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Research Progress of Arthroscopic Technology Based on Bone Defect Assessment in the Surgical Treatment of Recurrent Anterior Shoulder Dislocation

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ABSTRACT
In sports injury medicine, surgical treatment of recurrent anterior shoulder dislocation is one of the urgent problems to be solved at this stage, mainly because surgical treatment fails to effectively restore bony constraints and the dynamic function of the shoulder joint. Currently, in clinical practice, whether at home or abroad, arthroscopic surgery is the most commonly used surgical treatment for patients with recurrent anterior shoulder dislocation. This treatment can achieve a relatively ideal overall effect; however, there is still a lack of a unified standard for the specific selection of surgical methods. In clinical practice, arthroscopic technology should be used to conduct a comprehensive assessment of bone defects, and the most appropriate treatment plan should be selected based on the bone defects of the humeral head and glenoid. In addition, factors such as the surgeon's operational skill level, the patient's sports level, and age should also be comprehensively considered to ensure the surgical treatment effect.

KEYWORDS
Recurrent anterior shoulder dislocation; Arthroscopic technology; Bone defect; Surgical treatment

1 Introduction

Among all joints in the human body, the shoulder joint has the largest range of motion. In a narrow sense, its composition includes the glenoid fossa of the scapula, ligaments, joint capsule, and humeral head. The glenoid articular surface is not only shallow but also small, accounting for only 30% of the total area of the humeral head. Therefore, its stability is not ideal, and the risk of dislocation is relatively high, accounting for approximately 50% of all joint dislocations in the body [1]. Recurrent shoulder dislocation specifically refers to the recurrence of dislocation during specific positional movements of the shoulder joint or re-dislocation of the shoulder caused by minor external forces, usually within 1-2 years after the successful reduction of the first dislocation [2]. The articular surface faces anterior-inferior-laterally, and the anterior joint capsule is very weak, making anterior dislocation more likely to occur. Especially in young adults and adolescents, the probability of re-dislocation is about 20%-40% [3]. In recent years, with the gradual improvement and advancement of laparoscopic surgical technology and related instruments and equipment, arthroscopic shoulder surgery has become the gold standard for the treatment of recurrent anterior shoulder dislocation. Its repair effect is similar to that of open surgery, or even more ideal; however, there is still a lack of a unified standard for the selection of specific surgical methods [4]. This article mainly analyzes the application of arthroscopic technology based on bone defect assessment in the surgical treatment of recurrent anterior shoulder dislocation, and the following review is presented.

2 Arthroscopic Bone Tissue Surgery

2.1 Arthroscopic Bone Grafting

In the treatment of patients with recurrent anterior shoulder dislocation, the application of arthroscopic bone grafting can effectively restore the depth and width of the glenoid fossa, thereby significantly enhancing its mechanical blocking function. At present, the widely used arthroscopic bone grafting techniques in clinical practice mainly include the following types.

(1) Arthroscopic Distal Tibial Allograft Bone Grafting. the application of arthroscopic distal tibial allograft technology can yield relatively ideal outcomes in the treatment of patients with anterior shoulder instability complicated by bone loss. Arthroscopic technology was used to assess the bone defect, and an appropriate arthroscopic bone stabilization procedure was selected for the treatment of patients with shoulder instability with a glenoid bone loss of more than 20%. The results showed that the bone graft healing rate was 94% in patients treated with allogeneic tibial grafting, while it was only 75% in patients treated with autologous coracoid process grafting. Therefore, short-term results indicate that autologous coracoid process can be replaced by allogeneic tibia in the bone graft reconstruction of scapular morphology, and this method can significantly reduce donor site complications [5]. Essentially, bone grafting belongs to anatomical reconstruction, which can effectively restore the original anatomical structure of the shoulder joint. It not only reduces damage to the surrounding nerves but also promotes the restoration of normal shoulder joint range of motion. Arthroscopic technology is used to conduct a comprehensive assessment of bone defects. If the bone defect of the humeral head or glenoid exceeds 40%, or if the Latarjet procedure fails, bone grafting can be performed. However, further

research is needed on the differences in curative effects among different types of grafts, specific healing mechanisms, and the degree of bone resorption and osteolysis.

