

1 **Results of open Bankart surgery for the treatment of recurrent anterior shoulder**
2 **dislocation with glenoid bone defect and concomitant Hill-Sachs lesion**

3 **Background:** Open Bankart surgery is a main treatment procedure in the patients with
4 recurrent anterior shoulder dislocation , especially in cases with glenoid bone defect . The
5 goal of this study is to determine results after open Bankart surgery in cases of recurrent
6 anterior shoulder dislocation with glenoid bone defect and concomitant Hill-Sachs lesion.

7 **Methods:**Between 2006 and 2010, 89 patients with recurrent anterior shoulder dislocation
8 with glenoid bone defects (10-30%) and Hill-Sachs lesions undergoing open Bankart
9 surgery were reviewed. mean Follow-up after the surgery was 7 years (5.5-9.5 years).The
10 recurrence rate was determined and the degree of shoulder pain and daily activity level
11 were determined subjectively based on VAS (Visual Analogue Scale) and ADL (Activity
12 Daily Living).Shoulder ROM in abduction and external rotation compared with
13 contralateral side and finally, ASES (American Shoulder and Elbow Score) and CMS
14 (Constant-Murley score) were calculated .

15 **Results:** Over 7 years of follow-up, a total of 15 patients (16.8%) undergoing surgery had
16 instability (3 patients (3.3%) had dislocation and 12 patients had (13.4%) Subluxation).
17 There were larger glenoid bone defect (p value =0.0001) and Hill-Sachs lesion(p
18 value=0.019) in these patient versus patient without postsurgical instability. Mean loss of
19 forward flexion compared with the normal contralateral side was 4° and Mean loss of
20 external rotation between both sides was 5°.In the final visit, average VAS was 0.4 (out of
21 10). ADL was 28.97 (range,25-30) and ASES=96.1(range 78.3-100) . The mean value of
22 CMS was 93.9(range 82-100).

1 **Conclusion:** Open Bankart surgery with anteroinferior capsular shift for recurrent anterior
2 shoulder dislocation with up to 30% glenoid bone defect and Hill-Sachs lesion provided
3 desirable results in terms of shoulder function and recurrence rate . It is a successful and
4 practical option in these patients and can be considered as an alternative to other
5 procedures.

6 **Keywords:** recurrent shoulder dislocation, open Bankart surgery, glenoid bone defect,
7 Hill-Sachs lesion .

8 **Introduction**

9 Bankart lesion is the most common pathology observed in 85% of patients with recurrent
10 anterior shoulder dislocation (1). The treatment includes repairing the capsule and labrum
11 in the anterior border of glenoid with anteroinferior capsular shift, considered as the
12 primary therapeutic procedure for recurrent shoulder dislocation (1,2,3).

13 Despite the success of arthroscopy in the treatment of Bankart lesion (4,5,6), still the rate
14 of recurrence and treatment failure in patients with extensive glenoid bone defects and
15 Hill-Sachs lesion is relatively high (7). However, open surgery in this group of patients is
16 associated with greater success rate and lower recurrence (7,8,9).

17 Moreover, Latarjet procedure as an effective treatment for patients with extensive glenoid
18 defect has low recurrence rate (10,11), but is not chosen as the initial treatment for
19 treatment of recurrent anterior shoulder dislocation in most clinical centers, due to its
20 significant complication, especially in case of technical problems (12). This study aims to
21 determine the medium-term result and clinical recurrence rate after open Bankart surgery
22 and anteroinferior capsular shift for recurrent anterior shoulder dislocation with glenoid
23 bone defect and Hill-Sachs lesion.
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Methods

After ethic committee's approval, this retrospective study evaluated 89 patients that undergoing open Bankart surgery with two anchor sutures and anteroinferior capsular shift due to recurrent anterior shoulder dislocation with glenoid bone defects (10-30%) and Hill-Sachs lesions (10-30%) at our medical center in the period of 2006-2010. The exclusion criteria were posterior dislocation, multidirectional instability ,convulsive disorders and revision cases, concomitant SLAP (Superior Labral Anterior Posterior) lesions or massive rotator cuff tears, patients receiving arthroscopy or undergoing other surgical procedures and patients who were lost to the follow-up . Patients without bone defect or Patients with a glenoid defect of less than 10% and non-engaging Hill-Sachs were treated with arthroscopic surgery. Patients with a Hill-Sachs lesion or glenoid defect of more than 30% were treated with other surgical procedures like Latarjet surgery.

