



Arthroscopic Latarjet Procedure Combined With Bankart Repair: A Technique Using 2 Cortical Buttons and Specific Glenoid and Coracoid Guides

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Abstract: The arthroscopic Latarjet procedure is challenging because it can be difficult to place 2 screws parallel to the glenoid surface and a medial portal (dangerous for the brachial plexus) is mandatory. In addition, precise positioning of the coracoid bone block flush with the joint line and in a subequatorial position as recommended is troublesome without the use of a guiding system because of the arthroscopic lens distortion. To improve the reproducibility of the arthroscopic Latarjet procedure and to minimize the risk of nerve complications, we developed a guiding system to optimize the positioning of the coracoid bone block and 2 cortical buttons to facilitate its fixation. Four portals are used: a posterior standard portal and 3 anterior portals, all lateral to the conjoint tendon. The anterior rim of the glenoid and the coracoid process are prepared. Two holes are drilled in the glenoid and in the coracoid process with 2 specific guides. The subscapularis is then split, and 2 cortical buttons are passed from posterior to anterior through the tunnels with a shuttle relay. The coracoid process undergoes osteotomy and is guided through the split in the subscapularis to the anteroinferior rim of the glenoid by pulling on the cortical buttons.

The arthroscopic Latarjet procedure was described by Lafosse et al.¹ in 2007 to address anterior shoulder instability with anterior glenoid bone loss. This technique is fully arthroscopic and combines an anterior capsulectomy with fixation of the coracoid process in the lying position (Latarjet procedure)² by 2 screws at the anterior rim of the glenoid, flush with the joint and under the equator. In 2007 and 2010, Boileau et al.^{3,4} described another technique using an arthroscopic coracoid bone block, in which the tip of

the coracoid process is transferred to the anterior rim of the glenoid through the subscapularis and fixed in a standing position by a screw (Bristow-Latarjet procedure)⁵ in combination with a Bankart repair. These 2 procedures provided excellent functional results with a low rate of recurrence (1%-3%) but with a 5% to 10% revision rate because of hardware problems caused by the screws.⁶ There are several potential drawbacks regarding the use of screws to fix the coracoid process, including screw pullout or breakage, fracture of the bone block, and graft avulsion. In addition, to place the screws parallel to the joint line, a portal medial to the coracoid needs to be created, which can lead to nerve complications. These reasons pushed Boileau et al.⁷ in 2016 to propose an arthroscopic technique for the Bristow-Latarjet procedure with a different method of fixation of the coracoid bone block using a cortical button. However, a recent biomechanical study has shown that the Bristow and Latarjet procedures are not equivalent in terms of effects on glenohumeral joint stiffness and stability in cases of glenoid bone deficiency.⁸ Moreover, the use of only 1 cortical button could expose the joint to the risk of insufficient stability of the fixation of the coracoid graft, which could rotate around the cortical button and therefore not heal to the glenoid. Therefore, we

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developed an arthroscopic Latarjet technique combined with a Bankart repair using 2 cortical buttons and specific glenoid and coracoid guides.

Surgical Technique

Anesthesia and Patient Positioning

Surgery is performed with the patient under general anesthesia with an interscalene block (Video 1). The patient is placed in a semi-beach-chair position, with the arm draped free to allow shoulder mobilization. The joint is set in neutral rotation and 30° of forward flexion with only 1 kg of distal traction to easily mobilize the shoulder as needed. A bump is placed along the medial border of the scapula to achieve scapular external rotation to decrease the risk of iatrogenic axillary nerve injury.⁹ The patient's head is secured on a headrest. A 30° arthroscope is used throughout the entire procedure, and the arthroscopic pump is set at 50 mm Hg of pressure to limit bleeding.

