



# Arthroscopic Autologous Scapular Spine Bone Graft for Recurrent Anterior Shoulder Dislocation With Subcritical (10%-15%) Glenoid Bone Loss

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**Abstract:** For anterior shoulder instability with subcritical glenoid bone loss (10%-15%), there is no consensus on the optimal treatment. Now, we describe the technique of using autogenous scapular spine bone graft for recurrent anterior shoulder dislocation. This procedure can effectively increase the anterior bone barrier and strengthen the effect of Bankart repair. In addition, this procedure not only avoids coracoid or iliac crest transfer, but also adopts nonrigid fixation, which makes it safer and more convenient. We believe that this technique will provide a promising alternative to the surgical treatment of recurrent anterior shoulder dislocation in subcritical glenoid bone loss (10%-15%).

## Introduction

Glenoid bone loss is one of the main risk factors for recurrent anterior shoulder dislocation. Glenoid bone loss significantly reduces the shoulder stability in biomechanics after Bankart repair with a high predicted recurrence rate.<sup>1,2</sup> Currently, for the treatment of shoulder anterior recurrent dislocation, most scholars consider 10% as the threshold of glenoid bone loss that Bankart and Remplissage soft tissue repair is sufficient to achieve satisfactory results. When the glenoid bone loss exceeds 15%, bony surgery, such as the Latarjet-Bristow or autologous iliac crest bone graft (ICBG), should be strongly recommended.<sup>3-6</sup> However, patients with subcritical glenoid bone loss at 10% to 15% are common. For this type of glenoid bone loss, the failure rate is high for simply soft tissue reconstruction, especially in patients with high-level

sports activity or joint laxity; therefore, bony surgery may achieve more satisfactory results.<sup>7</sup> In brief, there is no consensus on the optimal treatment for patients with subcritical glenoid bone loss at 10% to 15%.

It has been reported that, as the loss of glenoid bone cannot be addressed, there is a higher risk of redislocation after soft tissue repair.<sup>8,9</sup> On the other hand, despite the fact that the Latarjet procedure can significantly reduce the rate of redislocation, growing evidence in the literature indicates that it has plenty of postoperative complications, such as bone graft osteolysis and nerve injury.<sup>10-12</sup> ICBG procedure has similar drawbacks, and it requires an additional surgical site, making donor site morbidity also a concern. The reported complication rate of ICBG procedure is approximately 25%-30%, with infection hematoma, meralgia paresthetica, and iliac wing fracture being the main reasons of failure.<sup>13,14</sup>

Therefore, in patients with subcritical (10%-15%) glenoid bone loss, we developed the technique of using autogenous scapular spine bone graft for recurrent anterior shoulder dislocation (Fig 1). Our clinical experience<sup>15</sup> indicates that this technique is safer and easier to perform compared to Latarjet procedure and ICBG; also, it can effectively promote glenoid reconstruction and labrum regeneration, with multisite morbidity and complications being greatly reduced.

This autogenous scapular spine bone graft technique is indicated in a Bankart lesions with subcritical glenoid bone loss (10%-15%). Contraindications to this technique include severe bone defects of the glenoid or

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Full ICMJE author disclosure forms are available for this article online, as supplementary material.

Received March 14, 2022; accepted June 27, 2022.

