Shoulder dislocation is a common injury, with anterior shoulder dislocation among male patients being the most common presentation. A patient with recurrent shoulder instability, anterior-superior escape, and chronic subscapularis tendon rupture following multiple shoulder stabilization surgeries presents the surgeon with a complex and challenging case. This report describes a 40-year-old man with an extensive left shoulder history that included a failed Latarjet procedure, an irreparable, chronic subscapularis tear with grade 4 Goutallier fatty infiltration, and associated anterior-superior escape. Given his marked dysfunction, weakness, pain, and recurrent instability in the absence of glenohumeral arthritis, he underwent an open Eden-Hybinette procedure (iliac crest autograft), a pectoralis major transfer, and an anterior capsule repair. The patient returned to his previous work activities without limitations. To the authors’ knowledge, this is the first report describing a combination of anterior glenoid bone grafting with a full pectoralis major muscle transfer for a patient with chronic subscapularis rupture and anterior-superior escape after a failed Latarjet procedure with minimum glenoid bone loss. Furthermore, the authors provide a biomechanical rationale for the reconstruction used for this problem. [Orthopedics. 2017; 40(1):e182-e187.]

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tears. However, the outcome after a pectoralis major transfer in the subset of patients with chronic subscapularis tear and static anterior-superior escape or subluxation is unpredictable. The combination of anterior-superior escape with a chronic subscapularis tendon tear is a devastating problem and often leaves the patient with limited options.

The authors present a case of a 40-year-old man with an extensive left shoulder history that included a failed Latarjet procedure, an irreparable, chronic subscapularis tear with grade 4 Goutallier fatty infiltration, and associated anterior-superior escape in the setting of minimum anterior-inferior glenoid bone loss. Given his marked dysfunction, weakness, pain, and recurrent instability in the absence of glenohumeral arthritis, he underwent an open Eden-Hybinette procedure (iliac crest autograft), a pectoralis major transfer, and an anterior capsule repair with suture anchors. To the authors’ knowledge, this is the first article describing a combination of anterior glenoid bone grafting with a full pectoralis major muscle transfer for a patient with a chronic subscapularis rupture and anterior-superior escape after a failed Latarjet procedure. Furthermore, the authors provide a biomechanical rationale for the reconstruction used for this problem.

**Case Report**

A 40-year-old, right-hand–dominant man presented to the senior author’s (X.L.) outpatient clinic with a complex left shoulder history that dated back 23 years. His original shoulder injury resulted from a plane crash while he was serving in the US Navy. He underwent multiple open and arthroscopic operations for persistent instability and pain. The most recent operation was an open Latarjet procedure performed 2 years prior to his initial presentation to the author’s clinic. The patient reported pain, persistent instability, and loss of function of his left arm. He also reported development of left arm numbness and tingling following his most recent injury sustained from a simple fall at home. On presentation, his pain level on the visual analog scale was 8 of 10, with a Subjective Shoulder Value of 15%. His preoperative American Shoulder and Elbow Surgeons score was 15 and Simple Shoulder Test score was 1 of 12 (8%).

Visual inspection showed deformity of the left shoulder from anterior-superior escape of the humeral head (Figure 1). Physical examination revealed 30° of active forward flexion and 80° of passive flexion, 60° of abduction limited by pain, and apprehension with external rotation of the arm. All other anterior shoulder instability provocative tests yielded positive results, and there was no evidence of subscapularis function with positive results on belly press and bear hug tests. No other significant motor or sensory deficits were noted and deltoid function was intact to both light touch and active contraction.

Radiographic imaging showed an incorporated but 5-mm medialized bone graft without glenohumeral osteoarthritis (Figure 2A). The humeral head was slightly subluxated anteriorly on the static axillary view (Figure 2B). Both the axial and oblique sagittal magnetic resonance images showed minimum anterior glenoid bone loss (<10%). Magnetic resonance imaging evaluation confirmed a complete, retracted tear of the subscapularis tendon through the original surgical tenotomy site from the previous Latarjet procedure (Figure 3A), with near complete fatty infiltration of the muscle belly (Figure
Electromyography testing showed no deficits in his extremity, including spinal accessory nerve, long thoracic nerve, or axillary nerve.