To determine surgical procedure (arthroscopic, open Bankart or Latarjet surgery) preoperative evaluation including physical examination, radiography, CT scan and MRI were performed for all patients. MRI assessed associated lesions such as bankart lesion or SLAP lesions. CT scan was used to assess bone defect in glenoid and head of the humerus. The glenoid defect was determined using “best-fit circle "(13). and the size of Hill-Sachs was measured using conventional methods described in “Atlas of Radiologic Measurement" (14).

Surgical techniques: After general anesthesia, the patient was placed in semi sitting position. All affected upper extremity was prepped and draped. Using deltopectoral incision, the cephalic vein was retracted to the lateral and conjugate tendon was to medial

1 side. Subscapularis tendon splitted transversely in line with its fibers at the junction of the
2 upper two thirds and lower one third of the tendon, and 1 cm medial to insertion in an L-
3 shaped fashion and hold with stay sutures. Axillary nerve was explored and protected until
4 the end of the operation. The capsule was opened by NEER technique (3) (T-shape
5 incision, that produces a superomedial and an inferomedial leaves) and the Bankart lesion
6 was observed and completed. The glenoid edge and 1-2 centimeter of the anterior cortex of
7 the scapular neck were decorticated with a dental burr.

8 Two anchor suture No. 2.8 produced by Artex Co. (Fastak®) were placed at 3 and 5
9 o'clock in the right shoulder and 7 and 9 o'clock in the left shoulder. Both threads of the
10 inferior anchor were passed though the inferomedial leaf. One thread of the superior
11 anchor was passed though the inferomedial leaf and the other through the superomedial
12 leaf. To do so, threads were directed from the innermost part of the capsule and labrum to
13 the outsider using a suture shuttle. The distance between each thread was approximately 1
14 cm. The threads were tied on the anterior side of the capsule. After repairing Bankart
15 lesion, anterior inferior capsular shift was performed using NEER technique and with
16 fiberwire® thread No. 2 at 20° external rotation and 20° abduction of the humerus. Rotator
17 interval was repaired up to 0.5 cm of coracoid process without reefing or overlapping with
18 the same sutures. Subscapularis tendon was also sutured to its anatomical site with the
19 same sutures. Drain was inserted, deltopectoral split was repaired with No. 2 Vicryl®
20 sutures, the skin was repaired in two layers and the wound was dressed. The shoulder was
21 immobilized with sling & swathe.(figure 1,2).

22 **Post operation management:** The patients were visited at 2, 6 and 12 weeks; and 3, 6 and
23 12 months postoperatively, and then annually for unlimited time.

1 After two weeks, pendular movement exercises were started intermittently. 6 weeks after
2 surgery, the immobilizer was removed and active assisted exercises were started at home
3 and the physiotherapy department to restore full range of motion except abduction in
4 external rotation. This motion was started after 12 weeks postoperatively concomitant with
5 strengthening exercises. The patients were informed to prevent of the extreme abduction in
6 external rotation until one year postoperatively.

7 **Assessment:** Initial patient data included age, gender, age of dislocation, cause of
8 dislocation, frequency of dislocation and the duration of suffering were collected from the
9 clinical records of the patients. During the follow-up period, all patients who had any signs
10 or symptoms of subluxation or dislocation were screened out. Post-operative dislocation
11 was defined as any event that required manipulation for reduction. Subluxation was also
12 defined as any event that the patient described as slip, move or pop in the shoulder that
13 caused pain and led to abandonment of exercise and sports activities. To evaluate
14 postoperative pain, visual analog scale (VAS) was used in which the patients assessed their
15 pain level subjectively in final visit. The daily activity was evaluated based on ADL
16 (activity daily living) questionnaire, which contained 10 items daily on personal activities
17 and ASES was computed using $[(10-VAS) \times 5] + [(5/3) \times ADL]$ formula (15).

18 Constant-Murley score (CMS) or Constant Shoulder Score , included pain (15 points),
19 level of daily activities (ADL) (20 points), strength (25 points) and mobility (40 points).
20 Shoulder mobility was measured by goniometer at forward elevation, abduction, external
21 rotation at side and internal rotation. Strength was determined based on muscle strength in
22 bearing weight at 90° shoulder abduction position based on Murley's scale (16).