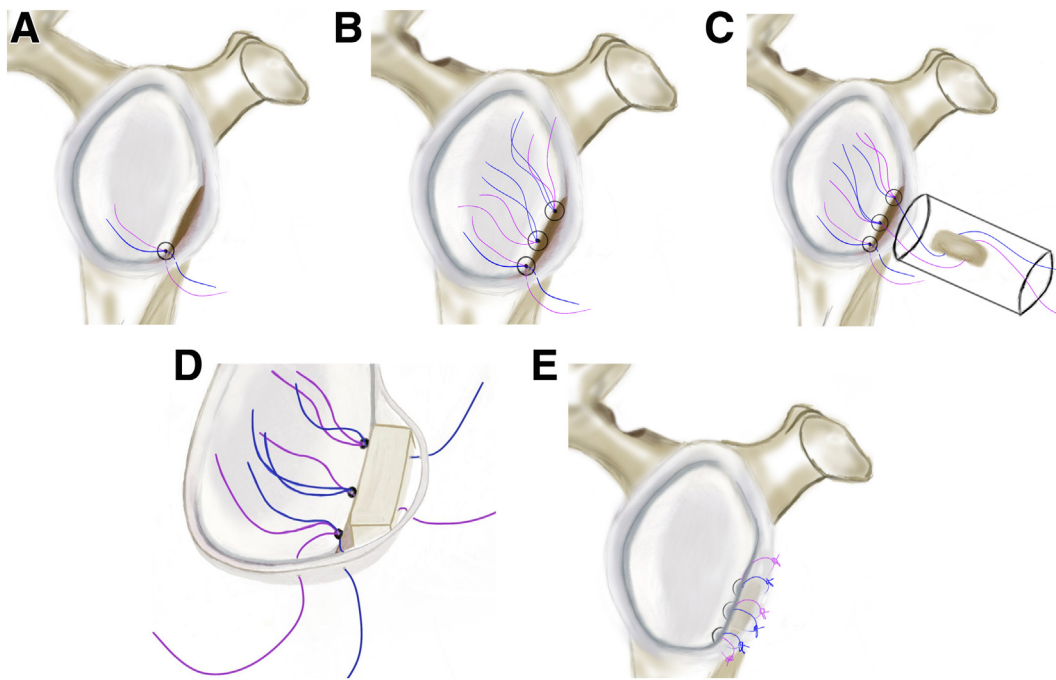
Address correspondence to Ming Xiang, Ph.D., Department of Upper Limb, Sichuan Provincial Orthopaedic Hospital, Chengdu, 610041, China. E-mail: [joseph\\_xm@sina.com](mailto:joseph_xm@sina.com)

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2212-6287/22368

<https://doi.org/10.1016/j.eats.2022.06.027>



**Fig 1.** (A) The “labral anchor” is inserted at 5 o’clock from the anterosuperior portal, and two sutures are passed through the inferior glenohumeral ligament complex (IGHLC) in preparation for subsequent Bankart repair. (B) The “graft anchors” are inserted at the 4:30 and 3 o’clock from the anterosuperior portal. And the bone graft is obtained at the scapular spine. (C) One suture from each of the two graft anchors is correspondingly shuttled through the bone tunnels separately. And a cannula from the anterosuperior portal is used for transporting the bone graft. (D) The bone graft is covered by the IGHLC and integrated with the anterior glenoid rim. Two graft anchors sutures, which are shuttled through the bone tunnels, are then passed through the IGHLC. (E) After the IGHLC is pretensioned, sutures of the two graft anchors are tied up to fix the bone graft and repair the IGHLC simultaneously. Additional sutures are then tied up to accomplish the Bankart repair and reinforce the fixation of the bone graft.

humeral head, joint hypermobility, and associated scapular lesions (Table 1).

### Surgical Procedure

The operation is illustrated in Video 1. Autogenous scapular spine bone graft and Bankart repair are combined operations that ensures that the glenoid bone graft has optimal biomechanical results, and capsulolabial repair and reliably ensures bone graft flush with the articular surface are critical steps. Table 2 explains the tips, pitfalls, and key points of this technique.

### Preoperative Patient Positioning

After general anesthesia and interscalene block, the patient is put in lateral decubitus position. The affected

shoulder is abducted by 40° through the abduction brace, and appropriate forward flexion traction is performed.

### Portal Establishment and Arthroscopic Examination

The routine posterior portal is established to introduce the scope. A thorough check of the biceps tendon lesion, rotator cuff, and capsular integrity, both on the glenoid and the humeral side, is carried out. Then glenoid bone loss is checked, and the range of bone grafting is measured. Anterosuperior and anteroinferior portals are routinely established with cannulas.

