ORIGINAL ARTICLE

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Modified Latarjet procedure for patients with glenoid bone defect accompanied with anterior shoulder instability

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Objective: The aim of this study was to assess the effects of coracoid bone block (modified Latarjet) procedure on clinical and functional results in cases with glenoid bone defect accompanied with anterior shoulder instability.

Methods: The study included 35 patients (average age: 35 years; range: 20 to 58 years) with glenoid bone defect and recurrent dislocations treated with the modified Latarjet procedure. There were 12 sports injuries, 5 post-epileptic cases and 18 recurrent anterior shoulder dislocation following non-sports-related injuries. Recurrence was reported in 7 patients formerly treated with the Bankart procedure. Average number of preoperative dislocations was 10.8±6.5 and average time range between the first dislocation and surgery was 14.9±13.2 months. All patients underwent preoperative diagnostic arthroscopy. Postoperative isometric exercises in braces were assigned for the first 6 weeks, followed by active strengthening exercises. Pre- and postoperative functional results were evaluated using the ASES (American Shoulder and Elbow Surgeons) and Rowe scores and pain using the VAS (Visual Analog Scale).

Results: Osseous union of coracoid graft was achieved in all patients. Average follow-up was 24±12.2 (range: 12 to 74) months. No degenerative arthritis or continuing instability was detected in any of the patients. Average forward flexion was 165°±20° and external rotation 59°±13°. Mean preoperative ASES and Rowe scores of 49.6±10.6 and 47.9±21.5 increased postoperatively to 91.3±11 and 89.1±9.2, respectively. Mean VAS scores decreased significantly from 6.2±2.4 to 1.8±0.6 postoperatively ($p<0.05$).

Conclusion: Shoulder functionality and former activity levels can be successfully achieved in terms of increased patient satisfaction through use of the modified Latarjet surgery in the treatment of glenoid bone defect and anterior shoulder instability.

Key words: Glenoid bone defect; Latarjet; shoulder instability.

Shoulder instability affects the young population and causes serious labor loss. The majority of such injuries are traumatic and are accompanied by capsulolabral complex problems such as Bankart and variant lesions. Many studies have reported perfect results with open or arthroscopic repair.[1-3] However, failure to understand

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the underlying cause of instability can lead to unsuccessful results.[4-6] Poor surgical outcomes have been linked to chondral and osseous defects,[7] pattern and extent of the tear,[8] inadequate soft tissue tension,[9] laxity,[4] unhealed lesions following surgery,[10] ALPSA lesions,[11,12] patient age,[13] sex,[14] inadequate surgical instruments,[4,15] family history,[16] bone quality,[17] self-development and control,[18] high-energy sports activity,[19] previous immobilization and number of dislocations,[9] technical errors,[9] late surgery,[9] and previous rehabilitation programs.[20]

Bone defect in the anterior aspect of the glenoid reduce the contact area of the glenohumeral joint, resulting in instability.[6] Most defects are the result of a traumatic event and increases with the rate of recurrent dislocations. Several techniques have been suggested for the reconstruction of glenoid bone loss, including tricortical iliac crest autograft,[21] reconstruction with allograft, the Bristow procedure,[22,23] and the Latarjet procedure.[24-28]

In this study, we evaluated the clinical and functional results of coracoid bone block (modified Latarjet) procedure for the treatment of anterior shoulder instability with glenoid bone loss.

Patients and methods

This study included 35 shoulders (15 left, 20 right and %80 dominant side) of 35 patients (33 male, 2 female) diagnosed with anterior shoulder instability with glenoid bone loss and operated with the modified Latarjet bone block procedure between 2005 and 2011. Average age of the patients was 35 (range: 20 to 58) years. Recurrent anterior shoulder dislocation was due to sports trauma in 12 patients, epileptic seizure in 5 and traumatic injury during daily activities in 18. Previous arthroscopic or open repair was performed in 7 patients (%20), with later recurrence. Average number of preoperative dislocations was 10.8±6.5 months and average duration from first dislocation to surgery was 14.9±13.2 months. Patients were evaluated with true anterior-posterior, axillary and scapular "Y" radiographs and 3D computed tomography (CT) (Fig. 1). The modified Latarjet procedure with diagnostic arthroscopy and