Portal Placement

Four portals are used for this procedure (Fig 1). First, a standard posterior (P) portal is created in the soft spot, 1 cm inferior and 1 cm medial to the posterolateral angle of the acromion. Second, an anteroinferior (AI) portal is created 2 cm distal to the tip of the coracoid

process, lateral to the conjoint tendon. Third, an anterolateral (AL) portal is placed 2 cm lateral to the anterolateral corner of the acromion. When one is creating this portal, care must be taken not to place it above the level of the inferior border of the coracoid process to facilitate the freshening of the inferior part of the coracoid process. An additional coracoid (C) portal is created just above the coracoid process. All the anterior portals are lateral to the conjoint tendon and are created under arthroscopic control from the posterior viewing portal. No potentially dangerous portals medial to the coracoid are needed in this technique. Seven steps are performed for the arthroscopic Latarjet procedure, and one additional step is needed for the Bankart repair.

Step 1: Intra-articular Evaluation. The camera is introduced in the P portal, and instruments are introduced in the AI portal. An intra-articular inspection of the joint is systematically performed. The glenoid and humeral articular surfaces are visualized and assessed. Injuries of the soft tissue and bone loss (on the humeral side and on the glenoid side) are confirmed. The rotator cuff tendons, long head of the biceps, and superior labrum are also investigated to identify associated lesions.

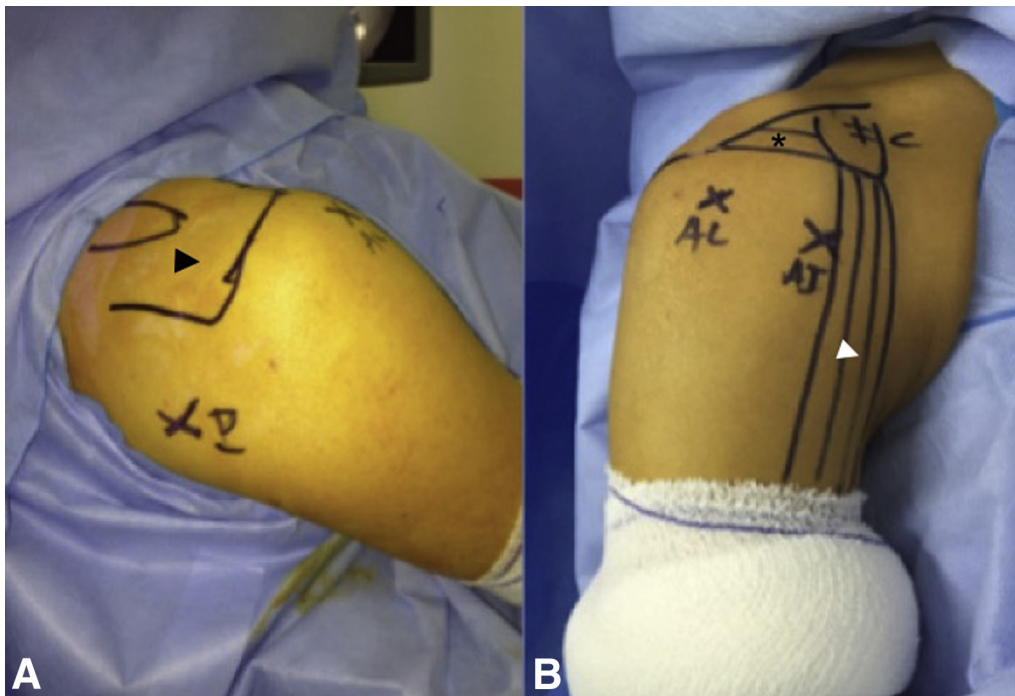


Fig 1. Arthroscopic portals: standard posterior (P) portal 1 cm inferior and 1 cm medial to the posterolateral angle of the acromion; anteroinferior (AI) portal 2 cm distal to the tip of the coracoid process, lateral to the conjoint tendon; anterolateral (AL) portal 2 cm lateral to the anterolateral corner of the acromion; and coracoid (C) portal just above the coracoid process. Preoperative pictures of a right shoulder are shown from the back (A) and from the front (B). The landmarks of the acromion (black arrowhead), conjoint tendon (white arrowhead), and coracoacromial ligament (asterisk) can be seen. All 4 portals are lateral to the conjoint tendon.