(2) Arthroscopic Autologous Iliac Bone Grafting. Currently, autologous iliac bone grafting is one of the most widely used surgical methods in clinical arthroscopic bone grafting for treatment. Arthroscopic iliac bone grafting was selected for the treatment of patients with recurrent anterior shoulder instability. Long-term follow-up of the patients showed that both imaging and clinical results were relatively ideal. Arthroscopic technology was used to assess the degree of bone defect. For patients with anterior shoulder instability with a glenoid bone loss of more than 10%, open autologous iliac bone grafting and arthroscopic autologous iliac bone grafting were respectively selected for treatment. CT examination was used to analyze the positioning of the graft. The results showed that arthroscopic technology can effectively reconstruct the glenoid bone defect of the shoulder joint [6]. In the past, metal anchors were often used in clinical practice to effectively fix the grafted bone blocks; however, this method is prone to various complications such as bone resorption and osteolysis. With the in-depth development of clinical research, in clinical practice, the posterior glenoid guide has gradually been used under arthroscopy to position the grafted iliac bone blocks, and full suture anchors have been used to effectively fix the iliac bone blocks [7]. The application of this technology can not only accurately position the grafted bone blocks and prevent damage to the axillary nerve but also significantly reduce anchor-related complications. However, compared with metal anchors, further research is needed on the holding power of this technology at present.

2.2 Arthroscopic Bristow-latarjet Procedure

The performance of the Bristow-Latarjet procedure can provide the shoulder joint with more ideal stability through a triple blocking effect, which are the tension of the subscapularis muscle, the sling effect of the conjoint tendon, and the bone blocking of the grafted bone block. In clinical practice, when treating patients with shoulder dislocation accompanied by significant bone defects, if arthroscopic Bankart repair is selected, the recurrence rate after surgery is 67%, while the Bristow-Latarjet procedure can achieve more ideal therapeutic effects. It can restore good stability of the shoulder joint without causing significant trauma to the patient [8]; however, the surgical operation is relatively difficult, and it will destroy the normal structure of the coracoacromial arch to a certain extent. Further research is needed on its long-term impact on the shoulder joint [9]. The conventional arthroscopic Bristow-Latarjet procedure has a long learning curve, complex operation techniques, certain risks in the screw fixation position, multiple surgical approaches, complex operations, and a high risk of nerve injury. To improve the above problems, some scholars have begun to modify the conventional arthroscopic Bristow-Latarjet procedure. The modified arthroscopic Bristow-Latarjet procedure can not only significantly reduce the number of surgical approaches but also fix the bone blocks more accurately, improving clinical efficacy and healing rate [10]. In the past, the anterior positioning method was adopted, and the extremely medial "E" approach was often selected during operation. Excessive approaches would increase the risk of nerve injury, while the modification can significantly reduce nerve injury.

3 Arthroscopic Soft Tissue Surgery

3.1 Arthroscopic Simple Bankart Procedure

Bankart injury is one of the main pathological mechanisms of traumatic anterior shoulder dislocation. Therefore, the key to treating patients with traumatic recurrent anterior shoulder dislocation is to effectively repair the Bankart injury. The Bankart reconstruction procedure is to effectively reconstruct the height of the labrum and restore the good integrity of the labrum-capsule-ligament complex, thereby reconstructing the anterior structure of the shoulder joint. Currently, in clinical practice, arthroscopic Bankart reconstruction has become the standard surgical method for the treatment of patients with traumatic anterior shoulder instability [11]. For patients with recurrent anterior shoulder dislocation, they often have anterior glenoid bone defects. Biomechanical analysis reveals that the degree of anterior glenoid bone defect directly influences shoulder stability: the more severe the defect, the poorer the stability of the shoulder joint. Therefore, arthroscopic technology should be used to accurately assess the bone defect, and the size of the defect should be used to determine whether to perform only the arthroscopic simple Bankart procedure. However, there is still a lack of a unified standard for the standard value of the degree of bone defect [12]. If the patient has no bone defect, arthroscopic simple Bankart procedure can be performed. If the patient is accompanied by bone defect, the surgical standard should be determined by distinguishing between high-level athletes and the general population. In actual clinical treatment, scientific and reasonable reference standards should be formulated based on different populations, and further discussion is needed to clarify the optimal critical value of the degree of bone defect.

