

ANALYSIS OF THE FACTORS INFLUENCING THE CLINICAL EFFECT OF ARTHROSCOPIC TREATMENT OF SHOULDER INSTABILITY: 2-YEAR FOLLOW-UP ANALYSIS

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ABSTRACT

Objective: In order to further explore the relevant factors that affect the postoperative effect of total arthroscopic treatment of shoulder instability, and the influence of different factors on the postoperative effect in a certain period of treatment.

Method: From 2013 to 2017, 57 patients underwent arthroscopic joint instability repair in the Affiliated Hospital of Chengde Medical College, all of whom received and completed at least a two-year follow-up. The basic data were collected and recorded, and logistic regression analysis was carried out on the related factors such as gender, injury side, injury mechanism, age of first dislocation, number of dislocations before operation, joint relaxation score (Beighton score), Bankart injury range (20%), Bankart repair + reimplissage operation (B + R), internal fixation form (single row / double row), time of starting active shoulder joint movement and so on.

Result: After two year's follow-up, the related factors affecting the postoperative outcome of the treatment of shoulder instability under the total arthroscope are: injury mechanism, number of dislocations before operation, joint relaxation score, Bankart injury range (20%), Bankart repair + replissage (B + R).

Conclusion: The main factors that influence the postoperative effect are the injury mechanism and the extent of Bankart injury. Slight external force can cause poor functional recovery of shoulder joint in patients with dislocation. Meanwhile, it has the most obvious influence on the subjective score and the excellent rate of shoulder joint function.

Keywords: Shoulder arthroscopy, Shoulder instability, Bankart injury, Hill Sachs injury, Remplissage repair.

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Introduction

Recurrent shoulder instability is not uncommon in the field of sports injuries. Simonet et al. reported an annual incidence of shoulder instability of up to 0.112%⁽¹⁾, Zacchilli et al. reported an average annual incidence of shoulder instability of 0.239 % in the United States⁽²⁾, and a prospective study by Hovellius et al. reported an incidence of up to 2%⁽³⁾. The traditional treatment for patients with a first occurrence of unstable shoulder dislocation is suspension and immobilization for 3 weeks after manual repositioning. In contrast, scholars now

generally agree that traditional conservative treatment modalities are not effective in reducing the tendency of recurrence of shoulder instability, which can be as high as 90%, especially in young patients⁽⁴⁻⁵⁾. Some patients with recurrent shoulder instability require surgical treatment. The relatively common surgical procedures are open surgery and arthroscopic repair. Arthroscopic surgery is increasingly accepted by clinicians and patients because of its small incision, minimal trauma, quick recovery, and low incidence of joint adhesions. However, not all patients with shoulder instability are candidates for arthroscopic repair and reconstruction.

Moreover, some patients may experience a recurrence of shoulder instability dislocation after arthroscopic repair and have to undergo open revision surgery again. There are many factors that influence the clinical outcome after shoulder instability surgery. The studies that have been published mostly analyze a single aspect from preoperative factors and intraoperative factors. There are few studies that have investigated the degree of influence of different factors in various aspects on postoperative outcomes. Therefore, this study is intended to be a preliminary exploration to provide a partial reference for further extensive and in-depth clinical studies.

Materials and methods

Inclusion criteria: (1) patients with a significant history of traumatic shoulder dislocation or instability; (2) patients with MRI-confirmed tears of the joint capsule complex; (3) patients with symptoms of shoulder instability and a positive fear test.

Exclusion criteria: (1) patients with combined rotator cuff injury or posterior superior glenoid labral tear requiring repair; (2) biceps tendon-related injury; (3) multidirectional instability; (4) history of shoulder surgery; (5) patients with combined shouldered fracture or brachial plexus nerve injury; (6) patients >45 years of age (>45 years or need to be considered for Laserjet surgery).

A total of 57 patients were included in this study according to the above criteria, of whom 39 were men (age range 19-45 years) and 18 were women (age range 18-45 years). There were 42 patients with Bankart injury (Bankart injury alone, Bankart injury combined with Hill-Sachs injury not requiring surgical management) and 15 patients with Bankart injury combined with Hill-Sachs injury requiring surgical treatment. All patients had preoperative MRI and CT examinations and were confirmed to have anteriorly oriented shoulder instability during shoulder arthroscopy, as well as being followed up for at least 2 years after surgery. All patients gave informed agreement and signed a consent form for the surgery.