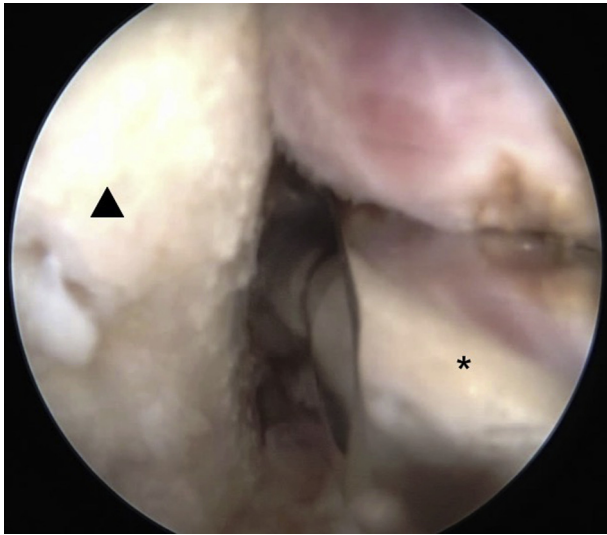


Fig 2. Posterior arthroscopic view of a right shoulder. The anterior wall of the glenoid (arrowhead) is debrided and flattened with a flat burr (asterisk) until a bleeding bony bed is obtained. The flat burr is in the anteroinferior portal, and the arthroscope is placed in the posterior portal.

Step 2: Preparation of Labrum and Anterior Glenoid Wall and Preparation of Inferolateral Part of Coracoid Process. A radiofrequency ablation (RFA) device (VAPR; Mitek, Raynham, MA) is introduced in the AI portal, and the rotator interval is opened. The coracohumeral ligament, superior glenohumeral ligament, and anterosuperior capsule are excised, and the coracoid process and conjoint tendon are exposed. The anterior labrum is detached from the 3- to 6-o'clock position using the RFA device. The equator of the glenoid is marked on the glenoid edge using the RFA device. The anterior wall is debrided and flattened with a flat burr (PowerRasp; Arthrex, Naples, FL) until a bleeding bony bed is obtained (Fig 2). Preparation for the future Bankart repair, which will be achieved at the end of the procedure, is performed. The anteroinferior labrum and anterior capsule are completely released from the glenoid until the muscular fibers of the subscapularis are visualized. Two to three capsulolabral lasso loop braided nonabsorbable sutures (FiberWire; Arthrex) are then passed and retrieved through the AL portal.

The anterior and lateral aspects of the conjoint tendon are dissected, and the coracoacromial ligament is excised with the RFA device. The inferior and lateral surfaces of the coracoid process are exposed after debridement of the surrounding soft tissue. Dissection of the conjoint tendon is carefully continued on its medial side just 2 cm distal to the coracoid tip after visualization of the neurovascular pedicle (musculocutaneous nerve).

The inferior surface of the coracoid process is then flattened with the flat burr from the AL portal (Fig 3).

Great care must be taken to remove all cortical spurs because these could prevent satisfactory contact between the graft and the anterior wall of the glenoid and could increase the risk of nonunion.

Step 3: Subscapularis Split. The subscapularis split is one of the most difficult steps of this procedure. This is why we recommend performing the split early in the procedure (third step) when the muscle is still not too swollen and before performing the other steps, which could lead to some bleeding (drilling of bone and osteotomy).

The camera is moved to the AL portal, and the RFA device is moved to the AI portal. The bursa of the subscapularis is removed, and the muscle fibers are exposed. The musculocutaneous and axillary nerves must be bluntly dissected and visualized in the space between the posterior part of the conjoint tendon and the anterior part of the subscapularis. Visualization of the nerves is facilitated by placing the arm in retro-pulsion to open the space (Table 1). A Wissinger rod is inserted in the P portal and passed through the subscapularis muscle at the height of the equator mark previously selected (Fig 4). Care must be taken to maintain the arm along the body during this step in order for the rod to exit at the junction between the upper two-thirds and inferior third of the muscle. The rod exits through the muscle lateral to the conjoint tendon and to the nerves. The split of the subscapularis can now safely be performed with the RFA device from anterior to posterior and from medial to lateral, in line with the muscle fibers, until the articular space is reached (Fig 4). A subscapularis spreader is then inserted in the P portal and opened to widen the subscapularis split.