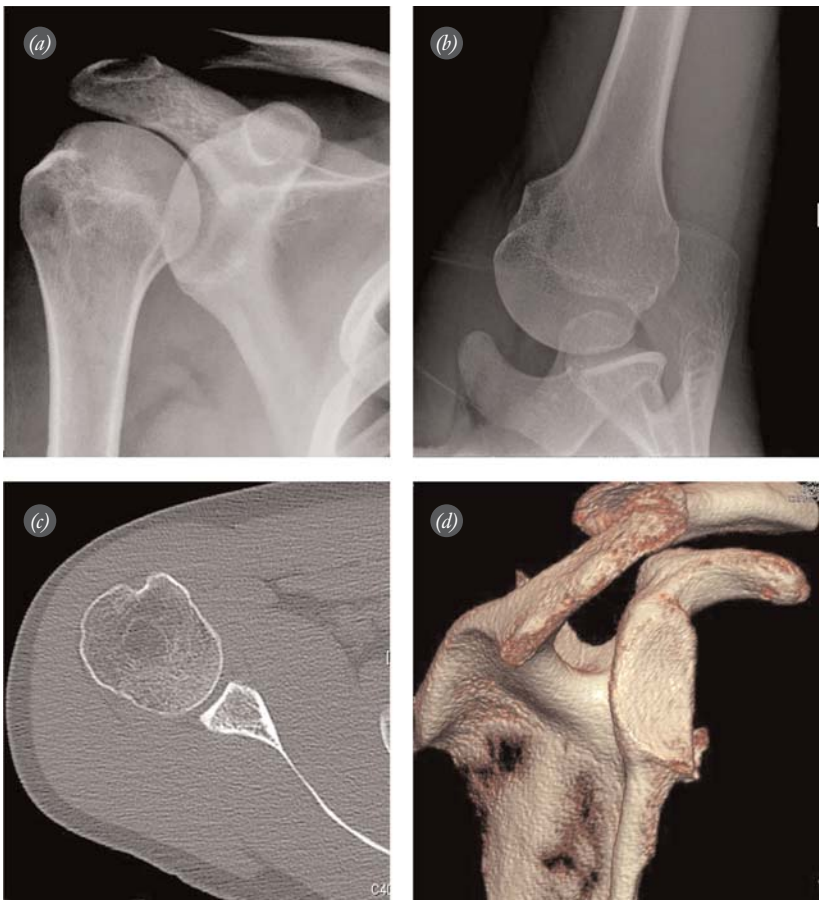


Fig. 1. Preoperative **(a)** anteroposterior and **(b)** axillary X-rays of the shoulder. **(c)** Bone loss evaluation with preoperative **(c)** axial cross-section conventional and **(d)** 3D CT. [Color figure can be viewed in the online issue, which is available at www.aott.org.tr]

radiologic evaluation was indicated before open intervention. The same surgical technique was used for all patients. Functional results were assessed using the ASES (American Shoulder and Elbow Surgeons) and Rowe scores and pain with VAS (Visual Analog Scale) both pre- and postoperatively.

Patients were prepared in the beach-chair position on a radiolucent table for fluoroscopic evaluation and the upper extremity was draped to remain sterile. Diagnostic arthroscopy was performed initially and glenoid bone loss evaluated in particular (Fig. 2). Open surgery was performed following arthroscopic examination in cases with accompanying pathologies. A 5 cm deltopectoral skin incision was performed starting from the coracoid and proceeded with subcutaneous dissection. The cephalic vein was retracted laterally, preserving the deltoid attachments. The deltoid and pectoralis major was retracted to reveal the coracoid and conjoint tendon and the coracoacromial ligament was transected laterally to the coracoid. The pectoralis minor was detached from its insertion from the medial side of the coracoid to reveal the angled part formed by the vertical and horizontal fractions. A motorized saw was used to section the coracoid just at the base, preserving the coracoclavicular ligaments. The upper half of the subscapularis muscle was sectioned from its insertion in an L shape to reveal the capsule, and the medial side of the capsule was sectioned to retract the humeral head posteriorly using a Fukuda retractor. The anterior and inferior surfaces of the glenoid were revealed. A scraper and burr were used to decorticate

