The Latarjet procedure provides a “triple blocking” effect in the treatment of anterior shoulder instability. First, the coracoid bone block increases the anterior posterior diameter of the inferior portion of the glenoid fossa, making it more difficult for the humeral head to subluxate or dislocate. Second, the conjoined tendon acts as a sling reinforcing the inferior capsular ligamentous complex and the inferior portion of the subscapularis. Finally, repair of the inferior capsular ligamentous complex to the stump of the coracoacromial ligament reconstructs the capsulolabral anatomy. We describe our preferred technique for this procedure. With proper patient selection and systematic surgical technique, instability can be eliminated without loss of external rotation in more than 98% of cases.

KEY WORDS: Latarjet coracoid transfer procedure, anterior shoulder instability

Many different procedures have been described for anterior shoulder instability, including capsulolabral reconstructions, subscapularis transfers, and coracoid transfer procedures. Although most of these procedures have been successful in restoring glenohumeral stability, some have been associated with loss of shoulder external rotation and development of glenohumeral osteoarthritis. Loss of external rotation may bring an early end to a throwing athlete’s career. A procedure that restores glenohumeral stability while preserving external rotation is, therefore, desirable. Additionally, as many as 85% of shoulders with recurrent anterior shoulder instability have bony lesions of the anterior inferior glenoid rim. A procedure that can address these lesions would also seem advantageous. The Latarjet procedure successfully restores glenohumeral stability (recurrence rate of less than 2%), does not limit external rotation, and can address bony lesions of the glenoid rim in patients with recurrent anterior shoulder instability. We describe the rationale, indications, and our preferred technique for this procedure.

RATIONALE

The rationale for the Latarjet procedure was described by Patte as the “triple blocking” effect. Most obvious is the “bone block” introduced by positioning of the coracoid at the anterior inferior glenoid rim. Because as many as 85% of shoulders with recurrent anterior instability have a bony lesion of the anterior inferior glenoid rim, this facet of the Latarjet procedure has obvious advantages. Although the Latarjet, like the Bristow, is traditionally thought of as a “bone block” procedure, in reality, most of the stability gained from this procedure is more likely attributable to the conjoined tendon sling. When the arm is placed in the abducted and externally rotated position, the conjoined tendon, in its new position, acts to reinforce the inferior subscapularis and anterior inferior capsule.

Finally, repair of the capsule and inferior glenohumeral ligament to the stump of the coracoacromial ligament provides a third mechanism of stability to the glenohumeral joint. This portion of the procedure emulates a capsulolabral reconstruction, such as a Bankart procedure, with its associated advantages. Distinct advantages of this procedure in athletes include a less than 2% recurrence rate with minimal if any loss of external rotation. Because the capsule is repaired with the arm in full external rotation, no postoperative limitation of motion is needed. Furthermore, because the primary stability mechanism of this procedure relies on bone healing to bone (as opposed to soft tissue healing and remodeling), earlier and more aggressive activity can be instituted, usually with return to full athletic activities at 3 months postoperative.

INDICATIONS, CONTRAINDICATIONS, AND IMAGING

The Latarjet procedure is an acceptable alternative to capsulolabral reconstructions in most patients with anterior shoulder instability. Contraindications include patients with a subscapularis tear and patients with fractures of the anterior glenoid involving more than one third of the
articular surface. In the case of a large glenoid fracture, the coracoid does not provide enough bone for glenoid reconstruction. In these cases, the fracture should be fixed, if possible, or reconstruction should be undertaken.

For patients with suspected shoulder instability, we obtain anterior to posterior views with the arm in neutral, external, and internal rotation, as well as a glenoid profile view with contralateral comparison view as described by Bernageau. These radiographs are taken under fluoroscopic control if possible. Using these two views, a glenoid rim lesion will be apparent in 85% of cases and a Hill Sachs lesion will be visualized in 75% of cases.

