Eden-Hybinette and Pectoralis Major Transfer for Recurrent Shoulder Instability Due to Failed Latarjet and Chronic Subscapularis Rupture

Article *in* Orthopedics · October 2016

DOI: 10.3928/01477447-20161006-02

CITATION
1

READS
65

3 authors:

Xinning Li
Boston University
104 PUBLICATIONS **867** CITATIONS

SEE PROFILE

Antonio Cusano
Boston University
30 PUBLICATIONS **27** CITATIONS

SEE PROFILE

Josef K Eichinger
Medical University of South Carolina
51 PUBLICATIONS **141** CITATIONS

SEE PROFILE

Eden-Hybinette and Pectoralis Major Transfer for Recurrent Shoulder Instability Due to Failed Latarjet and Chronic Subscapularis Rupture

XINNING LI, MD; ANTONIO CUSANO, BS; JOSEF EICHINGER, MD

abstract

Shoulder dislocations are 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*. 201x; xx(x):xx-xx.]

Shoulder dislocation is a common orthopedic condition that accounts for approximately 50% of all joint dislocations.[1] These injuries can occur anteriorly, posteriorly, or inferiorly; however, anterior dislocations are most common, with rates as high as 96% reported.[2] The overall incidence rates of shoulder dislocations range between 23.9[3] and 26.9[4] per 100,000 person-years, with young male patients representing the demographic most at risk for such an injury.[3] Additional risk factors include age, tuberosity fracture, contact sports, glenoid bone loss, and hyperlaxity.[5]

Operative techniques for surgical repair of recurrent shoulder dislocation can be categorized into 1 of 4 classifications:

1. Anatomically repair the damaged anterior capsulolabral complex (Bankart procedure).
2. Bristow-Latarjet or iliac crest bone graft procedure that uses a bony block placed anteriorly on the glenoid to avoid anterior humeral head translation.
3. Glenoid or humeral osteotomies to modify rotational alignment of the humerus.
4. Putti-Platt and Magnuson-Stack procedures, which tighten anterior structures with the goal of limiting external rotation.[6]

Although compromised anatomical structures and obstructive scar tissue can interfere with revision efforts for patients with recurrent shoulder instability, a pectoralis major tendon transfer has been a viable option for the management of select chronic, irreparable subscapularis

The authors are from the Boston University School of Medicine (XL, AC), Boston, Massachusetts; and the Medical University of South Carolina (JE), Charleston, South Carolina.

Mr Cusano and Dr Eichinger have no relevant financial relationships to disclose. Dr Li is a paid consultant for Tornier and Mitek.

Correspondence should be addressed to: Xinning Li, MD, Boston University School of Medicine, 720 Harrison Ave, Ste 808, Boston, MA 02118 (Xinning.li@gmail.com).

Received: July 2, 2016; Accepted: September 9, 2016.

doi: 10.3928/01477447-20161006-02

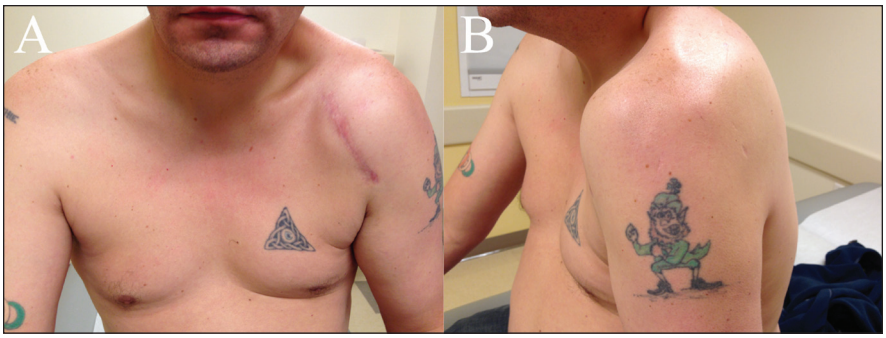

Figure 1: Preoperative anterior (A) and lateral (B) clinical photographs showing anterior-superior escape of the humeral head.