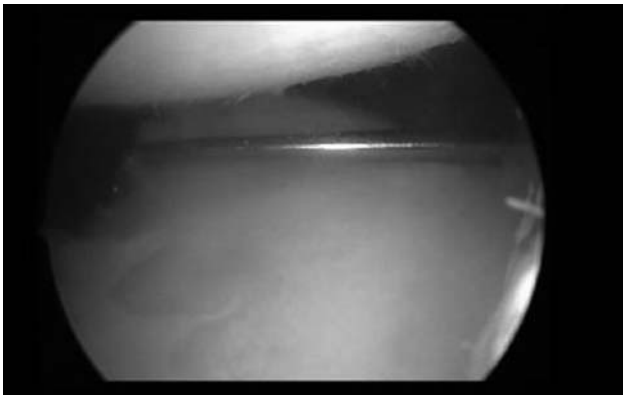


Fig. 2. Arthroscopic assessment of the glenoid defect. While the scope is at the anterosuperior portal, the probe inserted from the posterior measures the inferior glenoid defect.

and vitalize the defective surface. Suture anchors were placed at the 4 and 5 o'clock position for later capsule repair. The coracoid graft was turned to sit on its long axis and its surface was flattened with a thin saw. K-wires were used to temporarily fix the graft on the defective glenoid surface. A specially-designed, wedged profile plate for coracoid fixation (Arthrex Inc., Naples, FL, USA) was used with two 4 mm cannulated cancellous screws (Synthes GmbH, Zuchwil, Switzerland) (Fig. 3). Average length of the coracoid graft was 24.4±2.5 mm and average length of the plate was 20 mm. Screws were used for graft fixation in 14 shoulders and plating in 21. Fixation of the graft at the same level as the glenoid to prevent overflow or medialization is important. Following graft fixation, posi-

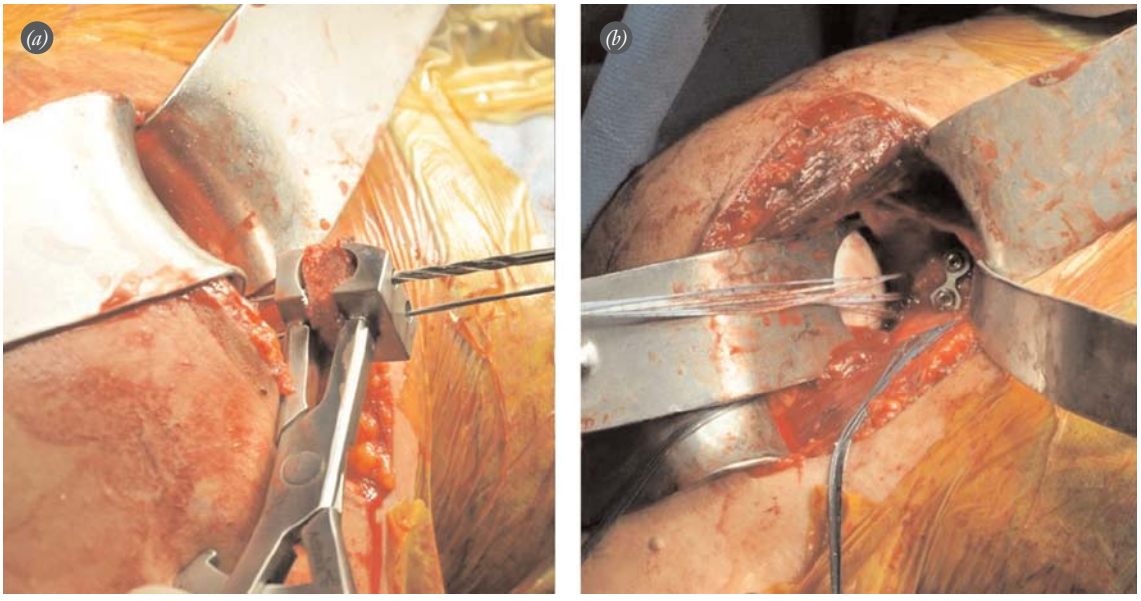


Fig. 3. **(a)** Preparation of the coracoid bone graft and **(b)** anchor and graft placement. [Color figure can be viewed in the online issue, which is available at www.aott.org.tr]