Step 4: Glenoid Drilling. The camera is maintained in the AL portal to visualize the posterior aspect of the glenoid. The RFA device is moved to the P portal, and a posteroinferior capsulotomy of 1 cm in length is

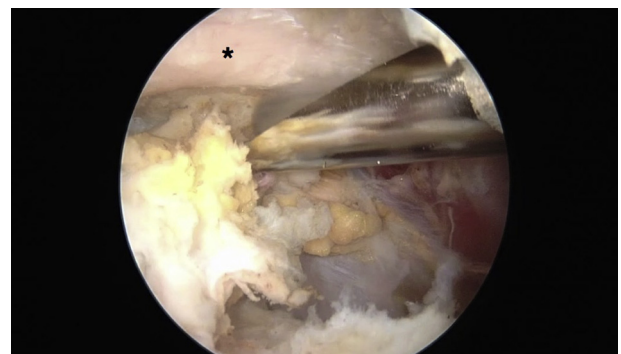


Fig 3. Posterior arthroscopic view of a right shoulder. The inferior surface of the coracoid process (asterisk) is flattened with the flat burr from the anterolateral portal. The arthroscope is placed in the posterior portal.

Table 1. Pearls and Pitfalls**Pearls**

The arm should be placed in retropulsion to open the space between the subscapularis and conjoint tendon to allow proper visualization of the axillary nerve before the split of the subscapularis.

The split should be performed at the level of the circumflex pedicle to prevent any limitation of external rotation (when the split is performed too high).

Great care should be taken to adequately prepare the anterior glenoid and the undersurface of the coracoid process to optimize matching.

Pitfalls

The surgeon should perform the tenotomy of the pectoralis minor with the probe of the radiofrequency device oriented superiorly to cut from inferior to superior to prevent injury to the brachial plexus.

Anterior dissection of the tendon of the pectoralis minor from the conjoint tendon should not go further than 2 cm distal to the tip of the coracoid process to prevent lesions of the musculocutaneous nerve.

Drilling of the glenoid tunnels from posterior to anterior should not go further than the subscapularis to prevent lesions of the axillary nerve.

performed to expose the posterior rim of the glenoid. The P portal is expanded to 10 mm on the skin, and the interval between the infraspinatus and teres minor is split with blunt scissors. The specific glenoid guide is inserted until complete contact with the posterior wall of the glenoid is obtained. The blade of the guide is locked with a hook on the anterior glenoid rim below the equator. The guide is secured posteriorly by pushing the medial rod against the skin on the scapular spine and anteriorly with the help of a blunt trocar inserted in the AI portal (Fig 5).

Two tunnels are drilled through the guide, 7 mm medial to the glenoid rim, without passing through the subscapularis to prevent any iatrogenic axillary nerve lesions. A superior tunnel is drilled through the glenoid using a 3.5-mm drill bit, followed by an inferior tunnel. The inferior drill bit is removed and replaced by a metallic cannula. The same procedure is performed for the superior tunnel. The 2 cannulas exit at the level of the subscapularis split.

Step 5: Final Preparation of Coracoid Process and Drilling of Coracoid. A blunt trocar is inserted in the AI portal and used as a retractor to lift the deltoid, exposing and giving access to the superior aspect of the

coracoid process. The RFA device is inserted in the C portal. The upper and lower borders of the pectoralis minor are identified, and the tendon is carefully detached from the medial part of the coracoid process. It is mandatory that the RFA device always be kept oriented laterally and in contact with the medial aspect of the coracoid process to avoid any injury to the brachial plexus.

The C portal is expanded to 10 mm on the skin, and the coracoid guide is inserted with the blade facing laterally. The guide is secured around the coracoid process. A proximal tunnel and a distal tunnel are drilled from superior to inferior 7 mm medial to the lateral border with a 3.2-mm drill bit. Two metallic cannulas are inserted in the tunnels (Fig 6). The use of the aforementioned guide allows the glenoid and coracoid tunnels to be drilled at exactly the same distance (7 mm) from the anterior glenoid articular surface and from the lateral border of the coracoid process, respectively.