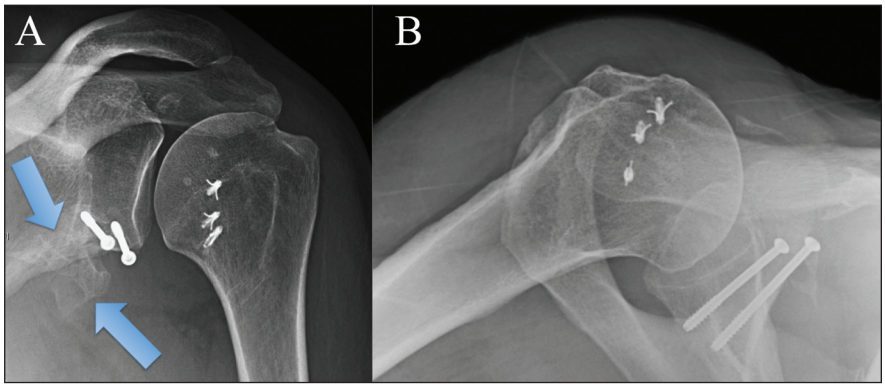

Figure 2: Preoperative anteroposterior radiograph of the left shoulder showing the medialized coracoid bone graft (blue arrows) and the 2 screws along with 3 previous anchors in the humeral head (A). Preoperative axillary radiograph showing slight anterior translation of the humeral head in relation to the glenoid (B).

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.[7] 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**

3B). 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.

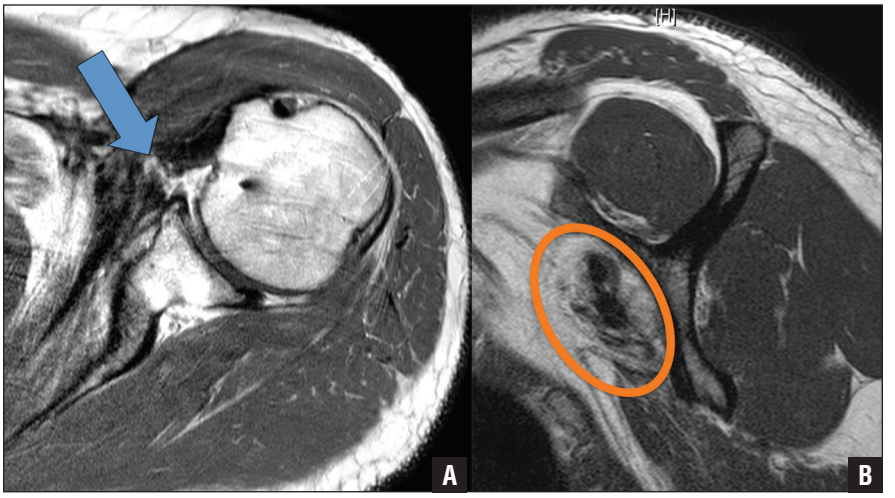

Figure 3: Preoperative axial T1-weighted magnetic resonance image of the left shoulder showing full-thickness subscapularis tendon rupture (blue arrow) (A). Preoperative sagittal magnetic resonance image of the left shoulder showing grade 4 Goutallier fatty infiltration into the subscapularis muscle belly (orange circle). The supraspinatus, infraspinatus, and teres minor muscles show no fatty infiltration (B).

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 coracoacromial ligament to the capsule.[8] 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[9] 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[10] 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 posterosuperior tears can lead to delays in diagnosis, which can potentially exacerbate subscapularis retraction and increase fatty degeneration of the muscle.[7] Because the subscapularis is essential in maintaining glenohumeral