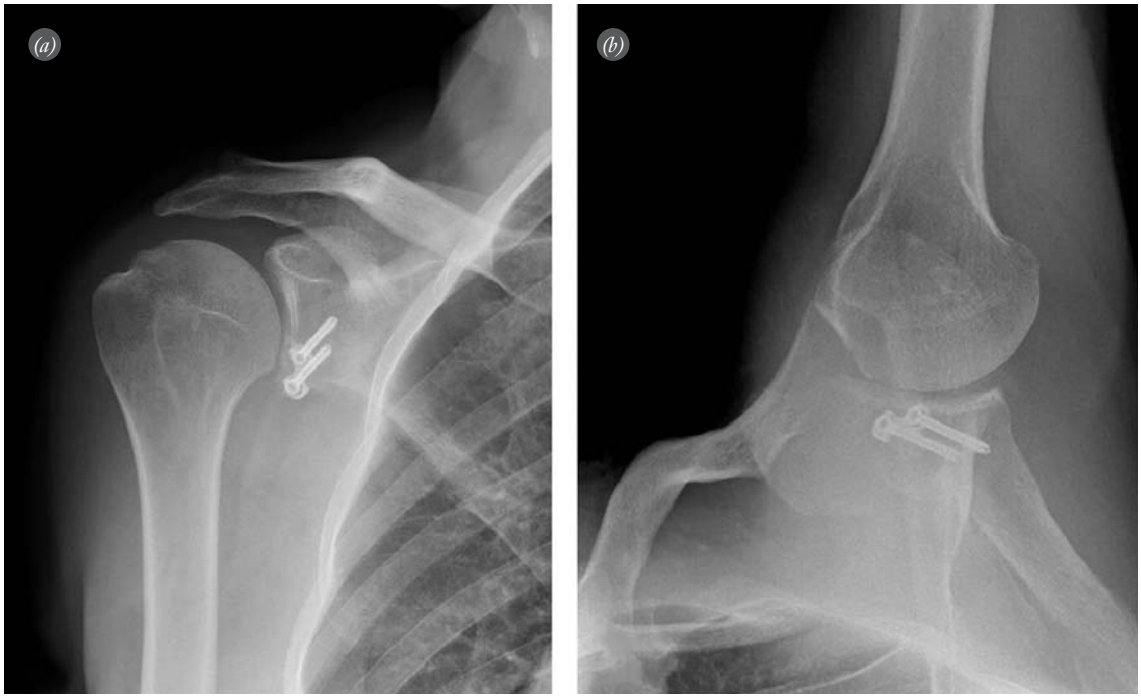


Fig. 4. Postoperative shoulder **(a)** anteroposterior and **(b)** axillary X-rays.

tion was confirmed with fluoroscopy and the capsule and subscapularis was repaired. An arm sling with 30° abduction pillow was positioned with the patient in the beach-chair position before transport.

Radiologic assessment was performed using true anterior posterior and axillary radiographs before discharge, on the 1st, 3rd, 6th and 12th postoperative months and at the final follow-up (Fig. 4). Physical therapy consisted of passive and isometric exercises for the first 6 months with the arm sling, followed by active exercises, and strengthening and proprioceptive exercises after the 3rd postoperative month. Physical therapy was initiated in the clinic and continued as home program according to patients' functional status.

Data was assessed using the Student's t-test on MedCalc software v.10.1.6 (MedCalc Software, Mariakerke, Belgium). Statistical significance was set at $p<0.05$.