### Preparation of Bone Grafts

The midpoint of the scapula is located, and a 4-cm transverse incision along the scapular spine is made. The scapula is well exposed by carefully dissecting trapezius fascia, aponeurosis, as well as the posterior deltoid insertion. A tricortical bone graft of 20 mm × 10 mm × 8 mm is retrieved by osteotome, then the deltoid fascia is repaired by suturing. Notably, care should be taken to avoid nerve injury, especially the accessory nerve, when retrieving the bone graft (Fig 2).

First, the cortical face of the graft, which is tended to integrate with the anterior glenoid rim, is slightly

**Table 1.** Indications and Contraindications

Indications
Bankart lesions with subcritical glenoid bone loss (10%-15%)
Contraindications
Severe bone defects of the glenoid or humeral head
Joint hypermobility
Associated scapular lesions

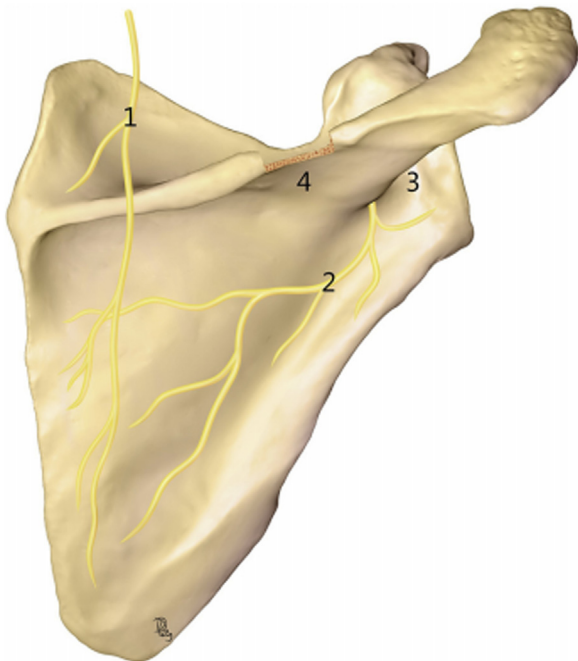
**Table 2.** Pearls and Pitfalls

Pearls
The cortical face of the graft, which is tended to integrate with the anterior glenoid rim, is slightly decorticated.
A fresh bone bed with a width of about 3 mm is made at the anterior glenoid rim to prepare for bone grafting.
The cancellous face of the bone graft is located on the medial side, and the large end of the bone graft should be located inferiorly.
When tying up the “graft-anchors” sutures to fix the bone graft and repair the IGHLC simultaneously, it is necessary to elevate the IGHLC up and pretension it.
The retriever or liberator knife should be used to prevent displacement, rotation or turnover of the graft fragment while tying.
Pitfalls
It should be adequately relieved when placing the bone graft, which would otherwise be difficult.
By controlling the suture that shuttled through the bone tunnels and adjusting the direction and position of the bone graft with the help of retriever or liberator knife; otherwise, the bone graft is displaced or turned over.

decorticated. Then two 1.5-mm-wide tunnels placed 10 mm apart are made through the graft along the midline of the surface, which are 5 mm away from the graft edge (Fig 3).

### Anterior Glenoid Preparation

The arthroscope is switched to the anterosuperior portal, and the retracted IGHLC is detached from the glenoid neck to the 6 or 6:30 o'clock position with the liberator knife, which would be elevated to a plane as high as the glenoid surface. The anterior glenoid rim is appropriately decorticated by the shaver and burr, and a strip of freshened bone bed with a width of about 3 mm is created (Fig 4).



**Fig 2.** Illustration of scapular spine bone graft harvest (right shoulder). 1, accessory nerve; 2, suprascapular nerve; 3, spino-glenoid notch; 4, graft harvest site. Reproduced with permission from Xiang M et al.<sup>15</sup>

### Placement of the Suture Anchors and the Guide Suture

One anchor (DePuy Mitek, Raynham, MA) is inserted as the “labral anchor” at 5 o'clock (Fig 5), and two sutures are passed through the IGHLC in preparation for subsequent Bankart repair. Then two suture anchors (DePuy Mitek, Raynham, MA; Smith & Nephew, Andover, MA) are inserted as the “graft-anchors” at the 4:30 and 3 o'clock (right shoulder) at the anterior glenoid rim, respectively.