Surgical methods

All surgeries were performed by a senior arthroscopist with 10 years of surgical experience. The patients were placed in the lateral position under general anesthesia. The upper limb of the affected side was suspended in a lateral postural frame

with 40° of abduction and mild forward flexion. The total intra-articular injury was evaluated via a standard posterior approach with microscopic placement. An anterior-superior approach was created through the posterior aspect of the biceps tendon in the tendonoverlaid joint area of the rotator cuff to simultaneously identify Bankart injuries. An anterior-inferior approach was made via the lateral rotator cuff septum adjacent to the superior border of the subscapularis tendon to facilitate anchor nail placement. The torn anterior joint capsule complex was repaired over the articular glenoid using suture anchors. As the suture passed through the glenoid labrum, the anterior capsule complex was elevated using a grasper through the posterior approach to restore tension to the anterior capsule and glenoid labrum. Sutures were placed on the anterior capsule complex over the glenoid to maintain tension and restore stability. When the articular glenoid defect or free defect of the bone mass was less than 15% of the glenoid width, Bankart injury repair was performed using a single-row fixation technique with at least four suture anchors. When the glenoid defect of the shoulder joint was >15%, an anchor nail was added to the medial glenoid neck of the shoulder joint (1.5 cm below the cartilage margin) via a subscapularis approach. The free bone was implanted back into the glenoid neck taking care to avoid tilting the bone block or raising it above the articular cartilage surface. The two caudal sutures of the cervical implant rivets were passed through the lower level of the free bone block with horizontal mattress sutures and tied tightly with knots. Another glenoid neck suture rivet tail was placed medially to the bone block with horizontal sutures and fixed with a modified Mason-Allen technique (double-row fixation). The patients combined with Hill-Sachs injury underwent Remplissage after repair of the Bankart injury. During the Remplissage operation, one or two anchor nails were implanted in the middle of the Hill-Sachs depression injury. A mattress suture was placed through the infraspinatus tendon and joint capsule, with a knot tied in the subacromial space.

Postoperative management

The abduction brace of the affected shoulder joint was immobilized for four to six weeks after surgery. The shoulder was allowed to perform progressive passive exercises under the guidance of the rehabilitation physician in the second week after surgery, and active functional exercises were

gradually started in the sixth to eighth week. The shoulder muscle strength exercises were started in the eighth to twelfth week, and sports could be resumed in the sixth month after surgery.

Shoulder joint function evaluation criteria

The Rowe score (6) was used, out of 100, with excellent 100-90, good 89-75, acceptable 74-51, and poor ≤50. Activity level assessment was based on the last follow-up visit.

Data acquisition

The basic patient information was gender, affected side. The preoperative factors were mechanism of injury, age at first dislocation, number of dislocations occurring preoperatively (limited to 3), joint laxity score (Beighton score), and extent of Bankart injury (20%). The intraoperative factors were whether Bankart repair accompanied by Remplissage (B+R) and the form of internal fixation (single/dual rows). The postoperative factors were time to start active shoulder motion.

Statistical processing

The data were analyzed using SPSS 19.0 statistical software. The independent variables were sex, age at first dislocation, mechanism of injury, side of injury, number of preoperative dislocations, Beighton classification score, extent of Bankart injury, B+R surgery, fixation method, and duration of active functional exercise. The dependent variable was the Rowe score of the shoulder joint. Combining Rowe scores excellent and good with acceptable and poor makes it a dichotomous variable. A chi-square test or continuous corrected chi-square test was used for one-way analysis, and then a dichotomous logistic regression model was used for multivariate analysis of statistically significant independent variables. The difference was statistically significant at P < 0.05.