**TECHNIQUE**

**Preoperative Patient Preparation and Positioning**

The patient is instructed to shave the shoulder girdle and take a shower using antibacterial soap (provided no allergy exists) the night before surgery. Immediately before surgery, an interscalene block is placed for postoperative pain control. A general anesthetic is administered and the patient is placed in the modified beach chair position with a 1-cm thick folded sheet placed under the scapula on the affected side, making the coracoid process readily palpable (Fig 1).

**Skin Incision and Surgical Exposure**

A 5-cm skin incision is made starting at the tip of the coracoid process and extending inferiorly (Fig 2). In cases in which improved cosmesis is desirable (ie, young females), as small as a 3-cm incision can be used with minimal increase in difficulty. Meticulous hemostasis is maintained throughout the procedure using the electrocautery. The deltopectoral interval is located superiorly and medially by identifying the small triangular area devoid of muscle. The cephalic vein is identified in the deltopectoral interval and the intermuscular plane is developed and retracted with right angle retractors, taking the cephalic vein laterally. Frequently, a branch of the cephalic vein crosses the operative field. This is ligated with braided absorbable suture to prevent postoperative hematoma. A self-retaining retractor is then placed between the pectoralis major and the deltoid, completing the operative exposure.

**Harvesting of the Coracoid Process**

The arm is abducted and externally rotated. Mayo scissors are used to clear the superior aspect of the coracoid process and a Hohman retractor is placed over the top of the coracoid process. The anterior edge of the coracoacromial ligament is identified, as is the lateral aspect of the conjoined tendon (Fig 3). The coracoacromial ligament is completely transected 1 cm lateral to its coracoid insertion. The arm is placed in an internally rotated position (arm at side, forearm across the abdomen), and the pectoralis minor tendon is identified and released from its coracoid insertion taking care not to disturb the blood supply to the coracoid process, which enters at the medial aspect of the coracoid insertion of the conjoined tendon. After release of the pectoralis minor tendon, a periosteal elevator is used to expose the “knee” of the coracoid process by sliding it along its medial aspect. Cutting of the coracoid at the level of the “knee” is initiated with a micro sagittal saw equipped with a 90° angled blade (Fig 4). After the plane of the cut is initiated, the periosteal elevator is removed, and the cut is completed using the saw. Grasping forceps are used to hold the coracoid process, and the arm is returned to the abducted and externally rotated position. The coracohumeral ligament is released from the coracoid, liberating the coracoid process.

**Preparation of the Coracoid Process**

A gauze sponge is placed over the skin at the distal aspect of the incision, and the coracoid process is placed on the sponge by flipping it (the deep surface should be superficial and the superior aspect should be distal). With the grasping forceps gripping the medial and lateral aspects of the coracoid, any remaining soft tissue is removed from the deep surface of the coracoid process, taking care not to disrupt the stump of the coracoacromial ligament. The micro sagittal saw is then used to decorticate the deep surface of the coracoid process. A 15-mm wide osteotome is then placed between the coracoid and the sponge, and two 3.2-mm holes are drilled in the coracoid process perpendicular to its long axis and centered with respect to its width (Fig 5). A depth gauge can be used to measure the thickness of the coracoid at the level of the screw holes. An electrocautery can be used to clear the holes on the superficial surface to facilitate later identification. The grasping forceps and gauze sponge are removed. The arm is then externally rotated, at which time the lateral border of
the conjoined tendon can be further released to additionally mobilize the coracoid process if necessary. The arm is returned to the neutral position, and the coracoid process is placed beneath the arm of the self-retaining retractor holding the pectoralis major.

Glenoid Exposure
The subscapularis tendon and muscle is exposed with the arm by the side and externally rotated. The superior and inferior margins of the subscapularis should be identified. The subscapularis muscle is divided in line with its fibers.
Fig 6. (A) Division of the subscapularis muscle in line with its fibers. (B) The scissors are oriented vertically and opened, exposing the underlying capsule.

using mayo scissors (Fig 6A). Normally, the level of division is the junction of the middle and inferior thirds of the muscle; however, in the case of the hyperlax patient, the junction of the superior and inferior half is selected to maximize the effect of the conjoined tendon sling. The scissors are opened vertically, exposing the underlying capsule (Fig 6B). To facilitate opening of the scissors and capsular exposure, it may be necessary to decrease the

Fig 7. Vertical capsulotomy with the subscapularis retracted using a Hohman on the anterior surface of the scapula. A gauze sponge has been placed in the subscapularis fossa to elevate the subscapularis muscle off of the scapula (not visible) and is located medial to the Hohman retractor.