Results

Average follow-up time was 24±12.2 (range: 12 to 74) months. Graft union was evaluated radiologically and achieved by the end of the 8th month in all patients. Degenerative arthritis was not encountered in any patient. No patient experienced dislocation or neurovascular complication. Physical therapy in the clinic lasted for a mean of 8.7±3.3 months. Superficial infection developed in one case that was treated with debridement and antibiotherapy. One patient suffered a seizure on the 3rd postoperative day, causing graft displacement, and was treated surgically. Both patients recovered without any sequelae.

At the final follow-up, average flexion was 165°±20°, extension 38°±13°, external rotation 59°±30° and internal rotation 62.6°±24°. Preoperative ASES and Rowe scores improved from 49.6±10.6 and 47.9±21.5 to 91.3±11 and 89.1±9.2, respectively. Average pre- and postoperative VAS scores were 6.2±2.4 and 1.8±0.6, respectively, while 23 patients stated that they were painless at the final follow-up. Changes in ASES, Rowe and VAS scores were statistically significant ($p<0.05$) (Fig. 5). Average postoperative ASES ($p=0.103$), Rowe ($p=0.12$) and VAS ($p=0.163$) scores were statistically similar between the 14 patients treated with screw alone and 21 treated with plating. Furthermore, graft union was achieved without any problems in both groups.

Discussion

The extent of the glenoid defect and glenoid shape plays an important role in shoulder instability. The role of osseous deficiency and its effect on failed surgery has been clarified recently. Burkhart and De Beer[29] defined the inverted pear shape and reported that glenoid defect increases recurrence rates to 68% from 4%. Failure rates of up to 68% following soft tis-

sue repair in cases with glenoid defect has been reported, and of up to 89% for athletes performing contact sports. Although the exact amount of defect leading to failure is unclear, in the literature, it is accepted that defects of less than 15 to 20% (5 to 7 mm) can be tolerated with soft tissue repair those of over 20 to 25% (6 to 8 mm) require osseous reinforcement.[5] The Latarjet procedure is insufficient for defects of over 50% and reconstruction with structural iliac bone crest autograft is recommended.[21] Glenoid defect should be considered in all cases of shoulder instability. For this purpose, apical oblique,[30] West Point[31] and Didiee[32] radiographs have been described. While, magnetic resonance imaging provides better information on soft tissues, 3D CT is the most useful radiological technique. It is also possible to determine the glenoid shape with arthroscopy.[33] Although there are different suggestions on the critical amount of defect, 20 to 25% (6 to 8 mm) is well accepted.[6,29]

The Latarjet procedure was later renamed the "modified Latarjet" due to changes in the fixation method. Notable technical differences from the classical method include the sectioning of the upper 1/2 part of the subscapularis, the fixation of the coracoid graft after rotating on its longitudinal axis and fixation of its anterior surface to the glenoid, the extracapsular placement of the graft, and the use of anchors for capsulolabral repair.[29] Although not yet proven, transferring of the coracoid graft with its conjoint tendon attachment has 3 possible effects: (1) Sling effect of the conjoint tendon with abduction and external rotation of the arm, (2) extension of the surface with bone block effect, and (3) arch effect of the capsule between the graft and the glenoid.[26]

While placement of the coracoid and iliac crest grafts are altered over time, a biomechanical study by Ghodadra et al.[34] stated that fixation of the graft level with the glenoid may lead to glenohumeral pressures closest to normal. Contact pressures increase by fixing the graft 2 mm lateral or over. Therefore, in this study the coracoid graft was placed level with the glenoid. Furthermore, the capsule was repaired with suture anchors before fixation. In this way, extra-articular placement of the graft and prevention of cartilage-graft contact is facilitated. Coracoid graft supports the glenoid bone structure, without any contact to the joint surface (Fig. 6).

Various screw types, washers and plates have been described for coracoid fixation.[23,25-27] We used two different methods in our series. Two 4 mm screws with washers were used in 14 patients and wedged profile plates in 21. The plate's wedge shape facilitates graft-glenoid concordance and best adherence to the coracoid surface. There was no difference between the two groups in terms of postoperative functional scores and graft union. However, in light of our surgical experience, we believe that plating prevents graft fracture during fixation and provides better compression and concordance. For an effective and scientific comparison, further randomized prospective studies designed with similar and higher number of patient groups are required.