Results

At follow-up until 2 years after surgery, 57 patients had a Rowe score of 87.5±10.8, including 32 excellent, 11 good, 11 acceptable, and 3 poor. All patients were free of recurrent dislocation and severe joint instability at the 2-year postoperative follow-up. However, subjective symptoms (e.g., fear and anxiety) were present in three patients. Although physical examination did not reveal signs of instability, the examiner could feel involuntary

protective contractions of some of the muscles around the shoulder joint.

The results of the chi-square test one-way analysis showed that the differences were statistically significant (P < 0.05, Table 1) for six of the ten factors suspected of influencing the functional outcome of the postoperative shoulder joint (age at first dislocation, mechanism of injury, number of postoperative dislocations, Beighton grading score, extent of Bankart injury, and B+R surgery). All 6 factors with statistical significance were assigned values and multifactorial analysis was performed (Table 2).

Influence factors	Cases	Shoulder function score		P-value
		Number of excellent and good	Excellent and good rate	
Gender				
Male	39	28	72%	0.347
Female	18	15	83%	
Age of first dislocation				
≤20 years old	8	3	37.5%	0.007
>20 years old	49	40	82%	
Mechanism of injury				
Contact motion/powerful overhead	50	41	82%	0.002
Daily activities/light external forces	7	2	28.5%	
Left/Right side				
Left side	8	6	75%	0.928
Right side	49	37	76%	
Number of preoperative dislocations				
≤3 times	48	39	81%	0.019
>3 times	9	4	44%	
Beighton grading score				
≥4 score	16	9	56%	0.036
<4 score	41	34	83%	
Bankart injury range				
≤15%	40	34	85%	0.010
>15%, <20%	17	9	53%	
B+R Surgery				
Yes	15	8	53%	0.021
No	42	35	81%	
Fixing method				
Single row	34	26	76%	0.826
Double row	23	17	73%	
Duration of active functional exercise				
6 weeks	46	35	76%	0.816
>6 weeks	11	8	72%	

Table 1: Relationship between relevant influencing factors and the results of shoulder Rowe score (cases).

A conditional logistic regression model was applied to conduct a multifactorial analysis of the six factors. A multivariate logistic regression

model was created for the main influencing factors such as age at first dislocation. The multifactorial logistic regression analysis revealed that recovery of shoulder function was significantly associated with mechanism of injury, number of postoperative dislocations, Beighton grading score, extent of Bankart's injury, and B+R surgery (Table 3).

Factors	Variables	Assignment Description
Age of first dislocation	X1	≤20 years = 0, >20 years = 1
Mechanism of injury	X2	Contact sports/strong overhead = 0, daily activities/light external force = 1
Number of preoperative dislocations	X3	≤3 times=0, >3 times=1
Beighton grading score	X4	≥4 score=0, <4 score=1
Extent of Bankart injury	X5	≤15%=0, >15%=1
B+R surgery	X6	Yes=0, No=1
Shoulder function	Y	Excellent, good=0, acceptable, poor=1

Table 2: Description of the grouping and assignment of factors.

Influencing factors	B	df	P-value
Age at first dislocation	0.841	1	0.359
Mechanism of injury	9.460	1	0.002
Number of preoperative dislocations	5.541	1	0.019
Beighton grading score	4.420	1	0.036
Extent of Bankart injury	6.617	1	0.010
B+R surgery	5.369	1	0.021

Table 3: Factors affecting functional recovery of the shoulder joint.

In this experiment, we performed a brief preliminary statistical analysis of the level of postoperative activity recovery alone. The level of motion recovery was graded, and the main discussion was to analyze the extent of preoperative Bankart injury and the procedure of B+R surgery. The statistical findings revealed that there was a definite effect of the degree of postoperative shoulder motion level recovery between the independent Bankart procedure and the combined Remplissage, mainly in the case of active patient activity. However, the statistical results showed that this difference was not highly significant (continuous corrected χ^2 test, $P=0.049$), not excluding the possibility of bias due to the small sample size and the possibility that it may be caused by subjective differences in patient perception.

