthritis was evident on 14 x-rays: seven had stage-1, five had stage-2 whereas only two patients had stage-3 arthritis. Only 5 (12.1%) cases with no radiological signs of arthritis during preop assessment developed radiologically significant arthritis till the last follow-up. Further analysis signified that progression of arthritis was noted only in 8 cases (i-e. 5 normal shoulders became arthritic and 3 arthritic shoulders progressed to higher stage after the surgical intervention) (Figures-4,5).

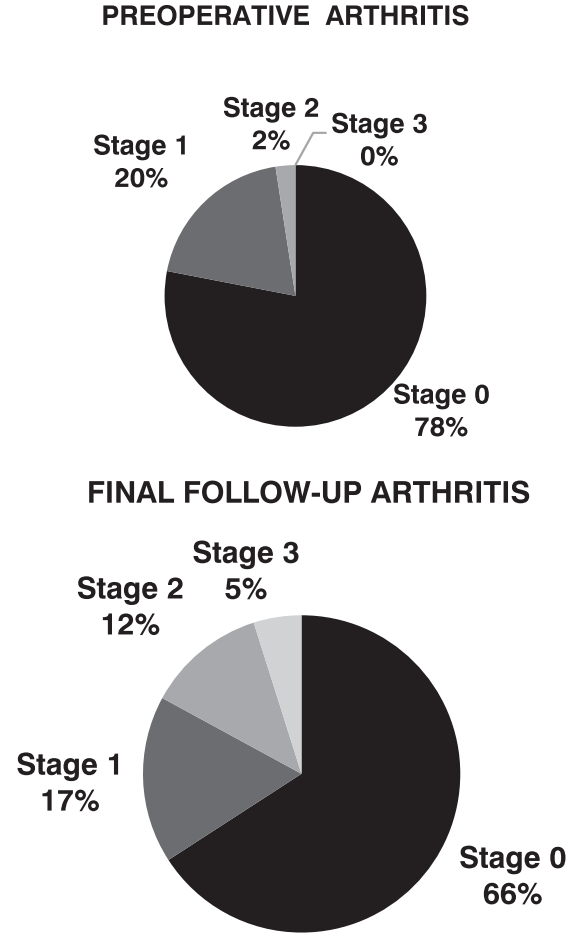

Figure-4,5. Signifying stages of arthritis both preoperatively and on the last follow-up

Correlation of outcome with glenohumeral arthritis

Arthritis affected the course of recovery and thus final outcome. Highly significant differences ($p<0.001$) for pain, Rowe and UCLA scores was noted on the final follow-up among arthritic and non-arthritic shoulders. Mean scores for pain, Rowe and UCLA were 0.814, 89.25 and 32.55 for non-arthritic shoulders and 2.42, 79.64 and 28.28 for arthritic shoulders, respectively. (Table-II) Stage of arthritis was a significant ($p<0.001$) independent factor, in determining the course of recovery following the procedure as evident by ANOVA analysis (Table-III).

Factors associated with progression of arthritis

Greater the age of the patient at time of the intervention, greater were the chances of progression of arthritis: as evident by significantly lower mean age of non-progressive cases (28.48±7.15 years) than that of progressive cases (41.12±5.89 years) with t=-4.621 & p<0.001. Similarly, comparison of number of preop dislocations had statistically significant t test result (t=-2.461, p=0.018) when a lower mean for nonprogressive cases. (Table-IV) Graft lateral overhang was the only graft position that was significantly associated with progression of arthritis (chi-square=9.951, p=0.009). (Table-IV)

Variable	Preoperative	Postoperative	t-value	P-Value
Pain (VAS)	2.90±0.86	1.36±1.11	10.069	<0.001
Rowe score	33.41±8.76	85.97±7.43	-35.446	<0.001
UCLA score	20.82±3.5	31.09±3.2	-13.491	<0.001
Range of motion				
Forward flexion	155° ± 8.3°	153° ± 8.85°	2.357	0.023
External rotation at side	61° ± 11.31°	52.68° ± 7.59°	5.662	<0.001
Internal rotation to back	T11 ± 2.82	T12 ± 2.55	-2.080	0.044
Abduction	152.68° ± 9.55°	149.75° ± 9.14°	1.840	0.073