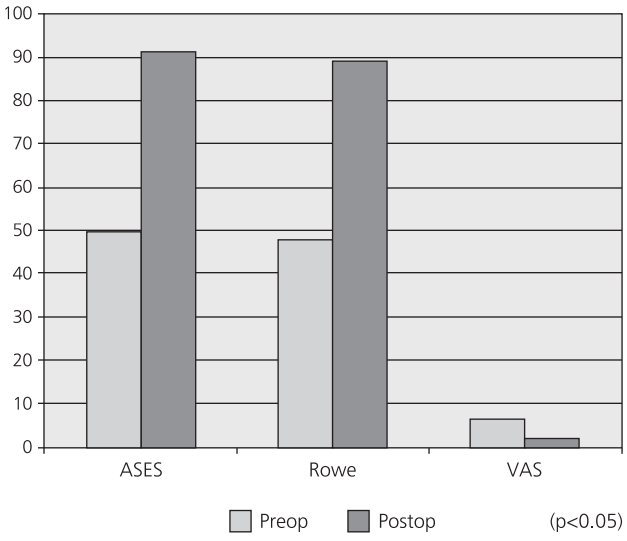


Fig. 5. Comparison of pre- and postoperative ASES, Rowe and VAS scores, which assess functional status and pain.

Postoperative range of motion have been reported as abduction of 42±17° and external rotation of 48±18°

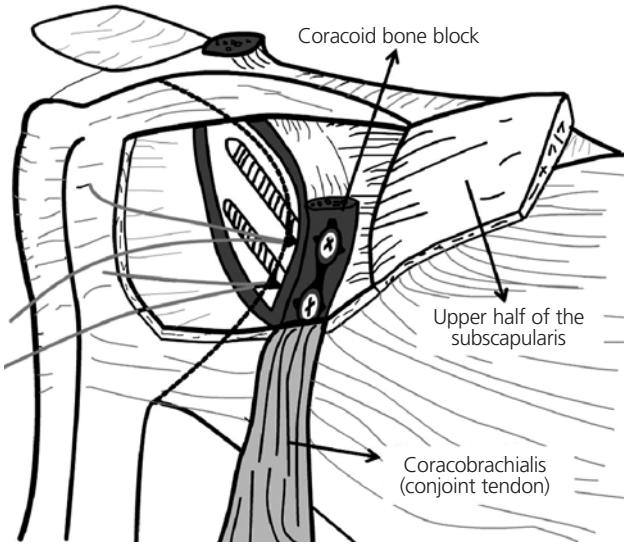


Fig. 6. Illustration of the modified Latarjet procedure; sectioning the upper half of the subscapularis, coracoid graft positioning and capsule repair.

by Allain et al. and flexion of 179.6±2.0° and external rotation of 50.2±12.6° by Burkhart and De Beer.[25,35] In our study, postoperative flexion was 165±20°, extension 38±13°, external rotation 59±30° and internal rotation 62.6±24°, in line with the literature. Also similar to the literature, postoperative ASES and Rowe scores improved significantly.

The majority of problems encountered in the modified Latarjet procedure postoperatively are related to inadequate surgical technique. Wide screws, improper drilling or graft harvesting may lead to intraoperative graft fracture.[25] Insufficient contact or inconvenient preparation of the surfaces may lead to non-union. Redislocation and glenohumeral arthrosis appear to be the most important complication encountered. Redislocation and subluxation rates of 1 to 5% have been reported.[25,26] Arthrosis is directly associated with instability and the effect of the modified Latarjet procedure on the development of arthrosis remains still unclear.[27] Grade 3 and 4 arthrosis has been reported responsible in up to 14% of cases.[28,35] We did not encounter instability or arthrosis in any of our cases during follow-up.

In conclusion, it is possible to gain shoulder functionality and return previous activity level with the modified Latarjet procedure for patients with glenoid defect and anterior shoulder instability. During the preoperative planning for the treatment of shoulder instability, it is crucial to recognize and properly guide the patient groups that have high recurrence rates after soft tissue procedures.