Step 6: Implant Positioning. The superior and inferior cortical buttons (TightRope; Arthrex) are passed from posterior to anterior in the glenoid and from inferior to superior in the coracoid process through the tunnels

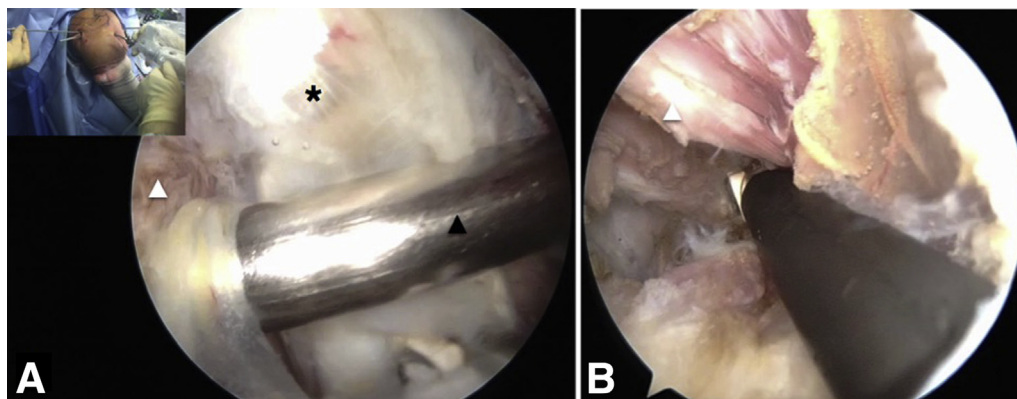


Fig 4. Subscapularis split. Anterolateral arthroscopic view of a right shoulder. The camera is placed in the anterolateral portal, and the radiofrequency probe is placed in the anteroinferior portal (inset). (A) A Wissinger rod (black arrowhead) is inserted in the posterior portal and passed through the subscapularis muscle (white arrowhead) from posterior to anterior, lateral to the conjoint tendon (asterisk) and to the nerves. (B) The split of the subscapularis is performed with the radiofrequency probe from anterior to posterior and from medial to lateral, in line with the muscle fibers, until the articular space is reached.

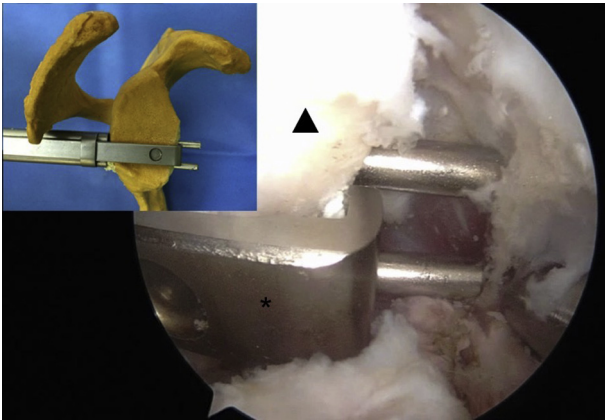


Fig 5. Anterolateral arthroscopic view of a right shoulder. The arthroscope is positioned in the anterolateral portal to visualize the posterior aspect of the glenoid. The specific glenoid guide (asterisk) is inserted until complete contact with the posterior wall of the glenoid is obtained. The blade of the guide is locked with a hook on the anterior glenoid rim (arrowhead) below the equator. Two tunnels are drilled through the guide, 7 mm medial to the glenoid rim. On the Sawbones model (inset), a specific glenoid guide introduced from the posterior portal allows drilling of two tunnels from posterior to anterior glenoid wall.

drilled previously, using a shuttle relay. The cortical buttons are lowered until they are secured on the superior aspect of the coracoid process by pulling gently and alternatively on the strands exiting through the posterior aspect of the glenoid.