Table-I. Inferential analysis (using dependent sample t-test) for clinical outcome following Latarjet procedure

VAS: Visual analogue scale, UCLA: University of California at Los Angeles

Variable	Not arthritic on last follow-up (n=27)	Arthritic in last follow-up (n=14)	t-value	P-Value
Pain (VAS)	0.814±0.78	2.428±0.85	-6.05	<0.001
Rowe score	89.25±4.53	79.64±7.95	4.94	<0.001
UCLA score	32.55±1.76	28.28±3.62	5.105	<0.001
Range of motion				
Forward flexion	153° ± 8.66°	154° ± 9.94°	-0.444	0.65
External rotation to side	52° ± 7.63°	53.57° ± 7.70°	-0.533	0.59
Internal rotation to back	T12 ± 2.61	T12 ± 2.50	-0.455	0.65
Abduction	151.66° ± 8.6°	146.07° ± 9.23°	1.918	0.06

Table-II. Difference in clinical improvement between arthritic and non-arthritic joints on final follow-up (Independent sample t-test)

VAS: Visual analogue scale, UCLA: University of California at Los Angeles.

Variable	Stage of arthritis on last follow-up	Mean	F	P-Value
Postop pain (VAS)	Stage 0 (n=27)	.8148 ± 0.78	12.79	<0.001
	Stage 1 (n=7)	2.7143 ± 0.95		
	Stage 2 (n=5)	2.2000 ± 0.83		
	Stage 3 (n=2)	2.0000		
Postop Rowe score	Stage 0 (n=27)	89.2593 ± 4.53	9.89	<0.001
	Stage 1 (n=7)	80.7143 ±5.34		
	Stage 2 (n=5)	76.0000 ±10.83		
	Stage 3 (n=2)	85.0000 ±7.07		
Postop UCLA score	Stage 0 (n=27)	32.5556±1.76	10.9	<0.001
	Stage 1 (n=7)	29.1429 ±2.96		
	Stage 2 (n=5)	26.4000 ±4.72		
	Stage 3 (n=2)	30.0000		

Table-III. Postoperative clinical results by stage of osteoarthritis on last follow-up

VAS: Visual analogue scale, UCLA: University of California at Los Angeles.

Variable	Non-progression (n=33)	Progression (n=8)	t-value	P-Value
Age at time of surgery (in years)	28.48 ± 7.15	41.12 ± 5.89	-4.621	<0.001
Number of preop dislocations	7.93 ± 2.44	10.5 ± 3.38	-2.461	0.018
Number of previous surgeries	3.18 ± 1.18	2.87 ± 1.24	0.651	0.519
Follow-up period	11.36 ± 4.21	9.25 ± 3.80	1.293	0.204
Gender (male)	27	6	0.191	0.642¥
Dominant hand	28	7	0.036	1.00¥
Preop recurrent dislocation (as cause of instability)	18	4	1.059	0.589
Preop arthritis	6	3	1.403	0.342¥
Bony bankart lesion	12	5	1.812	0.241¥
Glenoid bone defect	8	3	0.577	0.658¥
Hill-sachs lesion	21	5	0.004	1.00¥
Graft medial overhang	5	0	1.380	0.563¥
Graft evenhang	26	4	2.718	0.178¥
Graft lateral overhang	2	4	9.951	0.009¥

Table-IV. Association of studied factors with progression of arthritis.

