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Double-row fixation of the transferred coracoid process: a rescue technique for intraoperative coracoid fracture during the Latarjet procedure

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Background: The Latarjet procedure is the preferred method to treat recurrent anterior shoulder instability with glenoid deficiency. An iatrogenic fracture of the transferred coracoid process is one possible intraoperative complication.
Methods: We propose a rescue technique using double-row suture bridge fixation. Double-loaded 4.5-mm suture anchors were placed medially in the scapular neck. These sutures were then brought over the top of the coracoid fragment, placed around the bony fragment, and fixated to the glenoid face with knotless suture anchors.
Results: Radiologic evidence of bone graft healing was observed in the desired position.
Conclusions: We present a salvage procedure that will assist surgeons if an intraoperative fracture of the coracoid bone graft occurs during fixation when performing the Latarjet procedure.
Level of evidence: Technical Note

Keywords: Coracoid fracture; coracoid breakage; Latarjet procedure; glenoid bone loss; graft fracture; Latarjet complication; intraoperative coracoid process fracture; salvage for coracoid fracture

Bone defects of the anteroinferior glenoid and posterolateral humerus are common causes of recurrent anterior shoulder instability.[2] Soft-tissue repair alone in the setting of these bony defects is usually associated with increased surgical failure rates.[3,9] The Latarjet procedure (coracoid process transfer to the deficient anteroinferior glenoid rim) was introduced to address the bone deficiency in these patients.[10] This technique has the advantages of its triple-block effect, which consists of an increased congruent arc of motion, a dynamic sling effect from the conjoint tendon, and increased anterior stability by capsular repair. To prevent pseudarthrosis of the fixation site, good compression of the coracoid to the glenoid is critical. One of the intraoperative complications that can occur is iatrogenic fracture of the transferred graft; this can occur with tightening of the screws causing a ''log-split'' fracture down the middle of the graft.[8] The aims of this article are to demonstrate a salvage technique using double-row suture bridge–type

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fixation and to review alternative techniques in the case of coracoid fracture during the Latarjet procedure.

Surgical technique

A right-handed 25-year-old male patient presented with recurrent right shoulder dislocations. The initial traumatic dislocation occurred at age 16 years, which required a closed reduction in an emergency department. Because of his young age and activity level, he underwent an arthroscopic labral repair and did well for 3 years until he underwent another dislocation playing basketball. After this first recurrent postoperative dislocation, frequent and increasing recurrent instability developed, with 9 documented dislocations. The most recent dislocation occurred during his sleep. The patient did not believe he could live with the condition any longer because of the instability. A computed tomography scan showed 17% glenoid bone loss and a small Hill-Sachs lesion (Fig. 1). After discussion about the risks, benefits, and alternatives, he elected to proceed with a right shoulder open Latarjet procedure.

After successful regional anesthesia (interscalene block with sedation), the patient was placed in the beach-chair position and had all bony prominences well padded. Examination under anesthesia confirmed a 3+ anterior load and shift, 1+ posterior load and shift, and 1+ sulcus. After standard preparation and draping, an anterior incision through a deltopectoral interval was made. The cephalic vein was retracted laterally. The strap muscles were retracted medially. The musculocutaneous nerve was carefully protected throughout the procedure.

The pectoralis minor was released from the coracoid. The coracoacromial ligament was detached distally from the acromion, leaving a stump for lateral capsular repair. An osteotomy of the coracoid was made with an 90° oscillating saw just anterior to the insertion of the coracoclavicular ligaments at the coracoid base. The coracoid was then prepared for transfer.

After the subscapularis was split at the mid-level junction, a capsulotomy was performed just lateral to the joint line. The articular cartilage of the humeral head was intact. The anterior glenoid deficiency was then identified, measuring approximately 25%, and the glenoid neck was prepared for the coracoid transfer by decorticating and removing all soft tissue. A 3.2-mm drill was used at the 5-o'clock position and placed 7 mm medial to the articular surface. A depth gauge was used to measure the native glenoid (26 mm) and the thickness of the coracoid (14 mm), so a 4.5-mm × 40-mm malleolar screw was chosen. The screw was first placed through the coracoid and then directed into the inferior tunnel. Two-finger tightness was used to avoid fracturing the coracoid. A forceps was used to hold the coracoid to prevent rotation while tightening the first screw. Next, the 3.2-mm drill was placed through the previously placed superior coracoid