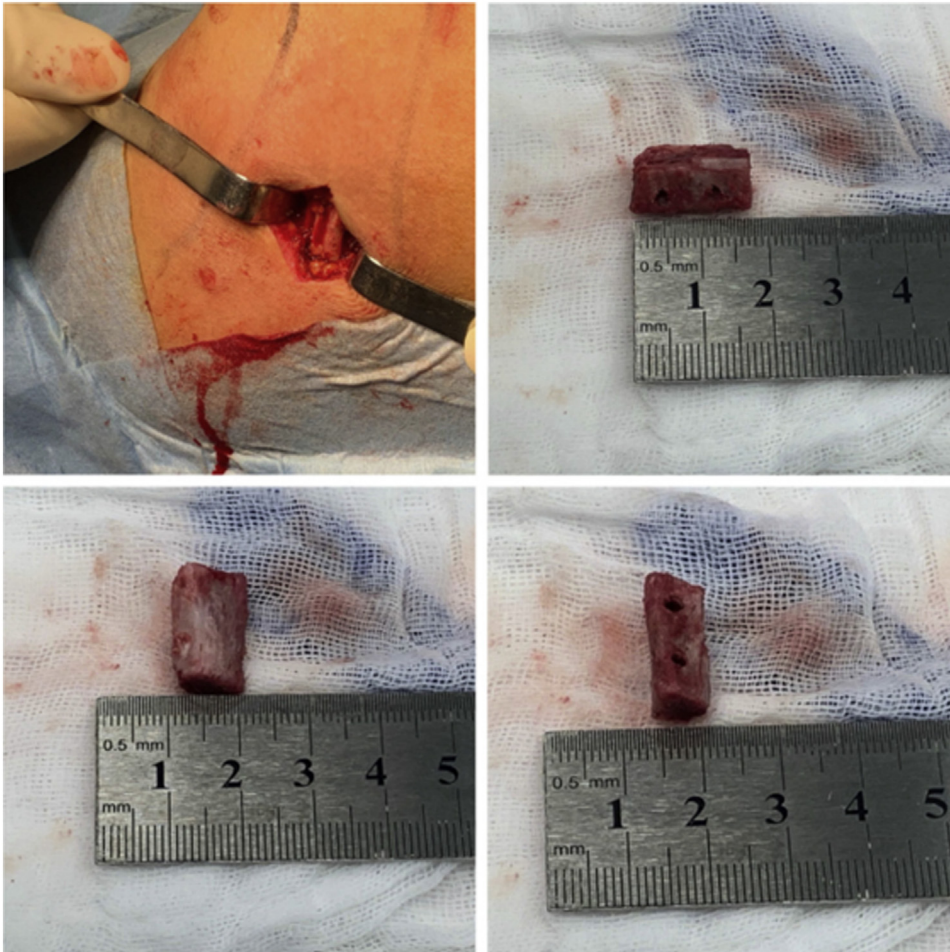
### Implantation of Bone Graft

One suture of each of the two “graft-anchors” is correspondingly shuttled through the bone tunnels separately (Fig 6). The bone graft is then carefully slid into the joint through the anteroinferior cannula (size 10 mm × 15 mm × 130 mm; Hangzhou Rejoin Mastin Medical Device Co., Ltd, Hangzhou, Zhejiang, China) (Fig 7).

The bone graft is covered by IGHLC and integrated with the anterior glenoid rim. It is carefully adjusted with a probe or a retriever to make it flush with the surface of the glenoid. When adjusting the orientation of the bone graft, it should be noted that the cancellous face of the bone graft is located on the medial side, and the large end of the bone graft should be located inferiorly (Fig 8).