Discussion

The surgical treatment for shoulder instability mainly includes open surgery represented by the Laserjet procedure and minimally invasive

arthroscopic surgery with Bankart repair and reconstruction combined with capsule tightening (Remplissage) under full scope. Open surgery for shoulder instability includes the Bristow procedure⁽⁷⁾, the Latarjet procedure⁽⁸⁾ and the Eden-hybinette procedure⁽⁹⁾, of which the open Latarjet procedure is the most widely used⁽¹⁰⁾. It can significantly reduce the recurrence rate of postoperative joint instability. However, the shortcomings of open surgery include greater trauma and a higher incidence of limited postoperative joint mobility and joint adhesions. Therefore, open surgery is not entirely appropriate for young patients with high motor level requirements. In contrast, the open Bankart procedure was reported to have relatively good results. According to a 7-year follow-up study, a total of 89 patients were followed up, of which 15 (16.8%) operated patients showed instability, with 3 (3.3%) dislocations and 12 (13.4%) subluxations⁽¹¹⁾. The advantages of arthroscopic repair and reconstruction include less trauma, faster recovery, as well as unrestricted or mildly restricted postoperative joint motion. Its recurrence rate of postoperative joint instability, although reported differently in various studies, is higher than that of the open Laterjet procedure, even with some scholars reporting recurrence rates between 5% and 20%⁽¹²⁻¹⁶⁾. Although recurrence rate was used as one of the criteria to assess postoperative outcome, the cases included in this study did not have severe recurrent postoperative symptoms of joint instability such as re-dislocation. At the 2-year postoperative follow-up, three patients complained of the presence of some subjective symptoms (e.g., feelings of fear and anxiety), while objective examination did not reveal signs of instability. It was not considered as a basis for recurrent joint instability because of the possibility of bias in the subjective impressions of patients.

The most influential of the preoperative factors on the postoperative outcome was the mechanism of injury ($p=0.002$). This may be related to a confounding of multiple factors in the author's analysis. The contact sports, forceful overhead movements, and trauma can cause tears of the shoulder capsule and glenoid labrum, as well as Hill-Sachs injuries. The more severe the injury, the more likely the patient was to be consulted and treated surgically. The rate of excellent and good postoperative shoulder function in these patients was 82%, while the rate of excellent and good postoperative shoulder function in patients whose dislocation could be caused by daily activities/slight external forces was lower, at

28.5%. When comparing the different mechanisms of injury, patients who underwent surgery for contact sports and forceful overtopping had better clinical outcomes than those whose dislocation occurred with daily activities/slight external forces ($P=0.002$).

The patient's age at first dislocation did not affect the postoperative outcome as significantly as other factors ($P=0.359$). However, when it comes to statistical comparative analysis of the rate of excellent postoperative shoulder function, it was found that the lower the age at which the dislocation occurred, the lower the rate of excellent postoperative function ($p=0.007$), which is similar to the findings of Carreira et al⁽²⁰⁾ and Voos et al⁽²¹⁾. The number of dislocations that occurred during surgical treatment had a more significant effect ($p=0.019$) which is consistent with the findings of other authors. The main reason for this analysis is that frequent joint instability may lead to wear of the anterior edge of the articular pelvis with resorption of the avulsed fracture fragments⁽²²⁾. Most bone fragments from bony Bankart injuries show extensive bone resorption within 1 year after the initial dislocation⁽²³⁾. Moreover, patients with multiple instabilities have a postoperative fear and a tendency to be conservative about postoperative functional recovery.

The effect of the extent of Bankart injury on the postoperative outcome was not as significant as expected ($P=0.010$). It was found that bone defect repair (bone filling effect) was important in cases of articular instability with a glenoid bone defect greater than 20% of the glenoid width. However, the importance of whether to repair bone defects in cases of articular instability where the articular glenoid bone defect is less than 20% of the articular glenoid width was unclear⁽²⁴⁻²⁶⁾. A boundary of 15% was used for Bankart injury in the current study. It was because bone transfer was required in many clinical and biomechanical studies when a more severe bone defect reached approximately 20% of the articular glenoid width⁽²⁷⁻²⁹⁾.

When the shoulder glenoid defect was less than this threshold, the glenoid already had sufficient bony support to avoid severe joint instability. In this case, adequate joint stability can be achieved even without bone block reimplantation. Recently, two studies have reported that the critical value for severe articular glenoid defects is to be lower than 20%, with their suggested critical values being 13.5% and 15%, respectively⁽³⁰⁻³¹⁾. However, the low prevalence of widespread articular glenoid defects may have some influence on the distribution of the

study data and thus on the statistical results of this experiment.