¥ Fischer's exact test

DISCUSSION

The project demonstrated remarkable clinical improvement among the studied individuals over the long term. Average sum of Rowe score of instability at last OPD assessment was 85.97, that lies within good range. Furthermore, UCLA improved from 20.82 to 31.09. Singer et al[28], whose study comprised a 20.5 years follow-up of 14 cases also reported that 93% postoperative readings were within good and excellent range. But in the aforementioned study arthritis was significantly higher than the literature published. They reported that 71% of the studied shoulders had arthritis whereas in our study arthritis was noted only in 34.14%: of which only 12.1% of total sample developed arthritis in previously non-arthritic shoulder. Rate of glenohumeral arthritis has been calculated to be as high as 62% with severe arthritis in 36% of the cases by a study conducted by Allain et al[25] on 58 patients undergoing Latarjet procedure: on following them for an average of 14.3 yrs. But they too published excellent clinical outcome: excellent Rowe score was noted in 88% of the sample. Findings reported by Hovelius et al[25] were more considerable as they had a larger sample size: 118 cases. They too reported good or excellent outcome in terms of Rowe score in 98% cases despite a 13.8% recurrence of instability and 49% arthritis on last follow-up. Staging of postoperative glenohumeral arthritis by Allain et al[25] showed that the shoulders in which arthritis progressed i-e developed arthritis in normal pre-op shoulders or preoperative arthritis worsened were 23.5% of the sample. This is very comparable to the figure calculated in our research i-e 19.5%. On last follow-up Allain et al[25] demonstrated that only 8.8% of the cases had severe i-e stage 3 arthritis and the rest of the 14.7% of the shoulders only had mild (stage 1 or 2) arthritis. These too are in accord to our results: stage 1 arthritis in 17%, stage 2 in 12.1% and stage 3 in only 4.87% cases.

Previously done research on the subject by Mizuno et al[20] showed that clinical outcome was worse in the patients who developed gleno-humeral arthritis as illustrated by lower Rowe and subjective shoulder scores in the arthritic patients. Similarly, Mizuno et al's[20] analysis showed that the radiologic finding was associated with lower level of patient satisfaction, though the clinical scoring systems didn't show any effect of the radiologic complication on the functional outcome. Similar findings were noted in our study group: arthritic shoulders were significantly more painful and showed lower improvement in terms of Rowe as well as UCLA scores. All these results were statistically highly significant. Since arthritis significantly alter the clinical results, its risk factors have been studied previously. Old age at the time of index dislocation event and at time of intervention, high demanding sports,

multiple preop dislocations, bony glenoid lesion and coracoid graft's lateral-overhang have previously been linked to progression of arthritis.[6,7,12,13,14,16,24,25] But Hovelius et all[25] and Buscayret et al.[29] suggested that it's the natural history of the disease i-e the recurrent dislocation, that results in development of arthritis rather than the surgical procedure itself. This study however illustrated that both disease-related as well as procedure-related factors affect the development of the aforementioned complication. Factors including older age at the time of intervention, greater number of preoperative dislocations, and graft's lateral-overhang were associated with progression of the arthritis. Allain et al[25] noted that 53% of their study population had lateral overhang of the coracoid process and it was a significant factor in development of arthritis. Whereas, 14.63% postoperative x-rays of our patients revealed lateral overhang and it was found to be a statistically significant factors in development of arthritis.

The study was uni-centric thus the results can't be generalized. A larger multi-centric trial would help depict and generalize the risk-factors of the disease: helping formulate guidelines for prevention of arthritis. Furthermore, the hypothesis that arthritis is a part of natural history of the disease (recurrent dislocation) needs to be tested: hence there is need of a study designed to test the aforementioned statement against the so-called development of arthritis post-latarjet procedure.

CONCLUSION

Latarjet's coracoid transfer effectively treats shoulder instability: it has been associated with very low recurrence rates and has excellent clinical outcome. However, development of arthritic changes and progression of previously evident arthritis is associated with the procedure over long-term follow-up. This arthritis affects the outcome adversely. Thus, the factors that are associated with arthritis progression: including age at time of intervention, preop dislocations number and coracoid graft's lateral-overhang, should be considered before opting for the surgical intervention.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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3	Kashif Shah Bukhaari	Jointly proposed the study, analyzed the data and prepared the final draft.	
4	Syed Muhammad Hasham Raza Kazmi	Contributed to the study design, data interpretation and review of the final manuscipt.	
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