1 Shoulder ROM in abduction and external rotation evaluated and compared with
2 contralateral side
3 Patient evaluation performed by one orthopedic surgeon, who had not participated in any of
4 the surgeries. Statistical analysis was performed using paired Student t test The significance
5 level was set at a p value of less than 0.05. Data were assessed with the statistical software
6 SPSS version 22 .

7
8 **Results:**

9 The number of patients referring for the final assessment was 89 patients out of whom, 72
10 were men and 17 were women with a mean age of 25.6 years (18-36 years) . The
11 dislocation of dominant limbs was observed in 51 patients (57%). The average frequency
12 of dislocation was 28 times (4-500 times) (based on interviews with patients), and the
13 mean time from the first dislocation to the time of operation was 17 months (5-60
14 months).

15 Trauma was the primary cause of dislocation in 64 patients (72%), and 25 patients (28%) had
16 suffered this injury because of seizure. The use of tramadol was reported in 21 (84%) of
17 dislocations induced by seizures .The average follow-up period was 7 years (5.5 -9.5) and
18 during this period, 15 patients (16.8%) had instability (12 (13.4%) subluxation, 3 (3.3%)
19 dislocation). Of this figure, 3 patients with dislocation and 1 with subluxation were subjected
20 to surgical treatment again. According to preliminary analyses prior to the surgery, the average
21 glenoid bone defect and Hill-Sachs lesion was 15.4% (10-30%) and 17.75% (10-30%)
22 respectively and all cases had both lesions (bipolar lesion) with a minimum 10% bone defect
23 for each lesion . The average glenoid bone defect and Hill-Sachs lesion was 17% (10-25%)
24 and 19.3 % (10-25%) respectively in patients (15 cases) that had postsurgical instability. The

1 average glenoid bone defect and Hill-Sachs lesion was 15.13% (10-30%) and 17.16 % (10-
2 30%) respectively in patients(74 cases) without postsurgical instability. Comparison between
3 patients with and without postsurgical instability showed a statistically significant difference
4 in glenoid bone defects (p value =0.0001) and Hill-Sachs lesions(p value=0.019) in patients
5 with postsurgical instability .this indicated the size of bone defect influence in increase
6 postsurgical dislocation and recurrence rate.

7 In the final assessment, 64 (72%) patients felt no pain in the operated shoulder and the
8 maximum severity of pain in patients based on VAS was 3 (out of 10). Also, the average
9 severity of pain based on VAS was 0.4. At last follow up the mean range of forward flexion on
10 the operated side was 172° (range,160-190) compared to 176° (range,170-210) on the
11 unaffected side with a mean deficit 4° . The mean external rotation with the elbow at the side
12 was 48° (range,30-80) on the affected side compared with 53°(range,40-100) on the intact side
13 with a mean deficit 5°.also ADL was 28.97 (range 25-30), ASES= 96.1 (range 78.3-100), and
14 44 patients (49%) had an ASES value of 100. The mean value of CMS was 93.9(range 82-
15 100).

17 **Discussion**

18 Among conventional treatments for recurrent anterior shoulder dislocation, open Bankart
19 surgery is a desirable procedure. In most studies, this procedure yielded more favorable
20 results in terms of recurrence, compared to arthroscopic surgeries (2,7). In particular, the
21 recurrence rate was high in patients with extensive glenoid bone defects or engaged Hill-
22 Sachs lesion. For these patients, open surgery was the recommended procedure (10).

23 In previous studies, variable rates of recurrence after open Bankart surgery were reported.

24 In the study of Rowe, which is one of the first studies on the results of open Bankart

1 surgery, on 145 patients, the recurrence of instability and dislocation following open
2 Bankart surgery was 8% and 2% respectively (1). In a study by Pelet al., which followed
3 up 39 patients for 2 years, 3 (10%) patients reported recurrence with a constant shoulder
4 score of 73.4 (17).

5 The study of Mordor on 40 patients without glenoid defect, who were treated with open
6 Bankart surgery, showed that after 20-25 years, instability was reported by 7 patients
7 (17.5%) out of whom 5 had dislocation. Surprisingly, all 5 patients had reported trauma-
8 induced recurrence after at least 8 years of going without any symptom. Subjective shoulder
9 value (SSV) in patients with and without dislocation was 83.7 and 91.4 and VAS was 0.6
10 and 0.8 respectively (18). Strahovink reported a recurrence rate of 12% for instability over a
11 9-year follow-up on 83 patients, The average VAS and CMS was 3.5 and 77 respectively
12 (19). Uhorchak JM (20) in his study on 66 athletes treated with open Bankart surgery
13 reported only 2 (3%) cases of dislocation, but 13 patients (20%) developed sublaxation after
14 surgery. However, satisfactions with the surgery was relatively high and mean ASES score
15 was 95 points (71-100) and mean Rowe score was 82 points (40-100).