### Graft Fixation and Bankart Repair

Two “graft anchors” sutures, which shuttled through the bone tunnels, are passed through the IGHLC with a suture hook (Fig 9). The surgeon elevates the IGHLC and pretensions it with the retriever. When the labrum is pretensioned, sutures of the two “graft-anchors” are tied up to fix the bone graft and repair the IGHLC simultaneously (Fig 10). It is important to prevent displacement and rotation of the graft while tying; thus, a retriever or a liberator knife from the posterior portal could be used (Fig 11). Additional sutures are then tied up to accomplish the Bankart repair and reinforce the fixation of the bone graft (Fig 12).



**Fig 3.** Scapular spine bone graft harvest (right shoulder).

### Rehabilitation

The affected shoulder is strictly immobilized with a sling for 4-6 weeks after surgery. Passive rehabilitation of elevation and external rotation are allowed at 4 weeks. Active rehabilitation and daily activities begin after 6 weeks. At 12 weeks, strengthening exercises start as soon as clinical and imaging evaluation confirms the bone graft is healing well. All sports activities are allowed after 6 months of the surgery.

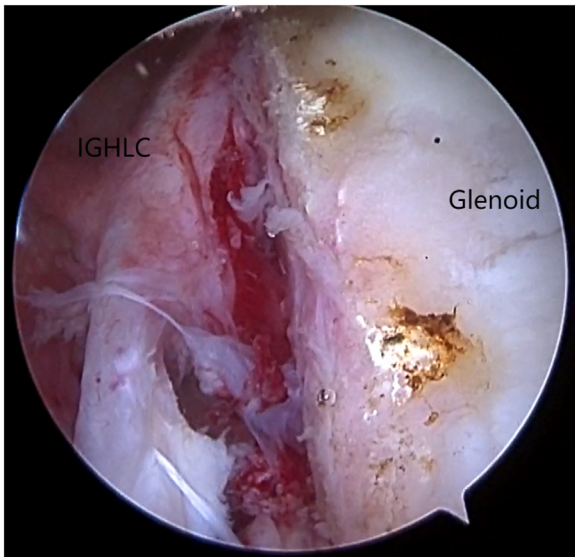
### Discussion

Soft tissue surgery (Bankart, Remplissage) or bony surgery (Latarjet-Bristow or ICBG) has proven to be available treatments for recurrent anterior shoulder dislocation, based on varying degrees of bone loss. Whereas for anterior shoulder instability with subcritical glenoid bone loss (10%-15%), each procedure has certain limitations and complications, which is why we try to seek an alternative bone graft source for glenoid bone grafting.

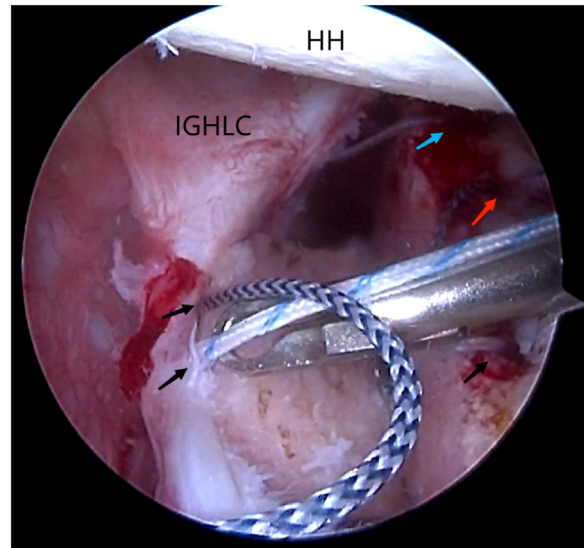
The technique currently has the following characteristics: First, autogenous scapular spine bone grafting for