Given his persistent pain, recurrent dynamic anterior instability, and chronic subscapularis insufficiency, revision stabilization surgery was indicated. Diagnostic arthroscopy confirmed the preoperative computed tomography scan, which revealed less than 10% of glenoid bone loss, minimal cartilage changes seen on the glenoid, and a small Hill-Sachs lesion on the humeral head. Examination under anesthesia revealed obvious anterior, unidirectional instability with a 3+ load and shift. Reconstruction was performed via an extended deltopectoral approach with hardware removal and revision glenoid reconstruction (Figure 4A) using autograft iliac crest bone graft and two 5.0-mm partially threaded osteopenia screws. Intraoperative assessment confirmed the irreparable nature of the subscapularis despite adequate dissection and mobilization. The entirety of the pectoralis major was transferred, including both the sternal and clavicular heads (Figure 4B). The pectoralis major transfer was secured to the lesser tuberosity (Figures 4C-D) with the arm in 20° of external rotation with suture anchors (Mitek Healix 5.5-mm Titanium Anchors; DePuy Mitek Sports Medicine, Raynham, Massachusetts). The anterior capsule was repaired back to the anterior glenoid rim and also onto the iliac crest bone graft using suture anchors (Bio-SutureTak; Arthrex, Naples, Florida) with a single row technique.

Postoperatively, he was managed with 6 weeks of shoulder immobilization with a sling and abduction pillow followed by progression to passive range of motion and active range of motion. At 3 months postoperatively, he demonstrated active forward flexion of 0° to 150°, abduction of 0° to 90°, external rotation of 0° to 45°, decreased internal rotation by roughly 2 spinal levels, and 4/5 strength in abduction and external rotation. The patient continued with a physical therapy program that incorporated mild rotator cuff and deltoid strengthening. At his latest follow-up at 1 year, the patient demonstrated full range of motion in both passive and active forward flexion, abduction, and external rotation (Figure 5); +5/5 strength in forward flexion and abduction; and negative results on belly press, bear hug, and lift-off tests. He demonstrated no evidence of apprehension or instability, including with the arm in 90° of abduction and maximum external rotation. His Subjective Shoulder Value had improved to 85%, American Shoulder and Elbow Surgeons score to 83, and Simple Shoulder Test score to 10 of 12 (83%). The patient returned to his previous work activities without limitations.

**DISCUSSION**

The Latarjet procedure involves the transfer of the coracoid to the anterior glenoid to provide a “triple blocking effect,” which includes increasing the anteroposterior glenoid diameter, sling effect of the conjoint tendon to stabilize the humeral head, and physical restraint from the repair of the coracoclavicular ligament to the capsule.

Failure or recurrent instability after a Latarjet procedure can occur for many reasons, including intraoperative technical failures, hyperlaxity, trauma, and subscapularis insufficiency. Lunn et al reported good to excellent outcomes for 34 patients who received an Eden-Hybinette operation as a revision procedure following a failed Latarjet operation. They found that revision using the Eden-Hybinette bone block successfully prevented recurrence in 68% of patients with minimal complications. Additionally, Rouxel et al found no recurrences of shoulder instability for 17 patients who received a modified Eden-Hybinette procedure following a failed Latarjet operation.