Step 7: Coracoid Osteotomy, Placement, and Fixation. With both implants securely in place, a 10-mm curved osteotome is inserted through the C portal. The

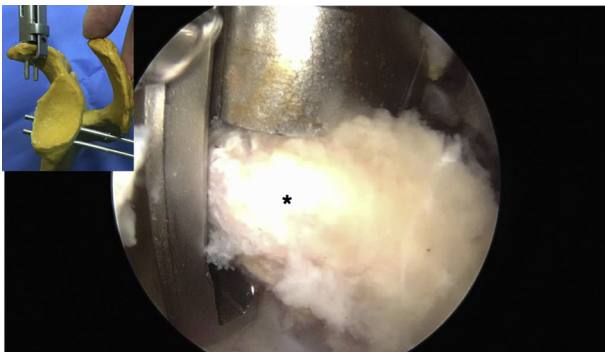


Fig 6. Anterolateral arthroscopic view of a right shoulder. The coracoid portal is expanded to 15 mm on the skin, and the coracoid guide is inserted with the blade facing laterally. The guide is secured around the coracoid process (asterisk). Two tunnels are drilled from superior to inferior 7 mm medial to the lateral border with a 3.2-mm drill bit. Two metallic canulas are inserted in the tunnels. On the Sawbones model (inset), two metallic canulas are inserted into the glenoid from posterior to anterior. A specific coracoid guide allows drilling of two tunnels through the horizontal part of the coracoid process from superior to inferior.

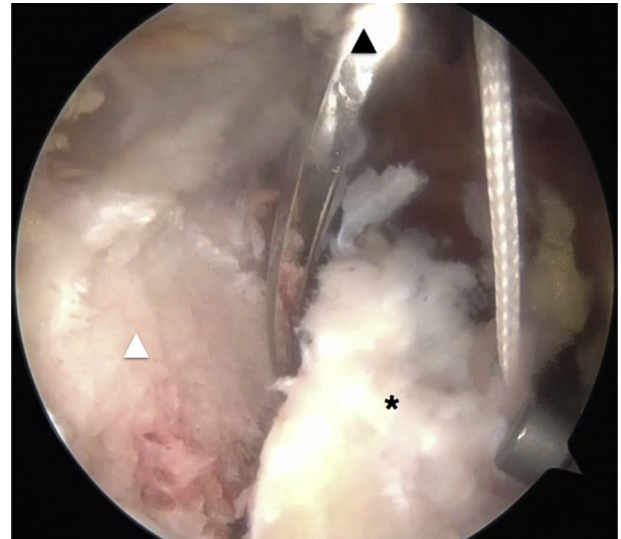


Fig 7. Anterolateral arthroscopic view of a right shoulder. A 10-mm curved osteotome (black arrowhead) is inserted through the coracoid portal. The arthroscope is placed in the anterolateral portal. The osteotomy of the coracoid is performed medial to the proximal cortical button at the junction between the horizontal (asterisk) and vertical (white arrowhead) parts of the coracoid process.

osteotomy is performed medial to the proximal cortical button at the junction between the horizontal and vertical parts of the coracoid process (Fig 7).

The bone block is guided with a grasper inserted in the AI portal through the subscapularis split while the strands of the cortical buttons coming out from the P portal are pulled. The strands of the superior button are pulled first, to horizontalize the coracoid process to facilitate its passage through the split of the subscapularis. The strands of the inferior button are then tightened to apply the bone graft on the anterior glenoid wall. The presence of 2 different sites of fixation prevents the rotation of the bone block. The implants are now tightened with a suture tensioner with a tensiometer to secure the graft in its subequatorial position and flush with the joint (Fig 8). Graft stability and correct positioning are assessed (Fig 9).

Step 8: Bankart Repair. The camera is placed in the P portal. Two to three 2.9-mm knotless anchors (PushLock; Arthrex) are loaded with the capsulolabral sutures that had been prepared at the beginning of the procedure and impacted to perform a standard Bankart repair.