glenoid bone loss not only can increase the anterior bone barrier but also avoid coracoid transfer. Therefore, the risk of nerve injury can be reduced. Second, because the bone graft donor site is just near the arthroscopic portals, it is much easier and convenient, which saves more preparation time by avoiding extra draping of the iliac crest area and also avoids the complications associated with bone grafting from the iliac crest. Third, bone grafts in this technique are nonrigid and fixed. Nonrigid fixation is convenient and time saving compared with rigid fixation. Glenoid bone grafting with suture anchor fixation has been widely reported with high satisfaction rates.<sup>16-19</sup> With suture anchor double-tunneled fixation, the graft is reliable, flush with the glenoid articular surface, and without rotation. Previous reports<sup>20</sup> have shown that glenoid bone grafting without fixation can induce glenoid remodeling, and satisfactory healing results can be obtained with nonrigid fixation.

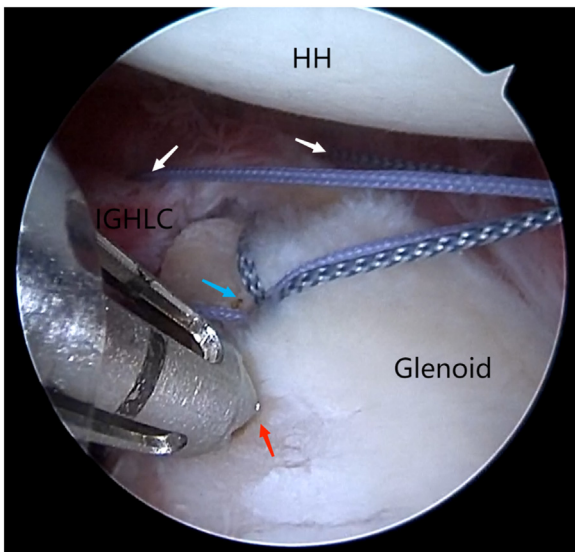
A potential disadvantage of this technique is that it relies on the scapular spine, which is not as bulky as the coracoid or iliac bone graft, so its bony blocking effect is



**Fig 4.** Anterior glenoid preparation (right shoulder viewing from the anterosuperior portal). The inferior glenohumeral ligament complex (IGHLC) is detached to the 6 or 6:30 o'clock position, which would be elevated to a plane as high as the glenoid surface. The anterior glenoid rim is appropriately decorticated by the shaver and burr, and a strip of freshened bone bed with a width of about 3 mm is created.



**Fig 6.** Implantation of bone graft (right shoulder viewing from the anterosuperior portal). One suture of each of the two "graft-anchors" is correspondingly shuttled through the bone tunnels separately (black arrows). The blue arrow indicates the "labral anchor" which at 5 o'clock. The red and black arrow indicate the graft-anchor, which at 4:30 and 3 o'clock separately. HH, humeral head.



**Fig 5.** Anchor implantation (right shoulder viewing from the anterosuperior portal). The "labral anchor" (blue arrow) is inserted at 5 o'clock and two sutures (white arrows) are passed through inferior glenohumeral ligament complex (IGHLC) in preparation for subsequent Bankart repair from the posterior portal. And then the "graft-anchors" is inserted at the 4:30 and 3 o'clock (right shoulder) at the anterior glenoid rim from the anterosuperior portal. The red arrow indicates the graft-anchor which at 4:30 o'clock. HH, humeral head.

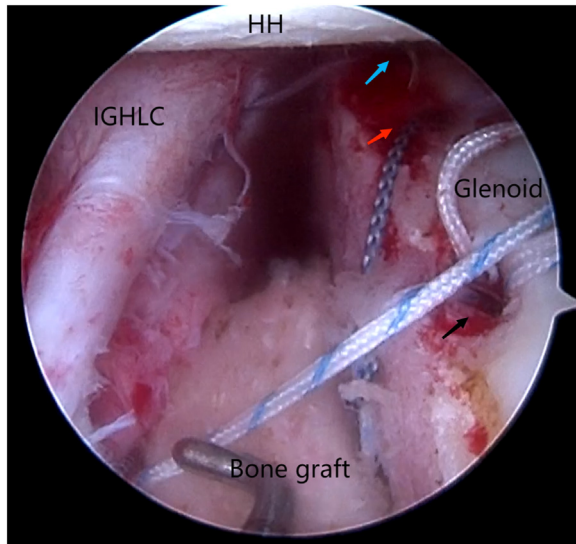
theoretically weaker. Therefore, it is not indicated for cases with severe glenoid bone loss. [Table 3](#) describes the advantages and disadvantages of the technique.