Subscapularis insufficiency can be a debilitating condition with limited options available for therapeutic intervention. The relative infrequency of subscapularis tears as compared with posterolateral tears can lead to delays in diagnosis, which can potentially exacerbate subscapularis retraction and increase fatty degeneration of the muscle. Because the subscapularis is essential in maintaining glenohumeral stability, it is crucial to address this deficiency promptly and appropriately.
Joint integrity and stability, damage to it can lead to severe functional deficits and pain. Although salvage procedures are available for patients with irreparable subscapularis tears or with tears that have failed primary intervention and continue to cause discomfort, the results are mixed and depend on surgical indications. Age, concomitant glenohumeral joint disease, and activity level guide patient management decisions and can interfere with restoration efforts. Nonetheless, a pectoralis major tendon transfer for irreparable subscapularis tears has emerged as a viable treatment option to restore normal shoulder range of motion and mitigate pain and discomfort in patients when the humeral head is centered.\(^{11-14}\)

A patient with recurrent shoulder instability and anterior-superior escape after a failed Latarjet procedure with a chronic rupture of the subscapularis tendon and grade 4 Goutallier fatty infiltration of the subscapularis muscle belly presents the surgeon with a complex and challenging case. The current patient had an excellent outcome at 1-year follow-up after an Eden-Hybinette procedure, anterior capsule repair, and a full pectoralis major transfer. Even in the setting of minimum anterior glenoid bone loss, reconstruction with an anterior glenoid bone graft (Eden-Hybinette) was essential in the successful outcome of this patient. The biomechanical rationale justifying this reconstruction method is shown in Figure 6. When the subscapularis muscle and the posterior rotator cuff (infra- and teres minor) are intact, the humeral head is well balanced and centered onto the glenoid (Figure 6A). For patients with chronic subscapularis muscle insufficiency, there is no anterior restraint, which can result in anterior-superior escape of the humeral head (Figure 6B). The pectoralis major muscle vector comes in at a 90° angle to the subscapularis muscle vector, and transferring the pectoralis major muscle in patients with anterior subluxation of the humeral head can result in unpredictable or poor outcomes because of the persistent...
anterior translation of the humeral head (Figure 6B). The addition of a bone graft in the front of the glenoid will increase the anterior-posterior glenoid surface available for articulation. After the pectoralis major transfer, the center of rotation of the humeral head is shifted anteriorly. Thus, with the addition of the bone graft, the humeral head will remain centered (Figure 6B) in relation to the reconstruction. The authors believe this is the major reason for the successful outcome of this particular patient.

Galatz et al\textsuperscript{15} reported the outcomes of 14 patients with anterior-superior humeral head subluxation due to subscapularis tear who were treated with a pectoralis major transfer under the coracoid. Despite 11 of 14 patients being satisfied with the procedure, the mean improvement in the American Shoulder and Elbow Surgeons score was disappointing, from 27 preoperatively to 48 postoperatively, and forward flexion improved from 24° preoperatively to 61° postoperatively. Elhassen et al\textsuperscript{16} evaluated the outcomes of 30 pectoralis major transfers and found the highest failure rate among patients with preoperative anterior subluxation of the humeral head. One particular case of failed pectoralis major transfer in the setting of anterior-superior escape and subscapularis rupture after a total shoulder replacement was revised with a Latarjet procedure and had significant improvement in stability, function, and pain at 6-year follow-up. Additionally, an isolated Latarjet procedure has been reported as an alternative to pectoralis major transfer in the management of chronic subscapularis tear in the setting of anterior shoulder subluxation after total shoulder arthroplasty.\textsuperscript{17} Another option to help center the humeral head after chronic subscapularis rupture is transferring the latissimus dorsi and teres major tendon to the footprint of the lesser tuberosity. The posterior line of pull will help center the humeral head onto the glenoid.\textsuperscript{18,19}

**CONCLUSION**

For patients with persistent instability and anterior-superior escape of the humeral head after a failed Latarjet procedure and with a chronic subscapularis tendon tear and grade 4 Goutallier fatty infiltration, a Eden-Hybinette or anterior bone block procedure should be performed, even in the setting of minimal glenoid bone loss, in addition to the full pectoralis major transfer. By increasing the glenoid excursion distance, the humeral head will be stabilized, which is essential for maximizing patient outcomes after a pectoralis major transfer.

**REFERENCES**