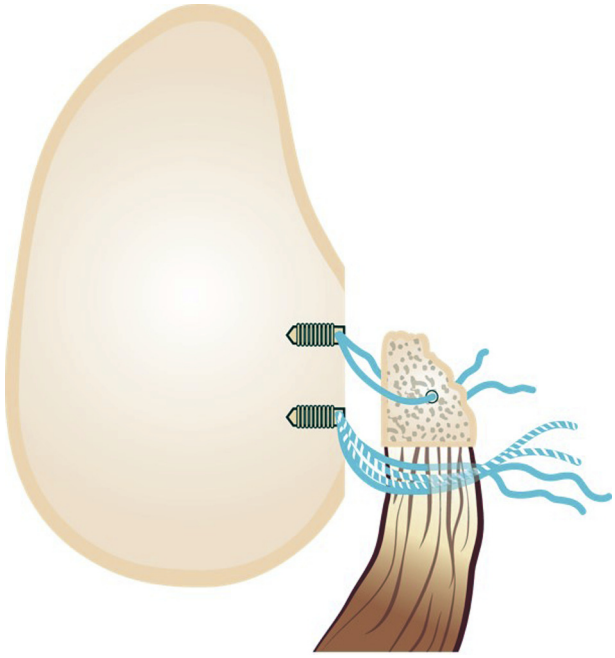

Figure 1 Two double-loaded suture anchors are placed in the medial scapular neck. Two limbs of suture from the superior anchor are passed through an empty hole in the coracoid bone. Four limbs of suture from the inferior anchor are passed at the conjoint tendon–coracoid bone junction. One should note the fracture line from the top of the fragment through the previously made upper hole.

screw and drilled into the native scapular neck. This measured 40 mm as well, so a second 4.5-mm × 40-mm malleolar screw was placed; however, during placement, the coracoid fragment splintered.

We removed the inferior screw at this point and elected to proceed with an alternative fixation plan. Two 4.5-mm PEEK (polyetheretherketone) FT suture anchors (Arthrex, Naples, FL, USA) were placed in the medial scapular neck. A 90° suture lasso was used to pass the 4 limbs of sutures from the inferior anchor at the conjoint tendon–coracoid bone junction in mattress fashion. Two limbs of a suture from the superior anchor were passed through the previously made hole in the coracoid (Fig. 1). The 2 mattress suture pairs were tied first, bringing the coracoid down the anterior glenoid. The 2 simple suture pairs were then tied superiorly, further securing the transferred coracoid. The 4 sutures from the inferior anchor were placed through the eyelet of a 2.9-mm PushLock anchor (Arthrex), and a 2.9-mm tunnel was made at the junction of the native glenoid and the transferred coracoid. The PushLock anchor was then placed into the hole and advanced. This nicely achieved a stable double-row fixation of the transferred coracoid (Fig. 2).

A 2.4-mm suture tack anchor was placed in the native glenoid, with the sutures passed through the lateral capsule, and the capsular repair was completed with the arm in external rotation. This anatomically restored the glenohumeral joint. The shoulder could no longer be dislocated in any position. The subscapularis was repaired with 3 No.

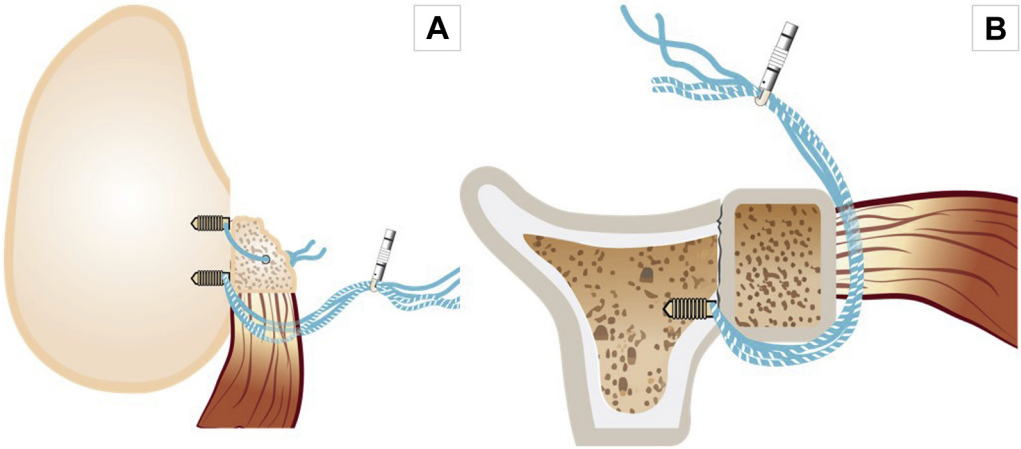

Figure 2 The 4 sutures from the inferomedial anchor are placed through the eyelet of a 2.9-mm PushLock anchor, which is going into the articular cartilage margin, securing the double-row repair of the coracoid fragment. **(A)** Sagittal plane. **(B)** Axial plane.