The Beighton classification score of joint laxity was used as an important reference. A score of ≥ 4 can be diagnosed as arthrosis. These patients were more prone than normal to shoulder dislocation during vigorous competitive sports or contact overhead sports, such as throwing. However, the postoperative clinical outcome of these patients was more obvious, and some patients may complain of a reduction in joint mobility compared to the preoperative and contralateral sides, but it was not significant. The results of the current study showed that there was a statistically significant difference ($P=0.036$) in the postoperative excellent and good rates (83% and 56%) for the <4 subgroup compared with the ≥ 4 subgroup, but its effect on postoperative clinical outcome was not as prominent as the other factors. Yan Hui et al⁽¹⁹⁾, on the other hand, showed that there was no statistically significant difference in the recurrence of postoperative instability in patients with joint laxity compared to patients without joint laxity. It so happens that one of the female patients in this study was a special case, with multiple dislocations of the shoulder joint and significant joint laxity. A large glenoid labral injury and Hill-Sachs injury were seen intraoperatively. The glenoid labral injury was repaired and Remplissage was performed at the same time. The patient had good joint stability at the last follow-up after surgery. There was no recurrence of dislocation during the course of normal life within 2 years. However, the patient complained of fear of movements such as over-the-top throwing. This suggests that microscopic repair of joint instability has a good clinical outcome, while the probability of recurrent instability events is not significantly higher than in the general population. It should be noted, however, that the study was conducted only for simple anterior instability, whereas caution should be exercised in the treatment of multidirectional shoulder instability, whether microscopic or incisional.

Among the intraoperative factors, Bankart injury repair with simultaneous Remplissage improved postoperative outcomes⁽³²⁾. However, it was found that some patients complained of some influence of self-consciousness on the recovery of postoperative motor level. It remained to be investigated whether the results of this statistical analysis had sufficient clinical value due to the small sample size. Other studies have shown that some cases of pain in abduction after shoulder

fatigue exercises were found in the follow-up after undergoing Remplissage, but the effect was not significant. It was also indicated that Remplissage was not recommended for people who frequently need to perform throwing movements⁽³³⁻³⁵⁾.

As for the differences in single- and double-row fixation for glenoid labral injuries, there are conflicting studies reported. Some biomechanical studies have shown that double-row fixation was superior in strength to single-row fixation⁽³⁶⁾. In contrast, a recent study in an animal model showed that repairing Bankart injuries with sutures alone versus using Mason-Allen sutures did not have a significant effect on the strength of the anchor nail against extraction, but was beneficial for restoration of glenoid labrum height⁽³⁷⁾. In the current study, there was no significant difference in clinical outcome at the 2-year postoperative follow-up ($P=0.826$). This may be related to the short follow-up period and the limited number of cases in the sample, but further long-term prospective clinical and basic trials are expected to validate it.

The shortcomings of this study are the short follow-up period and the ROWE grading score used, which tends to be applied for long-term follow-up assessment. Nevertheless, the combination of other common scores of the shoulder joint is not sufficiently specific for this type of shoulder instability. Another shortcoming is the small sample size of cases included in this study. Although the prevalence of joint instability has been reported to be high, the number of cases that actually participated in the treatment and met the experimental criteria is limited due to geographical and patient awareness differences.