Fig 8. Completed exposure of the anterior inferior glenoid rim with a Steinmann pin retracting the superior subscapularis, a toothed retractor retracting the medial subscapularis, a small Hohman retracting the inferior subscapularis, and a humeral head retractor holding the humeral head laterally.
amount of external rotation of the arm. Once the capsule is well visualized, heavy forceps are used to develop the plane between the anterior surface of the scapula and the subscapularis muscle belly, allowing placement of a gauze sponge in the subscapularis fossa and elevating the subscapularis muscle off the capsule. A Hohman-type retractor is placed on the anterior surface of the scapula as far medial as possible. The inferior portion of the subscapularis is retracted inferiorly (we use a Bennett-type retractor), and using a scalpel, the lateral portion of the subscapularis is divided in line with its fibers to its insertion on the lesser tuberosity. The underlying capsule should now be well visualized, allowing performance of a 1-cm vertical capsulotomy with a scalpel at the glenohumeral articulation (Fig 7). The articular cartilage of the humeral head should be visualized after performance of the capsulotomy, facilitating placement of a humeral head retractor (we prefer a Trillat type retractor secondary to its low profile; Axone Medical, Lyon, France) into the glenohumeral joint. The superior portion of the subscapularis muscle is then retracted superiorly and held by a Steinmann pin driven into the surgical neck of the scapula. At this point, the Hohman retractor previously placed on the anterior scapula can be exchanged for a forked glenoid retractor (we use one manufactured by Waldemar Link, Hamburg, Germany), once again placing it as medial on the scapular body as possible. A small Hohman is placed under the scapular neck, completing the exposure of the anterior glenoid (Fig 8).

Exposure of the Bankart Lesion, Placement of the Coracoid Process, and Glenohumeral Ligament Repair

Using the needle tip electrocautery, the anterior inferior glenoid labrum is transected starting laterally extending 2 cm medially, incising the scapular periosteum. The periosteal incision is carried superiorly 3 cm and then back laterally through the glenoid labrum, effectively creating a "u"-shaped labral/periosteal incision (Fig 9). Metzenbaum scissors can be used to retract the incised labrum medially, exposing the Bankart lesion. The labrum, Bankart lesion, and periosteum are excised with an osteotome or rongeur. The osteotome is used to roughen the bone on the anterior scapula to stimulate healing of the coracoid. The 3.2-mm drill is used to create an anterior to posterior hole in the scapula at approximately the 5 o'clock position (7 o'clock in a left shoulder) 7 mm medial to the articular border of the glenoid. The distance of the hole from the articular border of the glenoid may be greater if the coracoid process is exceptionally wide or smaller if the coracoid is exceptionally small. The depth of the hole can be measured with a depth gauge and added to the previously

![Fig 9. Labral/periosteal incision.](image-url)

![Fig 10. (A) Appropriate position of the coracoid process flush with the anterior border of the glenoid. (B) Medial positioning of the coracoid process is suboptimal, but acceptable. (C) Lateral positioning of the coracoid process is associated with development of arthritis and must be changed.](image-url)
is to position the coracoid flush with the articular surface of the glenoid (Fig 10). It is acceptable for the coracoid to be positioned slightly medial to the articular border of the glenoid, but no lateral overhang should be accepted (see complication section). Provided the position of the coracoid is acceptable, the drill is used to go through the superior coracoid hole and through the scapula. Using the depth gauge, the appropriately size malleolar screw is selected and placed in the superior hole. Both of these screws should engage the posterior cortex of the scapula, and care should be taken not to overtighten the screws, because this could cause a coracoid fracture. The position measured coracoid thickness. The summed measurement is usually between 30 and 40 mm. The coracoid is retrieved from under the self-retaining retractor and held with the grasping forceps. The appropriately sized, partially threaded malleolar screw is advanced through the inferior hole of the coracoid process until all of the threads have cleared the coracoid bone. The tip of the screw is then placed into the anterior glenoid hole and advanced until the coracoid is secured to the anterior glenoid. Forceps can be used to adjust the orientation of the coracoid. The goal Fig 11. (A) Anterior view of the final reconstruction with repair of the capsule to the stump of the coracoacromial ligament. (B) Lateral view of the final reconstruction.

