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Supplement 1

Guiding system for arthroscopic inlay Bristow

Specific instruments have been designed to improve the safety and accuracy of arthroscopic inlay Bristow procedure (Weigao, Shangdong, China).

1. The glenoid inlay positioning system was used to facilitate the positioning of the trough in the appropriate position in the glenoid (Figure S1A). The system ensures that the center tunnel of trough is medial to the anterior glenoid rim and up to the bottom of the glenoid with adjustable distance based on the size of the coracoid and the glenoid.
2. The coracoid plug preparation system had two functions (Figure S1B). First, it could be used to turn the transferred coracoid into a cylinder shape which could be put into the trough in the glenoid. Second, it helped to drill a center tunnel in the coracoid from the tip to the bottom of the coracoid graft.
3. The glenoid inlay drilling system was to make a trough for the transferred coracoid in the glenoid (Figure S1C). After positioning, a specific drilling bit was used to make a trough with diameter of 10mm and depth of 5-10mm to increase the contact area of the coracoid and the glenoid.

Supplement 2

Portal Placement

Four anterior portals were used for this procedure in addition to the posterior portal (A) (Figure S2). The entry point for the posterior (A)-portal was confirmed with a needle to ensure it was parallel with the glenoid, allowing the antero-posterior axis of the joint to be identified and marked on the skin. Superior lateral portal (B) was located just 1cm anterior and lateral to the anterior-lateral corner of acromion and was used for preparation for coracoid and visualization for Bankart lesion. The proximal portal (C) was above the coracoid process and used for coracoid osteotomy. The inferior-lateral portal (D) was located in the axillary fold and 2-3 finger-widths distal to the coracoid tip, and used for visualization during coracoid preparation and

subscapularis separation. Finally, the inferior-medial (E) portal was located 3-4 finger-widths medial to the inferior-lateral portal through the pectoralis major muscle, and used for soft tissue detachment of the medial coracoid, preparation of subscapularis and to introduce the guiding system for the making of trough and fixation of the coracoid.

Supplement 3

Surgical technique

Step 1: evaluation of shoulder joint

General anesthesia and interscalene block were used in all patients. A thorough evaluation was performed through posterior portal (A) including the glenoid and humeral chondral surfaces, the rotator cuff, glenoid labrum, and glenoid or humeral bony defects.

Step 2: coracoid preparation, drilling, and osteotomy

The first anterior portal (B) was created when the arthroscope was in the posterior portal (A). A needle was used to make sure that instrumentation would reach the undersurface of the coracoid and the anterior neck of the glenoid. The coracoid process was identified with electrocautery and soft tissue posterior of coracoid process was removed. The cortex of coracoid process was freshed with bur. And then coracocacromial ligament was released from the coracoid and the lateral and posterior aspect of conjoint tendon was exposed. The anterior bursa of the subscapularis was removed with a shaver to visualize the entire subscapularis muscle. Portal D and E were then created using a needle to ensure the appropriate position.

The scope was then placed in portal D and electrocautery was placed in portal E, which allowed a better view of the coracoid and easy release of the pectoralis minor from the medial border of the coracoid. For the present technique, the length of the coracoid osteotomy was usually 15mm and adjustable based on the defect size of glenoid. It is not necessary to remove too much soft tissue around the coracoid, and thus protect the tendon and ligament attachment as much as possible. Portal C was created for coracoid osteotomy with the help of a needle, usually 2cm at the medial superior part of the tip of coracoid, make sure that the needle was oriented to the

middle and perpendicular to the coracoid. A 2mm K-wire with an outer sleeve was used to drill until it came through the inferior surface of the coracoid. Then the K-wire was replaced with a polydioxanone (PDS) suture to retract the coracoid graft from portal D after it was osteotomized. The coracoid was osteotomized with an osteotome (introduced through the portal C), harvesting about 15 to 20 mm of bone.

Step 3: subscapularis splitting and labrum detachment

The anterior bursa of subscapularis was removed with a shaver to visualize the entire subscapularis muscle, and it was extremely important to identify the position of the axillary nerve.

The anterior-inferior labrum was completely detached to 6 o'clock, and preserved carefully to visualize the glenoid bone defect. A switch stick was used to penetrate through subscapularis from posterior portal on the level of 5 o'clock while holding the shoulder in external rotation. While the tip of the switch stick coming out of the SSC muscle, the axillary nerve was protected by the retractor.

While viewing from portal D, the split was performed at the junction of inferior 1/3 and superior 2/3 of the SSC muscle, using electrocautery and shaver through portal E. Caution should be taken while moving laterally towards the insertion into the lesser tuberosity. External and internal rotation of the arm would provide better view and expose the muscle and tendon. A PDS suture was placed around the upper 2/3 of subscapularis and retracted from portal C to elevate the upper part of the subscapularis. Working together with the stick from portal A could help to open the subscapularis.