2 FiberWire sutures (Arthrex), and the rest of the wound was closed in layers, ending in a subcuticular suture. Elbow, hand, and finger range-of-motion exercises were started immediately postoperatively. The patient was immobilized in a sling for comfort for 4 weeks. Active range-of-motion exercises were gradually restored after 4 weeks postoperatively.

The patient was discharged from physical therapy at 6 months postoperatively. He had no complaints, had full range of motion, and had returned to all sports including basketball and soccer (Fig. 3). The postoperative radiographs at 6 months showed excellent healing of the coracoid without any metal hardware (Fig. 4).

Discussion

The Latarjet procedure has gained in popularity over the past decade, particularly for the management of instability associated with bone defects. Despite the perception that complications are minimal, they occur more often than is perhaps published in the literature.

The intraoperative coracoid fracture rate is 1.5% for open Latarjet procedures.[7] Recently, with advanced techniques and surgical instruments, the arthroscopic Latarjet procedure has been introduced as an alternative to its open counterpart because of its minimally invasive nature. However, a steeper learning curve and specific training are necessary for the surgeon before performing this operation to prevent complications. The rate of intraoperative coracoid fracture for arthroscopic Latarjet procedures is 5.2% to 7%.[1,4] The reported causes of intraoperative coracoid fracture consist of excessive decortication of the coracoid; inappropriate placement of the screw, being placed either too close to the periphery of the graft or too close to another screw; excessive tightening of the screw; or use of the procedure in elderly patients with osteoporotic bone.[5,7,11] This complication can be prevented by performing meticulous graft harvest, appropriately decorticating the graft, achieving the proper length between the screw holes, and using the 2-finger technique[13] to tighten the screw during fixation. Despite heeding these precautions, we still experienced an intraoperative fracture of the coracoid in the case presented.

A number of surgical techniques to address coracoid process fracture have been presented (Fig. 5). After coracoid fracture, the first decision is to determine the quantity and quality of the remaining bone. If sufficient and good-quality bone is available, proceeding with internal fixation is recommended. Fixation options include single-screw fixation, suture anchor fixation, or buttress plate fixation. If the single screw achieves appropriate fixation, then it is reasonable to conclude the case similarly to a Bristow procedure. Another option would be to consider using a smaller screw if there is enough bone to fix. A buttress plate (Di Giacomo plate; Arthrex) can also be used, with screws being inserted through the plate to provide compression.

If the screw hole blows out and undergoes a log split, as occurred in this case, we recommend a double-row bony Bankart repair. In our technique, 2 suture anchors were placed in the medial scapular neck. The 4 limbs of sutures from the inferior anchor were passed through the conjoint tendon–coracoid bone junction. Two limbs of a suture from the superior anchor were passed through the previously made hole in the coracoid. All suture pairs were tied securing the transferred coracoid down the anterior glenoid. The 4 sutures from the inferior anchor were then placed through the eyelet of a medial-row anchor, which was inserted at the junction of the native glenoid and the transferred coracoid.

If the quality of the remaining bone is too poor or too osteoporotic, 2 options are available: The first option is to abandon the bone altogether and use suture anchors to perform a pure soft-tissue repair. Recently, Douoguih et al[6]

Figure 3 The patient has full range of motion of the right shoulder in all directions at 6 months postoperatively.

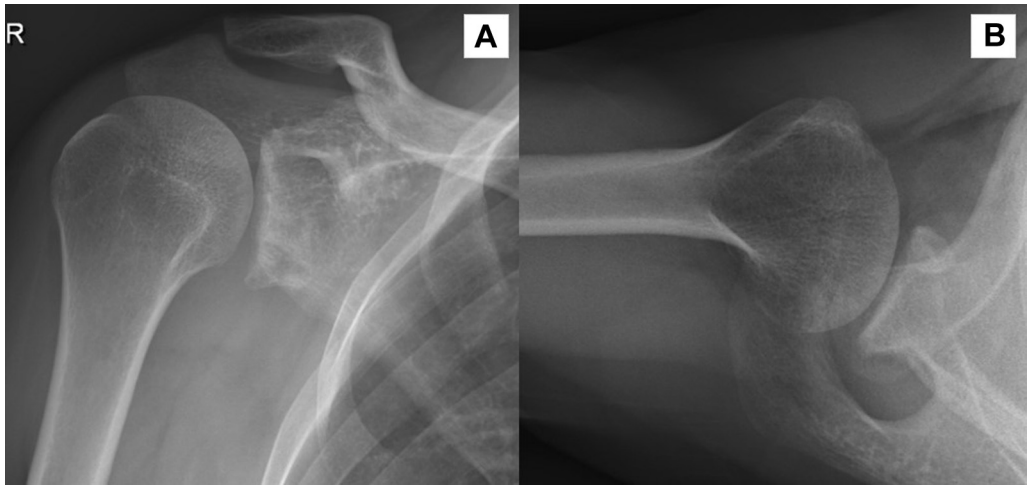

Figure 4 **(A, B)** The radiographs show healing of the coracoid process transfer in a good position. There is no metal fixation given the double-row suture anchor repair that was performed because of cracking of the coracoid. *R*, right.