3.2 Arthroscopic Remplissage Procedure

The Remplissage procedure specifically refers to the effective suture and fixation of the posterior joint capsule and infraspinatus tendon at the humeral head defect. The application of this technology can effectively repair patients with anterior shoulder dislocation accompanied by humeral bone loss. The risk of Hill-Sachs injury in patients with recurrent shoulder dislocation is 80%-93%. If patients with shoulder instability present with Hill-Sachs lesions, the success rate of arthroscopic Bankart repair alone is 0% [13]; arthroscopic technology was used to assess the bone defect in patients with

Hill-Sachs lesion, and the results showed that when the humeral head bone defect was less than 40%, the arthroscopic Remplissage procedure was selected for treatment, and the postoperative ROWE score of the patients was approximately 92.9 points, achieving a relatively ideal long-term follow-up effect [14]. In clinical practice, Bankart injury and Hill-Sachs injury often coexist. When treating such patients, if the Hill-Sachs injury is less than 40% and the glenoid bone defect is less than 20%, the arthroscopic Remplissage procedure and Bankart procedure can be combined. In actual clinical treatment, if the degree of bone defect exceeds the above values, bone reconstruction surgery can be selected.

3.3 Arthroscopic ASA Procedure

In clinical practice, the arthroscopic Bankart procedure is often used to repair the anterior-inferior glenoid labrum complex. If the glenoid bone defect area in patients with Hill-Sachs injury is less than 25%, the recurrence rate of dislocation is relatively high after only repairing the anterior glenoid soft tissue [15]; in addition to the combined application of the Remplissage procedure and Bankart procedure for treatment, the arthroscopic subscapularis anchor (ASA) procedure can also be selected. Specifically, on the premise of effectively fixing the anterior-inferior glenoid labrum complex, part of the subscapularis tendon is sutured to the anterior-inferior glenoid labrum to further improve the anterior stability of the shoulder joint [16]. Although the application of the arthroscopic ASA procedure can provide more ideal anterior stability of the shoulder joint, there is still no unified conclusion on whether this technology will limit the postoperative external rotation of the shoulder joint based on current results, and further research is needed in the future.

4 Conclusion

In recent years, with the gradual improvement and advancement of arthroscopic technology and related instruments and equipment, in clinical practice, most open surgeries can be completed under arthroscopy for the treatment of patients with recurrent anterior shoulder dislocation, and both clinicians and patients have recognized its curative effect. For patients with recurrent anterior shoulder dislocation, their injury conditions vary. To ensure the surgical efficacy and reduce the risk of postoperative recurrence, in actual clinical treatment, not only the patient's sports level and age should be considered, but also arthroscopic technology should be used to comprehensively assess the bone defect to determine the most appropriate treatment plan.

References

[1] Zhang H X, Zhai L D, Yang X M, et al. Efficacy Observation of Bone and Soft Tissue Surgery in the Treatment of Traumatic Recurrent Anterior Shoulder Dislocation[J]. Sports Science and Health Research, 2025(1):55-60.

[2] Jin P P, Tang L L, Ke Y Q, et al. Comparison of Clinical Efficacy between Open Surgery via Axillary Approach and Arthroscopic Minimally Invasive Treatment for Recurrent Anterior Shoulder Dislocation[J]. Orthopaedics, 2024,15(4):320-326.

[3] Deng G D, Lan R H, Huang M Q, et al. Analysis of Clinical Effect of Arthroscopic Surgery in the Treatment of Traumatic Recurrent Anterior Shoulder Dislocation[J]. Chinese and Foreign Medical Treatment, 2024,43(20):37-41.