In view of the advantages and disadvantages described above, the autogenous scapular spine bone grafting technique is indicated for recurrent anterior shoulder dislocation in the setting of subcritical glenoid bone loss (10%–15%). Conversely, contraindications to this technique are severe bone defects and associated scapular disease.

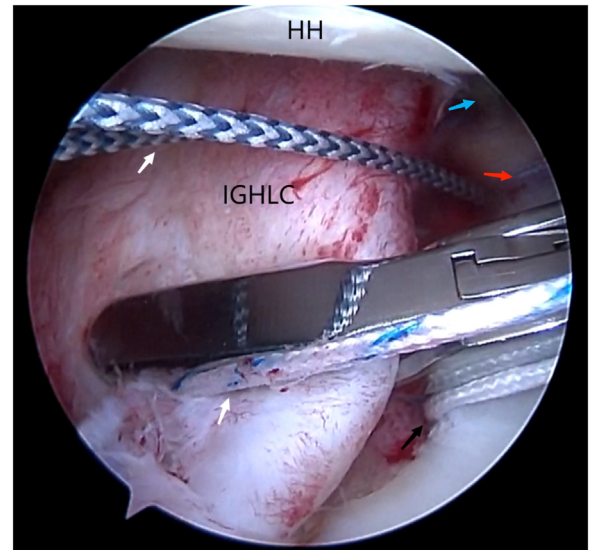
Encouraged by the success of previous techniques, we believe that the autogenous scapular spine bone



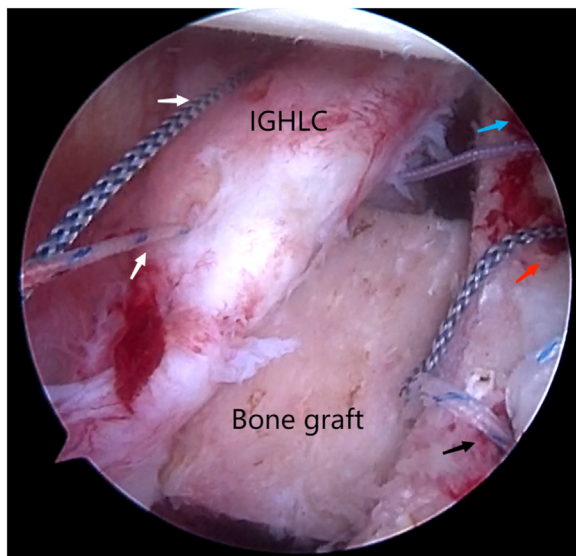
**Fig 7.** The cannula for transporting the bone graft (size 10 mm × 15 mm × 130 mm; Hangzhou Rejoin Mastin Medical Device, Hangzhou, Zhejiang, China)



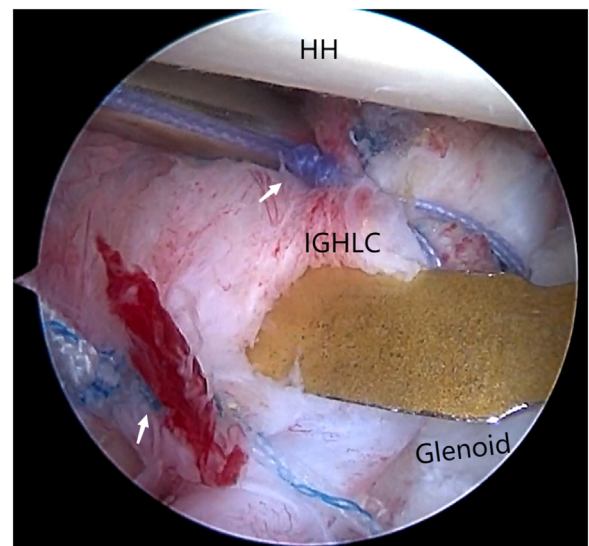
**Fig 8.** Right shoulder viewing from the anterosuperior portal. The bone graft is covered by the inferior glenohumeral ligament complex (IGHLC) and integrated with the anterior glenoid rim. The blue arrow indicates the “labral anchor,” which is at 5 o’clock. The red and black arrows indicate the “graft-anchors” which are at 4:30 and 3 o’clock separately. HH, humeral head.