Postoperative Management

A sling with the upper limb in neutral rotation is maintained during the first week. At the beginning of the second week, the patient is encouraged to start self-assisted rehabilitation, which lasts for 3 weeks. Passive anterior elevation assisted by the contralateral upper limb is allowed. External rotation and pendulum

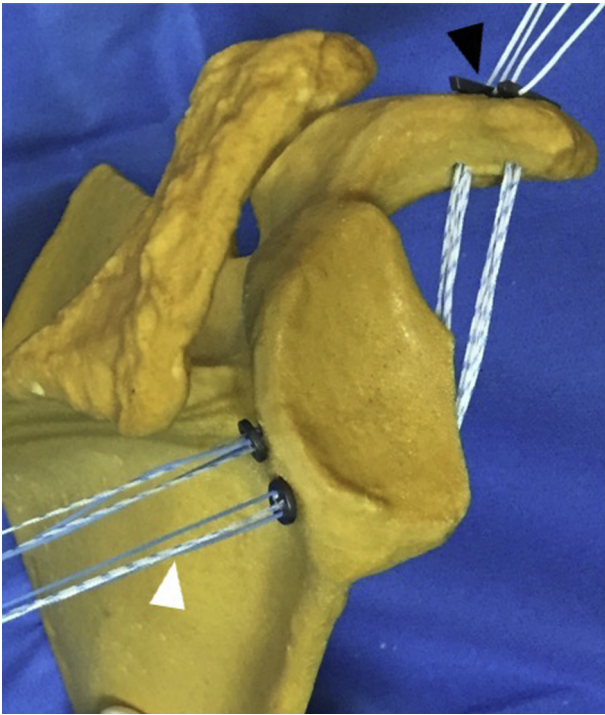


Fig 8. Sawbones model (Pacific Research Laboratories) of a left scapula. The superior and inferior cortical buttons are passed from posterior to anterior in the glenoid and from inferior to superior in the coracoid process through the tunnels drilled previously, using a shuttle relay. The cortical buttons are lowered until they are secured on the superior aspect of the coracoid process (black arrowhead) by pulling gently and alternatively on the strands exiting through the posterior aspect of the glenoid (white arrowhead).

exercises are not allowed. After 1 month, the patient is referred to a physiotherapist to start active mobilization in elevation and external rotation.

Discussion

The arthroscopic Latarjet procedure not only is technically challenging but also can be associated with dangerous complications.¹⁰ These considerations led many authors to question the usefulness and reproducibility of this procedure in terms of benefits and risks,¹¹ as well as benefits and costs.¹² The use of specific glenoid and coracoid guides improves the positioning of the bone block and the reproducibility of the technique. In addition, the 2 cortical buttons provide a stable and secure fixation of the bone block without the risk of hardware complications related to screws, which could require a second surgical procedure (sometimes open) for removal. Indeed, these buttons are smaller than screws and lie flush with the superior surface of the coracoid, avoiding soft-tissue irritation.

Lafosse et al.¹ in 2007 were the first authors to describe an arthroscopic technique to perform this procedure, using 7 portals including a medial portal. This portal is necessary to perform the subscapularis

split and to introduce the cannula, which helps in coracoid handling and fixation. They also systematically resected the anterior labrum and capsule between the 2- and 5-o'clock positions. In this article we describe an arthroscopic technique performed with only 4 portals, all lateral to the conjoint tendon to stay a safe distance from the brachial plexus and the axillary and musculocutaneous nerves. In our technique the Latarjet procedure is combined with a Bankart repair. The ability to reinsert the labrum and the glenohumeral inferior ligament whenever possible places the coracoid bone block outside the capsule. This helps to prevent contact between the humeral head and the bone block and allows better preservation of the proprioceptive receptors present in the labrum.¹³

Accurate positioning of the coracoid bone block is crucial because recurrent instability could occur with a bone block placed too medially. On the other hand, a bone block in a too lateral position could cause pain and early osteoarthritis. The use of specific glenoid and coracoid guides helps to have a fixed distance between the glenoid rim and the exit point of the drill bit and between the drill holes and the lateral border of the coracoid process. This improves positioning of the bone block. In addition, the 2 glenoid tunnels are drilled from posterior to anterior in the "safe glenoid zone,"⁶ decreasing the risk of suprascapular nerve injury related to screw insertion from anterior to posterior.