16 Berendes in an 11-year follow-up of 31 Bankart surgeries reported 2 (3%) cases of
17 dislocation and 4 (13%) cases of sublaxation. The mean Rowe score and constant shoulder
18 score was 90, and 96 respectively (21). Magnusson studied 18 patients with a 7.5-year
19 follow-up, reporting only 2 (11%) cases of dislocation and 1 (6%) of sublaxation after
20 surgery with the mean Rowe score and constant shoulder score of 90 and 89, respectively
21 (22).

22 Mandeep compared open and arthroscopic Bankart surgery by studying 24 patients with
23 open Bankart surgery and 58 patients with arthroscopic Bankart after 39 months. He
24 reported 4 (16.6%) cases of dislocation in the first group and 7 cases (2 dislocations and 5

1 subluxation) of instability in the second group. Also, the mean ASES score and constant
2 shoulder score was 94.7 and 93. 3 in patients with open Bankart (Group I), and 92.8 and
3 91.3 in patients with arthroscopic Bankart (Group II) (23)

4 In the final assessment of our patients, 72% reported no pain with VAS= 0.4 and the mean
5 ASES and CMS were 96.1 and 93.9 respectively, which was more desirable and promising
6 than previous studies. The recurrence rate and instability were 3.3% and 16.8%
7 respectively. In the interpretation of results, it should be noted that patients undergoing
8 surgery in this study had 10 to 30% glenoid bone defect and concomitant 10 to 30% Hill-
9 Sachs lesion, which could influence the recurrence rate. In this study the average bone
10 defect in the patients with postsurgical instability was more than the patients without
11 postsurgical instability that indicated increase of recurrence rate of open bankart surgery in
12 patient with increase size of glenoid bone defect and concomitant Hill-Sachs lesion.
13 however our study result conclude that Open Bankart surgery with anteroinferior capsular
14 shift is a practical procedure in recurrent anterior shoulder dislocation when glenoid bone
15 defect and concomitant Hill-Sachs lesion is less than 30%.

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17 Latarjet procedure is performed in patients with recurrent anterior shoulder dislocation
18 with extensive glenoid defect. Recent studies have reported a high level of satisfaction and
19 desirable function along with high stability of shoulder after this surgical procedure (24).
20 Zimmerman drew a comparison between 93 patients undergoing Latarjet surgical
21 treatment and 271 patients treated with arthroscopic Bankart surgery, suggesting that the
22 recurrence rate of dislocation and subluxation was 1% and 9% in the first group(latarjet
23 procedure) and13% and 19% in the second group (24). Mizano reported a recurrence rate
24 of 5.9% in a 20-year follow-up after Latarjet surgery. Also, in the final analysis, 20% of

1 patients had reported symptoms of osteoarthritis (25). The study of Havelius on comparing
2 the results of Bankart and Latarjet surgeries after 27 years of follow-up suggested that
3 postoperative instability in the Latarjet and Bankart groups was 13.8% and 28.7%
4 respectively (26).

5 However, in Latarjet surgery, considering the disturbed anatomy of shoulder after surgery,
6 reproducibility and revision in case of recurrence would be more difficult. There is also
7 greater risk of technical problem during the surgery with more complications. In long-term
8 follow-ups, there is higher risk of osteoarthritis in these patients, especially in case
9 encountering technical problems (12,25,26)

10 One major limitation of this study was the lack of a comparison group (such as patients
11 undergoing Latarjet or arthroscopic Bankart surgeries) to be incorporated in the analysis.
12 Moreover, this study offered medium-term follow-up, and as noted earlier, the chance of
13 recurrence increases in the long term. In addition, in the final evaluation, the occurrence
14 rate of joint osteoarthritis due to the failure to do radiography for all patients was not
15 determined.

16 **Conclusion:**Open Bankart surgery with anteroinferior capsular shift for recurrent anterior
17 shoulder dislocation with glenoid bone defect (up to 30%) and concomitant Hill-Sachs
18 lesion offered desirable results with low recurrence rate .despite increase failure rate in
19 the patients with highly bone defect, open Bankart surgery is a successful and practical
20 option in these patients and can be considered as an alternative to other procedures.

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