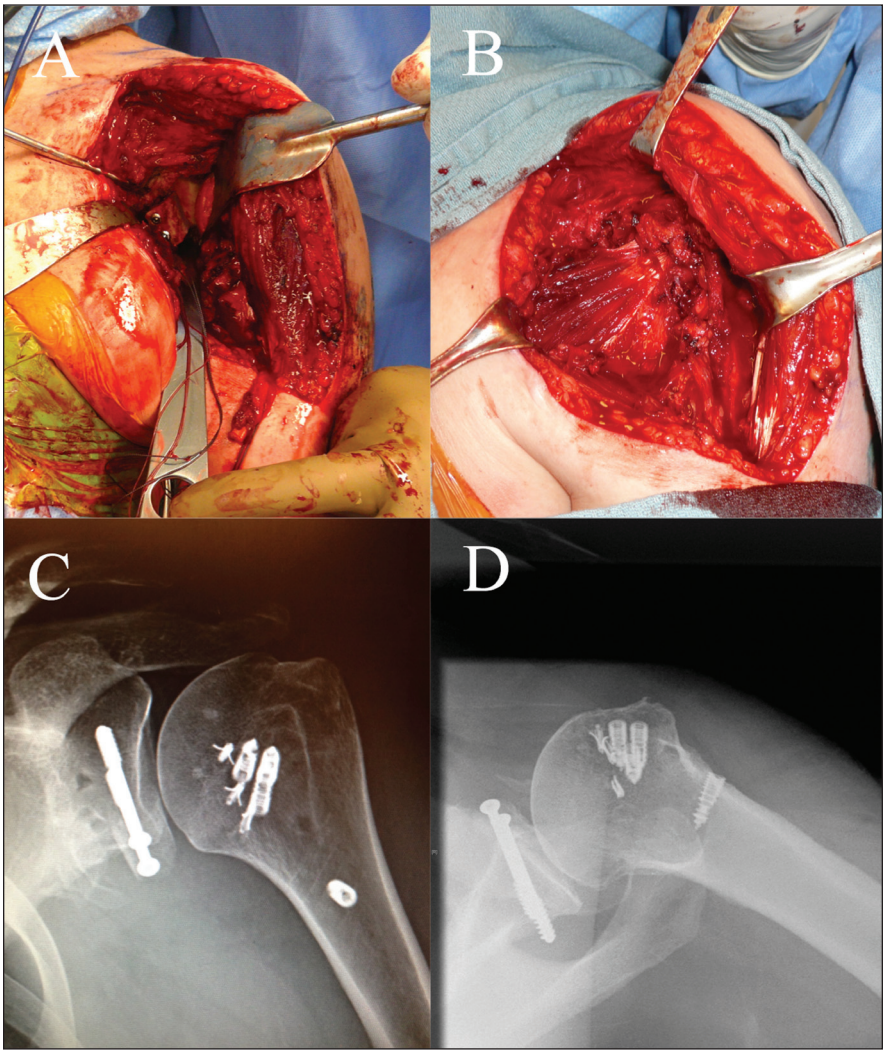

Figure 4: Intraoperative photograph showing the Eden-Hybinette anterior glenoid bone graft reconstruction with 5.0-mm partially threaded osteopenia screws (A). Intraoperative photograph showing full pectoralis major transfer to the lesser tuberosity with Mitek Healix 5.5-mm Titanium Anchors (DePuy Mitek Sports Medicine, Raynham, Massachusetts) (B). Postoperative anteroposterior (C) and axillary (D) radiographs showing recentering of the humeral head onto the glenoid.

Figure 5: Photographs 1 year postoperatively showing the patient with full forward flexion (A), full external rotation and the left shoulder in the reduced anatomic position (B), and symmetrical internal rotation to the contralateral side (C).

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 (infraspinatus 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[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. Elhassan et al[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.[17] Another option to help recenter the humeral head after chronic subscapularis rupture is transferring the latissmus dorsi and teres major tendon to the footprint of the lesser tuberosity. The posterior line of pull will help recenter the humeral head onto the glenoid.[18,19]

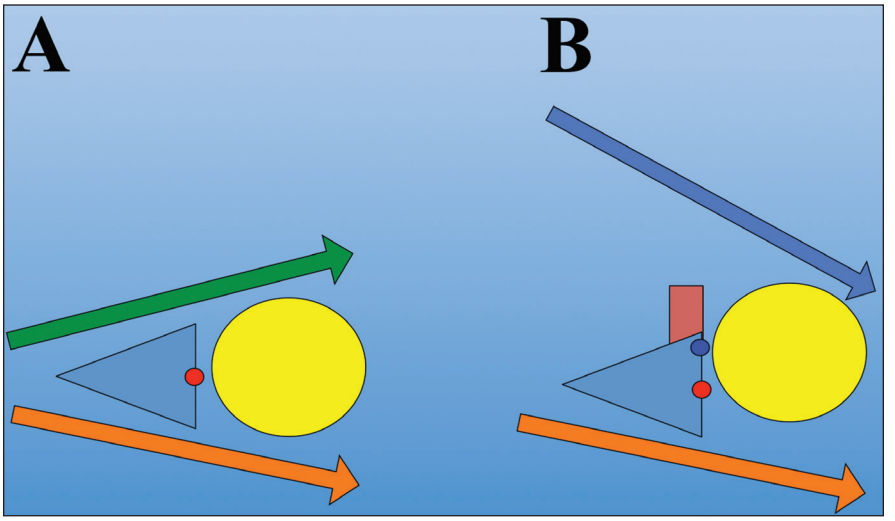

Figure 6: Biomechanical rationale for the methods of surgical reconstruction in this case. Normal shoulder with both the subscapularis muscle (green arrow) and infraspinatus muscle (orange arrow) intact. The humeral head is well centered onto the glenoid (A). For patients with chronic subscapularis rupture, the humeral head is translated anteriorly. The original center of rotation is the red circle. The pectoralis major muscle (blue arrow) is located anterior to the chest wall, which will pull the humeral head more anteriorly after the transfer. Adding the bone block anteriorly will provide additional glenoid excursion distance for humeral head translation after pectoralis major transfer. The new center of rotation is seen as the blue circle (B).