Step 4: glenoid preparation and drilling

Through portal E, the glenoid trough positioning system was to facilitate the positioning of trough in the appropriate position in the glenoid about 7.5mm above the bottom of the glenoid and 7mm below the joint surface of the glenoid (Figure S3 A, B). After positioning the trough, a specific drilling bit was used to make a trough with a diameter of 10mm and a depth of 5-10mm to increase the contact area of the coracoid graft and the glenoid (Figure S3 C, D).

Step 5: coracoid retrieval, trimming, transfer and fixation

The coracoid graft was retracted from portal D and held by Allice, then an Orthocord suture was placed in the junction of conjoin tendon and the tip of the graft to enhance the fixation of the graft. The coracoid graft was trimmed to fit the trough on the glenoid neck with a special designed razor (Figure S3 E, F). A K-wire was used to drill from the tip to the bottom of the coracoid graft to facilitate the fixation with the screw. **The diameter of screw is 3.5mm, typical lengths are from 36-40mm. After placing the screw in the graft, the graft was pushed in through Portal D. And then viewing through portal D, instrument was introduced using portal E to help guide the graft down through subscapularis split.** With the graft in place and aligned with the trough, the screw was then tightened to compress the graft into the trough (Figure S3 G, H).

Step 7: Bankart repair

Observation from the anterior superior portal and palpation with a probe confirmed the absence of overhanging of the coracoid bone block and the stiffness of the construct. The remaining capsule and labrum were now reattached to the glenoid rim, placing the graft in an extra-articular position. **Two grooves were drilled on the surface close to the anterior edge usually at 5 and 3o'clock position. The preset suture (Orthocord suture) on the junction of conjoin tendon and the tip of the graft was used to pass through the labrum and capsule, and then tightened and fixed with a 2.9mm-pushlock (Arthrex) on the 5 o'clock.** The other Pushlock was used to repair the upper labrum at 3 o'clock (Figure 4 I, J). Care was taken to avoid the screw of the coracoid.

Figure legends

Figure S1. Specific instruments designed to improve the safety and accuracy of arthroscopic inlay Bristow procedure. A. The glenoid inlay positioning system was to facilitate the positioning of trough in the appropriate position in the glenoid. B. The coracoid plug preparation system could be used to turn the transferred coracoid into a cylinder shape which could be put into the trough in the glenoid and helped to drill a center tunnel in the coracoid from the tip to the bottom of the coracoid graft. C. The glenoid inlay drilling system was to make a trough for the transferred coracoid in the glenoid.

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Figure S2. Portals used for inlay Bristow procedure. A. The entry point for the posterior -portal. B. Superior lateral portal. C. The proximal portal. D. The inferior-lateral portal. E. The inferior-medial portal.

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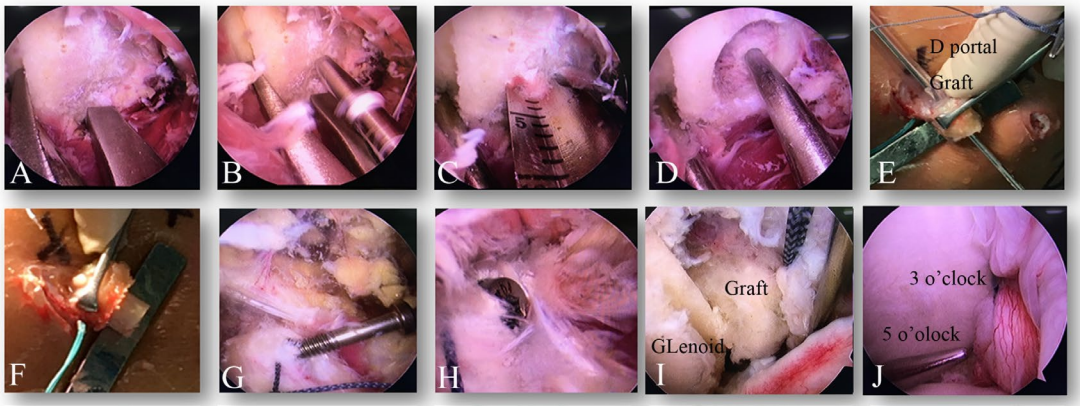

Figure S3. Arthroscopic Inlay Bristow procedure. A and B. The glenoid trough positioning system was to facilitate the positioning of trough in the appropriate position. C and D. A specific drilling bit was used to make a trough with a diameter of 10mm and a depth of 5 mm to increase the contact area of the coracoid graft and the glenoid. E and F. The coracoid graft was trimmed to fit the trough on the glenoid neck with a special designed razor. G and H. After placing the screw into the coracoid graft, the graft was pulled through the subscapularis split and into the trough of the glenoid. I and J. The remaining capsule and labrum were now reattached to the glenoid rim, placing the graft in an extra-articular position.