Fig 12. (A) Preoperative view of the shoulder in abduction and external rotation. (B) Postoperative view of the shoulder in abduction and external rotation after the Latarjet procedure. Note the sling effect of the conjoined tendon and the new position of the inferior portion of the subscapularis.
Fig 13. (A) Anterior posterior postoperative radiograph. (B) Scapular lateral postoperative radiograph. (C) Glenoid profile postoperative radiograph.
of the coracoid is checked one final time, ensuring no lateral overhang exists.

A no. 0 absorbable braided suture is placed through the inferior portion of the stump of the coracoclavicular ligament. The humeral head retractor is removed, and the arm is placed in adduction and full external rotation. The suture is then passed through the capsule and inferior glenohumeral ligament and tied. A second suture is placed superior to the first, completing the repair of the coracoacromial ligament to the inferior glenohumeral ligament and capsule. The sponge previously placed in the subacromial space is removed (this is sometimes facilitated by changing the glenoid retractor for a Hohman retractor). The Steinmann pin and remaining retractors are removed. It is not necessary to suture the horizontal split in the subacromial space. The wound is closed in layers. The final construct is shown in Figure 11. Figure 12 shows the dynamic function of the conjoined tendon sling created by the Latarjet procedure.

COMPLICATIONS

Complications specific to this procedure are almost always caused by technical error. Intraoperatively, coracoid fracture can occur if the screws are overtightened. This can be avoided by using a “two-finger” technique when using the screwdriver. Additionally, the use of too large a screw, such as a 4.5-mm cortical screw, risks coracoid fracture. Use of this larger screw necessitates the drilling of a 4.5-mm gliding hole (for compression) in the coracoid process, which is too large relative to the width of the coracoid. The use of partially threaded malleolar screw permits intersosseous compression and only requires a 3.2-mm hole. Coracoid nonunion can occur after this procedure. Adequate roughening/cortication of the undersurface of the coracoid process and the anterior border of the scapular neck, as well as the use of two cortical screws, help minimize this complication. Interestingly, this complication has not been shown to correlate with a poor result.

Allain et al have shown that a coracoid process graft placed with lateral overhang is associated with the development of osteoarthritis. In the event this occurs and is recognized at the time of surgery, the position of the coracoid should be changed. Figure 13 shows radiographs of a well-positioned coracoid process.

Loss of external rotation and postoperative stiffness are exceedingly rare after the Latarjet procedure. The coracoacromial ligament should always be sutured to the capsule with the arm in maximal external rotation. If this is done properly, loss of external rotation and postoperative stiffness will be unlikely.

REHABILITATION

After surgery, the arm is placed in a simple sling for a period of approximately 2 weeks for comfort. During this period circumduction exercises are initiated, and use of the hand, wrist, and elbow is encouraged. All activities of daily living are allowed by 6 weeks postoperatively. Patients are encouraged to swim starting at postoperative week 3 and continuing through the third postoperative month. Return to sport is permitted by 3 months postoperative. Home exercises are instituted with no formal physiotherapy. These exercises focus on active and passive mobility without specific strengthening exercises. Full external rotation is allowed. This is possible because the capsule was sutured with the arm in full external rotation. In the event that a patient is slow to progress, formal physiotherapy is instituted.

RESULTS

In more 1,000 cases, our recurrent instability rate is 1%,13,17 Additionally, 83% of our patients have been able to return to sports at their preinjury level, and 98% rated their result as excellent or good. Objectively, using the modified Rowe score, 76% of patients achieved an excellent or good result. In their report of 58 shoulders, Allain et al found similar results with the Latarjet procedure.REFERENCES