Regarding open procedures, Allain et al.¹⁴ have reported an excessively lateral bone block in 53% of patients and an excessively medial one in 5%. Hovelius

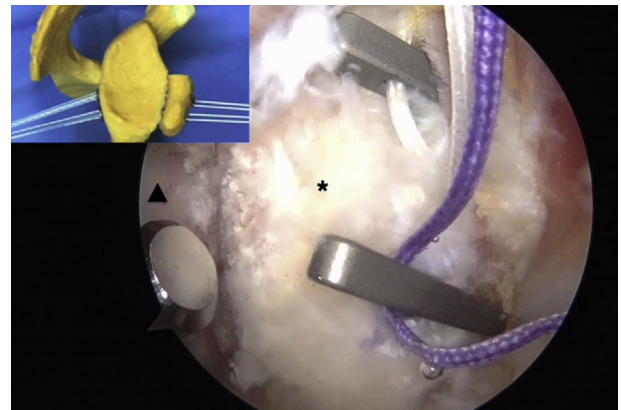


Fig 9. Anterolateral arthroscopic view of a right shoulder. The bone block is guided with a grasper inserted in the antero-inferior portal through the subscapularis split while the strands of the button coming out from the posterior portal are pulled. The strands coming from the buttons are tightened with a suture tensioner with a tensiometer to apply the bone graft (asterisk) on the anterior glenoid wall (arrowhead) in its subequatorial position and flush with the joint. In the Sawbones model (inset), the bone graft is positioned flush to the joint and in a subequatorial position. The two strands from the posterior portal are tightened to apply and to lock definitively the coracoid process onto the anterior glenoid wall.

Table 2. Advantages and Disadvantages

Advantages
Fully arthroscopic procedure
Arthroscopic assessment and treatment of associated lesions (e.g., associated Bankart repair)
No suicide portal medial to coracoid process
Control of rotation of bone block with 2 cortical buttons
Disadvantages
Risk of lesion of axillary and musculocutaneous nerves during dissection
Technically demanding: perfect knowledge of anatomy of nerves of shoulder is mandatory
More expensive than open procedure
Long learning curve

et al.¹⁵ reported in their series that 36% of coracoid bone blocks were positioned above the equator and 6% were too medial. However, several authors have reported better results with an arthroscopic technique. Good positioning of the coracoid bone block was observed in 80% of patients in a series by Dumont et al.⁶ and up to 94% in series reported by Boileau et al.¹⁶ and Casabianca et al.¹⁷

In 2016 Boileau et al.⁷ introduced the use of a cortical button to fix the coracoid graft instead of 2 screws. They used 6 portals to perform their procedure, including a portal medial to the coracoid process (east portal). In this technique, the authors harvested 1.5 cm of the horizontal part of the coracoid and fixed it to the glenoid with 1 cortical button. This bone block is smaller than that used in the original Latarjet procedure² and may not be sufficient in cases of large anterior glenoid defects.⁸

We believe that the use of 2 cortical buttons instead of 1 for coracoid graft fixation has several advantages: First, it enables more compressive force than a single cortical button with a 4-strand suture. Second, it helps to control the rotation of the bone block and may decrease the risk of osteolysis or nonunion.

However, this technique has several limitations. First, fixation using cortical buttons might not achieve the same compression as screws and might lead to higher rates of nonunion. Second, the preparation of the deep surface of the coracoid process might be more difficult with this technique than with the technique with screws described by Lafosse et al.¹ Indeed, with our technique, the preparation needs to be perfect before the osteotomy of the coracoid is performed because flattening of the deep surface is very challenging once the osteotomy of the coracoid process has been performed. In addition, flattening of the deep surface of the coracoid process and of the anterior wall of the glenoid to obtain a perfect match is no longer possible once the strands of the cortical buttons have been passed (Table 2).

The Latarjet procedure by arthroscopy has all the benefits of shoulder arthroscopy compared with open

procedures¹⁸: smaller scars, less bleeding, reduced risk of infection, and faster rehabilitation. It also allows a complete exploration of the shoulder and the treatment of potentially associated pathologies (rotator cuff tears, labral tears, and SLAP lesions).

The arthroscopic Latarjet procedure is still a challenging procedure, with a long learning curve and a potential risk of complications. This arthroscopic technique using 2 cortical buttons, specific coracoid and glenoid guides, and only 4 portals, with no portal medial to the coracoid, could be a satisfactory alternative to the existing arthroscopic techniques for the Latarjet procedure.

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