References

- 1) Simonet WT, Melont LR, Cofield RH, et al. Incidence of anterior shoulder dislocation in Olmsted County, Minnesota(J). *Clin Orthop Relat Res*, 1984(186): 186-191.
- 2) Zacchilli MA, Owens BD. Epidemiology of shoulder dislocations presenting to emergency departments in the United States(J). *J Bone Joint Surg Am*, 2010, 92(3): 542-549.
- 3) Helius L, Augustini BG, Fredin H, et al. Primary anterior dislocation of the shoulder in young patients. A ten-year prospective study(J). *J Bone Joint Surg Am*, 1996, 78(11): 1677-1684.
- 4) Henry JH, Genung JA. Natural history of glenohumeral dislocation-revisited(J). *Am J Sports Med*, 1982, 10(3): 135-137.
- 5) Helius L, Eriksson K, Fredin H, et al. Recurrences after initial dislocation of the shoulder. Results of a prospective study of treatment(J). *J Bone Surg Am*, 1983, 65(3): 343-349.
- 6) Rowe CR, Patel D, Southmayd WW. The Bankart procedure: a long-term end-resuh study(J). *J Bone Joint Surg(Am)*, 1978, 60:1-16.
- 7) Helfet AJ. Coracoid transplantation for recurring dislocation of the shoulder(J). *J Bone Surg Br*, 1958, 40-b(2): 198-202.
- 8) Latarjet M. Treatment of recurrent dislocation of the shoulder(J). *Lyon Chir*, 1954, 49(8): 994-997.
- 9) Hindmarsh J, Lindberg A. Eden-hybbinette's operation for recurrent dislocation of the humero-scapular joint(J). *Acta Orthop Scand*, 1967, 38(4): 459-478.
- 10) Eoghan TH, Shazil J, Zakariya SA, et al. Long-term outcomes of the Latarjet procedure for anterior shoulder instability: a systematic review of studies at 10-year follow-up(J). *Journal of Shoulder and Elbow Surgery*, 2019, 28(2): 33-39.
- 11) Morteza NA, David J, et al. Results of Open Bankart Surgery for Recurrent Anterior Shoulder Dislocation with Glenoid Bone Defect and Concomitant Hill-Sachs Lesion(J). *Arch Bone Jt Surg*, 2018, 6(3): 212-218.
- 12) Garofalo R, Mocci A, Moretti B, et al. Arthroscopic treatment of anterior shoulder instability using knotless suture anchors(J). *Arthroscopy*, 2005, 21(11): 1283-1289.
- 13) Lafosse L, Iserain A, Kempf J, et al. Arthroscopic treatment of chronic anterior shoulder instability(J). *Rev Chir Orthop Reparatrice Appar Mot*, 2000, 86(Suppl 1): 106-109.
- 14) Mishra D, Fanton G. Two-year outcome of arthroscopic Bankart repair and electrothermal-assisted capsulorrhaphy for recurrent traumatic anterior shoulder instability(J). *Arthroscopy*, 2001, 17(8): 844-849.
- 15) Tauro J. Arthroscopic inferior capsular shift and advancement for anterior and inferior shoulder instability: technique and results at 2 to 5 year follow-up (J). *Arthroscopy*, 2000, 16(5): 451-456.
- 16) Min K, Fedorka C, Olberg MJ, et al. The cost-effectiveness of the arthroscopic Bankart versus open Latarjet in the treatment of primary shoulder instability(J). *Journal of Shoulder and Elbow Surgery*, 2018, 27(6Suppl): S2-S9.
- 17) Park I, Lee JH, Hyun HS, et al. Effects of Bone Incorporation After Arthroscopic Stabilization Surgery for Bony Bankart Lesion Based on Preoperative Glenoid Defect Size(J). *American Journal of Sports Medicine*, 2018, 46(9): 2177-2184.
- 18) Chen XX, Kang H, Wang T, et al. Research progress of anterior instability of shoulder joint with articular glenoid bone defect(J). *Chinese Journal of Orthopaedics*, 2016, 36(14): 938-944.
- 19) Yan H, Cui GQ, Wang JQ, et al. Arthroscopic Bankart repair for recurrent anterior dislocation of the shoulder joint: analysis of surgical outcomes and risk factors for recurrence(J). *Chinese Journal of Surgery*, 2011, 49(7): 597-602.
- 20) Carreira DS, Mazzocca AD, Oryhon J, et al. A prospective outcome evaluation of arthroscopic Bankart repairs: Minimum 2-year follow-up(J). *Am J Sports Med*, 2006, 34(5): 771-777.
- 21) Voos JE, Livermore RW, Feeley BT, et al. Prospective evaluation of arthroscopic Bankart repairs for anterior