[4] Wang Y, Liu X W, Yan Z L, et al. Application of LU-tar jet Consistent Arc Technology in the Treatment of Recurrent Shoulder Dislocation with Giant Glenoid Defect[J]. Chinese Journal of Reparative and Reconstructive Surgery, 2024,38(6):672-678.

[5] Lou C, Lu Z K, Lin J, et al. Arthroscopic Adjustable Dilator for the Treatment of Posterior Shoulder Dislocation with Glenoid Bone Defect[J]. Chinese Journal of Traumatology, 2023,39(12):1109-1113.

[6] Wang C Q, Zhao C W, Wang K, et al. Short-term Efficacy of Modified Arthroscopic Iliac Bone Grafting in the Treatment of Recurrent Shoulder Dislocation[J]. Chinese Journal of Shoulder and Elbow Surgery (Electronic Edition), 2022,10(4):312-318.

[7] Zhang M T, Liu J X, Yang Z T, et al. Early Efficacy of Arthroscopic Autologous Osteochondral Grafting in the Treatment of Recurrent Anterior Shoulder Dislocation[J]. China Journal of Orthopaedics and Traumatology, 2022,35(3):233-237.

[8] Huang G, Xu J, Chen W G, et al. Efficacy Analysis of Minimally Invasive Modified Bristow-Latarjet Procedure and Bankart Repair in the Treatment of Recurrent Shoulder Dislocation[J]. Chinese Journal of Postgraduates of Medicine, 2025,48(2):154-159.

[9] Shao Z X, Zhang S H, Jiang Y F, et al. Arthroscopic Modified Loop Fixation "Double-Embedded" Iliac Bone Graft Revision for Recurrent Anterior Shoulder Dislocation: Two-year Initial Follow-up Results[J]. Chinese Journal of Sports Medicine, 2021,40(7):509-517.

[10] Yuan S C, Tan Z C, Lin F C, et al. Application Value of CT Localization of Suprascapular Nerve during Internal Fixation Bone Tunnel Drilling in Arthroscopic Bristow-Latarjet Procedure [J]. Chinese Journal of Tissue Engineering Research, 2020,24 (6):856-861.

[11] Yuan G S, Wu Y M. Mid-term Efficacy of Arthroscopic Bankart Repair in the Treatment of Recurrent Anterior Shoulder Dislocation[J]. Journal of Medical Theory and Practice, 2024,37(11):1869-1871.

[12] Zhang G F, Yu S J, Ke Y P, et al. Efficacy Analysis of Arthroscopic Bankart Reconstruction for Recurrent Shoulder Dislocation[J]. Journal of Navy Medicine, 2021,42(1):110-111.

[13] Yao W P, Li Y J, Wu J Q, et al. Arthroscopic Bankart Injury Repair Combined with Remplissage Procedure for Recurrent Anterior Shoulder Dislocation Complicated with Hill-Sachs Injury[J]. Chinese Journal of Orthopaedic Trauma, 2021,33(2):72-74.

[14] Xing J S, Lu M F, Zhao L L, et al. Arthroscopic Bankart Injury Repair Combined with Remplissage Plombage for Recurrent Anterior Shoulder Dislocation Complicated with Hill-Sachs Defect in Adults[J]. China Journal of Orthopaedics and Traumatology, 2021,34(6):497-503.

[15] Luo D J, Huang F G, Ji Y, et al. Autologous Iliac Bone Graft Combined with Bone Tunnel Repair and Fixation of Subscapularis Insertion for Three Cases of Old Posterior Shoulder Dislocation Complicated with Reverse Hill-Sachs Injury[J]. Chinese Journal of Reparative and Reconstructive Surgery, 2021,35(6):789-791.

[16] Tu X Z, Mi M, Zha Y J, et al. Efficacy Analysis of Subscapularis Approach for the Treatment of Ideberg Type Ⅰa Glenoid Fracture[J]. Chinese Journal of Orthopaedic Trauma, 2022,24(2):132-137.