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-Hybinettte 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

1. Blake R, Hoffman J. Emergency department evaluation and treatment of the shoulder and humerus. *Emerg Med Clin North Am.* 1999; 17(4):859-876.
2. McLaughlin HL. Posterior dislocation of the shoulder. *J Bone Joint Surg Am.* 1952; 24(3):584-590.
3. Zacchilli MA, Owens BD. Epidemiology of shoulder dislocations presenting to emergency departments in the United States. *J Bone Joint Surg Am.* 2010; 92(3):542-549.
4. Leroux T, Wasserstein D, Veillette C, et al. Epidemiology of primary anterior shoulder dislocation requiring closed reduction in Ontario, Canada. *Am J Sports Med.* 2014; 42(2):442-450.
5. Olds M, Ellis R, Donaldson K, Parmar P, Kersten P. Risk factors which predispose first-time traumatic anterior shoulder dislocations to recurrent instability in adults: a systematic review and meta-analysis. *Br J Sports Med.* 2015; 49(14):913-922.
6. Wen DY. Current concepts in the treatment of anterior shoulder dislocations. *Am J Emerg Med.* 1999; 17(4):401-407.
7. Nelson GN, Namdari S, Galatz L, Keener JD. Pectoralis major tendon transfer for irreparable subscapularis tears. *J Shoulder Elbow Surg.* 2014; 23(6):909-918.
8. Patte D, Debeyre J. Luxations récidivantes de l'épaule. Encycl Med Chir Paris. *Tech Chir Orthop.* 1980; 44265:4.4-02.
9. Lunn JV, Castellano-Rosa J, Walch G. Recurrent anterior dislocation after the Latarjet procedure: outcome after revision using a modified Eden-Hybinette operation. *J Shoulder Elbow Surg.* 2008; 17(5):744-750.
10. Rouxel Y, Rolland E, Saillant G. Postoperative recurrence: results of surgical revisions [in French]. *Rev Chir Orthop Reparatrice Appar Mot.* 2000; 86(suppl):137-147.
11. Aldridge JM III, Atkinson TS, Mallon WJ. Combined pectoralis major and latissimus dorsi tendon transfer for massive rotator cuff

deficiency. *J Shoulder Elbow Surg.* 2004; 13(6):621-629.

12. Gavriilidis I, Kircher J, Magosch P, Lichtenberg S, Habermeyer P. Pectoralis major transfer for the treatment of irreparable anterosuperior rotator cuff tears. *Int Orthop.* 2010; 34(5):689-694.
13. Jost B, Puskas GJ, Lustenberger A, Gerber C. Outcome of pectoralis major transfer for the treatment of irreparable subscapularis tears. *J Bone Joint Surg Am.* 2003; 85(10):1944-1951.
14. Resch H, Povacz P, Ritter E, Matschi W. Transfer of the pectoralis major muscle for the treatment of irreparable rupture of the subscapularis tendon. *J Bone Joint Surg Am.* 2000; 82(3):372-382.
15. Galatz LM, Connor PM, Calfee RP, Hsu JC, Yamaguchi K. Pectoralis major transfer for anterior-superior subluxation in massive rotator cuff insufficiency. *J Shoulder Elbow Surg.* 2003; 12(1):1-5.
16. Elhassan B, Ozbaydar M, Massimini D, Diller D, Higgins L, Warner JJ. Transfer of pectoralis major for the treatment of irreparable tears of subscapularis: does it work? *J Bone Joint Surg Br.* 2008; 90(8):1059-1065.
17. Endres NK, Warner JJ. Anterior instability after total shoulder replacement: salvage with modified Latarjet procedure. A report of 2 cases. *J Shoulder Elbow Surg.* 2010; 19(2):e1-e5.
18. Elhassan B, Christensen TJ, Wagner ER. Feasibility of latissimus and teres major transfer to reconstruct irreparable subscapularis tendon tear: an anatomic study. *J Shoulder Elbow Surg.* 2014; 23(4):492-499.
19. Elhassan BT. Feasibility of latissimus and teres major transfer to reconstruct irreparable subscapularis tendon tear: an anatomic study. *J Shoulder Elbow Surg.* 2015; 24(4):e102-e103.