- instability(J). *Am J Sports Med*, 2010, 38(2): 302-308.
- 22) Burkhart SS, De Beer JF. Traumatic glenohumeral bone defects and their relationship to failure of arthroscopic Bankart repairs:significance of the inverted-pear glenoid and the humeral engaging HillSachs lesion(J). *Arthroscopy*, 2000, 16(7): 677-694.
- 23) Nakagawa S, Mizuno N, Hiramatsu K, et al. Absorption of the bone fragment in shoulders with bony Bankart lesions caused by recurrent anterior dislocations or subluxations: when does it occur? (J)*Am J Sports Med*, 2013, 41(6): 1380-1386.
- 24) Giles JW, Puskas GJ, Welsh MF, et al. Suture anchor fixation of bony Bankart fractures: comparison of single-point with double-point “suture bridge” technique(J). *Am J Sports Med*, 2013, 41(11): 2624-2631.
- 25) Itoi E, Lee SB, Berglund LJ, et al. The effect of a glenoid defect on anteroinferior stability of the shoulder after Bankart repair: a cadaveric study(J). *J Bone Joint Surg Am*, 2000, 82(1):35-46.
- 26) Lo IK, Parten PM, Burkhart SS. The inverted pear glenoid: An indicator of significant glenoid bone loss(J). *Arthroscopy*, 2004, 20(2): 169-174.
- 27) Greis PE, Scuderi MG, Mohr A,et al. Glenohumeral articular contact areas and pressures following labral and osseous injury to the anteroinferior quadrant of the glenoid(J). *J Shoulder Elbow Surg*, 2002, 11(5): 442-451.
- 28) Shin SJ, Kim RG, Jeon YS, et al. Critical value of anterior glenoid bone loss that leads to recurrent glenohumeral instability after arthroscopic Bankart repair(J). *Am J Sports Med*, 2017, 45(9): 975-1981.
- 29) Shin SJ, Koh YW, Bui C, et al. What is the critical value of glenoid bone loss at which soft tissue Bankart repair does not restore glenohumeral translation, restricts range of motion, and leads to abnormal humeral head position? (J)*Am J Sports Med*, 2016, 44(11): 2784-2791.
- 30) Shaha JS, Cook JB, Song DJ, et al. Redefining “critical” bone loss in shoulder instability: functional outcomes worsen with “subcritical” bone loss(J). *Am J Sports Med*, 2015, 43(7): 1719-1725.
- 31) Shin SJ, Koh YW, Bui C, et al. What is the critical value of glenoid bone loss at which soft tissue Bankart repair does not restore glenohumeral translation, restricts range of motion, and leads to abnormal humeral head position? (J) *Am J Sports Med*, 2016, 44(11): 2784-2791.
- 32) Claire B, Olivier H, Julien G, et al. Impact of Remplissage on Global Shoulder Outcome: A Long-Term Comparative Study(J). *Arthroscopy*, 2019,35(5):1362-1367.
- 33) Bah A, Lateur GM, Kouevidjin BT, et al. Chronic anterior shoulder instability with significant Hill-Sachs lesion: Arthroscopic Bankart with remplissage versus open Latarjet procedure[J]. *Orthop Traumatol Surg Res*, 2018,104:17-22.
- 34) Grant H, Wu HH. Outcomes of the remplissage procedure and its effects on return to sports average 5-year follow-up[J]. *Am J Sports Med*,2016,44(5):1124-1130.
- 35) Judson CH, Voss A, Obopilwe E, et al. An Anatomic and Biomechanical Comparison of Bankart Repair Configurations[J]. *The American Journal of Sports Medicine*, 2018, 46(13):3004-3009.
- 36) Dos SR, Morais PC, Mertens FR, et al. Bankart lesion repair: biomechanical and anatomical analysis of Mason-Allen and simple sutures in a swine model[J]. *Revista Brasileira de Ortopedia (English Edition)*, 2018, 53(4): 454-459.
- 37) Mirbagheri E, Ahmadi M, Salmanian S. Common data elements of breast cancer for research databases: A systematic review. *J Family Med Prim Care*. 2020; 9(3): 1296-1301. Published 2020 Mar 26. doi:10.4103/jfmpe.jfmpe_931_19

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