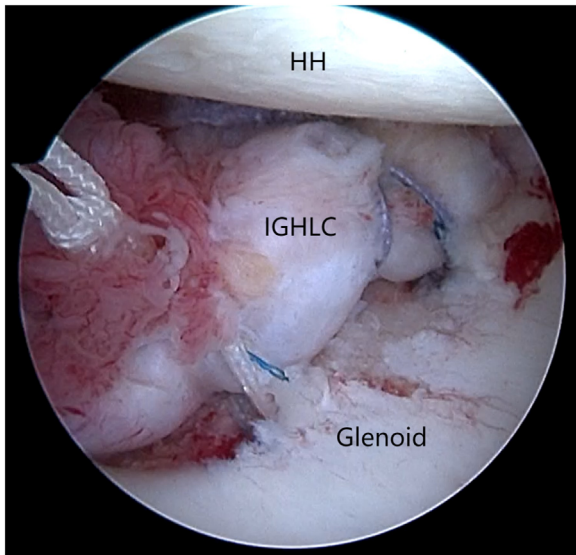
**Fig 10.** Anterosuperior viewing portal of right shoulder. The surgeon elevates the inferior glenohumeral ligament complex (IGHLC) and pretensions it with the retriever from the posterior portal. When the elevated IGHLC is pretensioned, sutures (white arrows) of the two “graft anchors” are tied up to fix the bone graft and repair the IGHLC simultaneously. The blue arrow indicates the “labral anchor,” which is located at 5 o’clock. The red and black arrows indicate the graft anchors which are located at 4:30 and 3 o’clock separately.



**Fig 9.** Anterosuperior viewing portal of right shoulder. Two “graft-anchors” sutures (white arrows), which are shuttled through the bone tunnels, are passed through the inferior glenohumeral ligament complex (IGHLC). The blue arrow indicates the “labral anchor,” which is at 5 o’clock. The red and black arrows indicate the graft anchors, which are located at 4:30 and 3 o’clock separately.



**Fig 11.** Anterosuperior viewing portal of right shoulder. The liberator knife from the posterior portal is used to prevent displacement, rotation, or turnover of the graft fragment while tying. The white arrows indicate the sutures that are used to repair inferior glenohumeral ligament complex (IGHLC) and reinforce the fixation of the bone graft.



**Fig 12.** Anterosuperior viewing portal of right shoulder. Additional sutures are tied up to accomplish the Bankart repair and reinforce the fixation of the bone graft. HH, humeral head.

**Table 3.** Advantages and Disadvantages

Advantages
Effectively increases the anterior bone barrier and strengthens the effect of Bankart repair
Easier, safer, and convenient, which saves more preparation time
Avoids coracoid transfer or bone graft from the iliac crest, so the risk of related neurovascular injury is reduced.
Induces glenoid remodeling, and satisfactory healing results can be obtained
Disadvantages
It relies on the scapular spine, which is not as bulky as the coracoid or iliac bone graft. If scapular spine is too small or too thin, the bony blocking effect is not good, and it is easy to fail.
Risk of migration or turnover of the bone graft.
When taking scapular spine bone graft, the accessory nerve is at risk of injury.

grafting technique presented here will provide a promising alternative to the surgical treatment of recurrent anterior shoulder dislocation in subcritical glenoid bone loss (10%-15%).

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