reported a 90% success rate for conjoined tendon transfer in patients with large glenoid bone defects. The second option, which is another salvage procedure, is to convert to an anteroinferior bone grafting procedure. Autogenous structural graft from the iliac crest, a variant of the Eden-Hybinette procedure, is fixated to the deficient glenoid with 2 screws.[14] The distal clavicle, as an osteochondral reconstruction, provides the advantage of articular cartilage restoration to the anteroinferior glenoid. Tokish et al[12] suggested that cannulated screw fixation of the graft can be performed arthroscopically. In the case that the K-wire is too vertical and the graft is then fractured again, the suture anchor technique can be performed as an open procedure.[12]

Potential complications of double-row fixation of the coracoid process may include suture cutout from the tendon, glenoid fracture, and recurrent instability. Although the

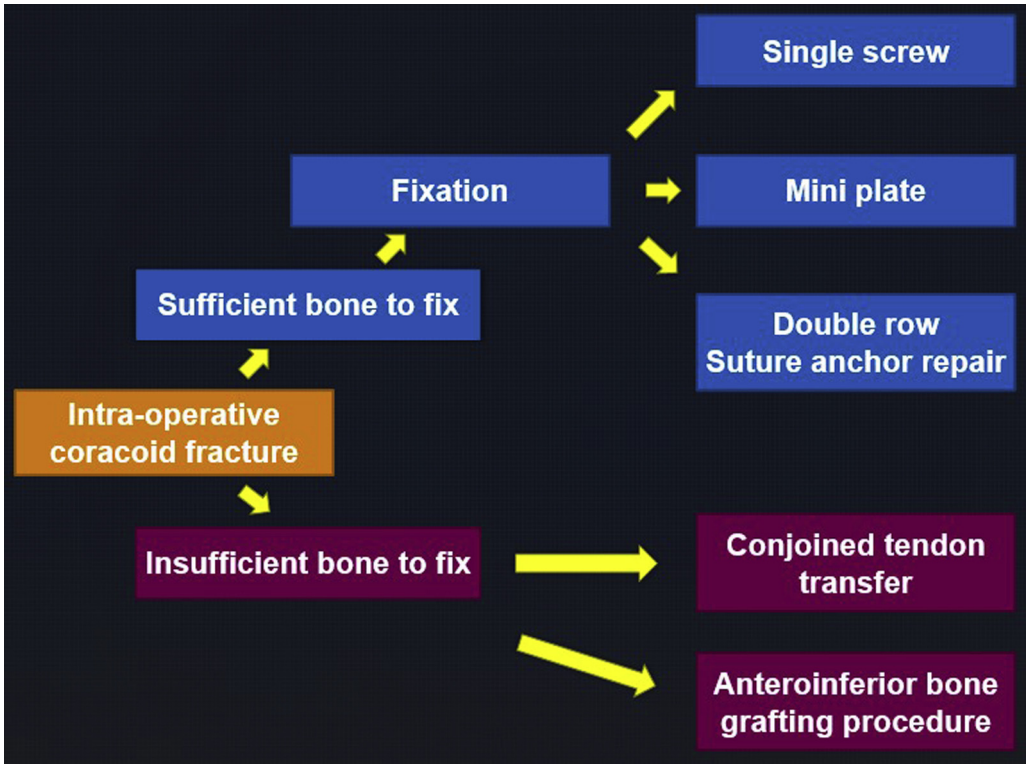

Figure 5 Summary of surgical techniques when the coracoid process fractures during fixation.

clinical and radiographic results of our technique are encouraging, a larger study is necessary to investigate the long-term outcomes of double-row fixation of the transferred coracoid process.

Conclusion

The Latarjet procedure extends the congruent arc of the glenoid in shoulders with recurrent shoulder instability and glenoid bone defects. Good compression of the coracoid is important to avoid pseudarthrosis. The standard fixation method relies on 2 bicortical screws. Care must be taken during graft harvest, preparation, and fixation to prevent intraoperative coracoid process fracture. However, in the case of a fractured coracoid, double-row fixation with suture anchors is a strong alternative fixation option with excellent healing potential.

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