Conflicts of Interest: No conflicts declared.

References

1. Gartsman GM, Roddey TS, Hammerman SM. Arthroscopic treatment of anterior-inferior glenohumeral instability. Two to five-year follow-up. J Bone Joint Surg Am 2000;82-A:991-1003.
2. Gill TJ, Micheli LJ, Gebhard F, Binder C. Bankart repair for anterior instability of the shoulder. Long-term outcome. J Bone Joint Surg Am 1997;79:850-7.
3. Kim SH, Ha KI, Cho YB, Ryu BD, Oh I. Arthroscopic anterior stabilization of the shoulder: two to six-year follow-up. J Bone Joint Surg Am 2003;85-A:1511-8.
4. Boileau P, Villalba M, Héry JY, Balg F, Ahrens P, Neyton L. Risk factors for recurrence of shoulder instability after arthroscopic Bankart repair. J Bone Joint Surg Am 2006;88: 1755-63.
5. Provencher MT, Bhatia S, Ghodadra NS, Grumet RC, Bach BR Jr, Dewing CB, et al. Recurrent shoulder instability: current concepts for evaluation and management of glenoid bone loss. J Bone Joint Surg Am 2010;92 Suppl 2:133-51.
6. Rowe CR, Zarins B, Ciullo JV. Recurrent anterior dislocation of the shoulder after surgical repair. Apparent causes of failure and treatment. J Bone Joint Surg Am 1984;66:159-68.
7. Gill TJ, Warren RF, Rockwood CA Jr, Craig EV, Cofield RH, Hawkins RJ. Complications of shoulder surgery. Instr Course Lect 1999;48:359-74.
8. Spatschil A, Landsiedl F, Anderl W, Imhoff A, Seiler H, Vassilev I, et al. Posttraumatic anterior-inferior instability of the shoulder: arthroscopic findings and clinical correlations. Arch Orthop Trauma Surg 2006;126:217-22.
9. Porcellini G, Campi F, Pegreffi F, Castagna A, Paladini P. Predisposing factors for recurrent shoulder dislocation after arthroscopic treatment. J Bone Joint Surg Am 2009;91:2537-42.
10. Bankart AS. The pathology and treatment of recurrent dislocation of the shoulder-joint. Br J Surg 1938;26:23-39.
11. Neviaser TJ. The anterior labroligamentous periosteal sleeve avulsion lesion: a cause of anterior instability of the shoulder. Arthroscopy 1993;9:17-21.
12. Ozbaydar M, Elhassan B, Diller D, Massimini D, Higgins LD, Warner JJ. Results of arthroscopic capsulolabral repair: Bankart lesion versus anterior labroligamentous periosteal sleeve avulsion lesion. Arthroscopy 2008;24:1277-83.
13. Postacchini F, Gumina S, Cinotti G. Anterior shoulder dislocation in adolescents. J Shoulder Elbow Surg 2000;9:470-4.
14. Loud KJ, Micheli LJ. Common athletic injuries in adolescent girls. Curr Opin Pediatr 2001;13:317-22.
15. Meyer DC, Gerber C. Failure of anterior shoulder instability repair caused by eyelet cutout of absorbable suture anchors. Arthroscopy 2004;20:521-3.
16. Rowe CR. Prognosis in dislocations of the shoulder. J Bone Joint Surg Am 1956;38-A:957-77.
17. Good CR, MacGillivray JD. Traumatic shoulder dislocation in the adolescent athlete: advances in surgical treatment. Curr Opin Pediatr 2005;17:25-9.
18. Huber H, Gerber C. Voluntary subluxation of the shoulder in children. A long-term follow-up study of 36 shoulders. J Bone Joint Surg Br 1994;76:118-22.
19. Handoll HH, Almaiyah MA, Rangan A. Surgical versus non-surgical treatment for acute anterior shoulder dislocation. Cochrane Database Syst Rev 2004;(1):CD004325.
20. Kim SH, Ha KI, Jung MW, Lim MS, Kim YM, Park JH. Accelerated rehabilitation after arthroscopic Bankart repair for selected cases: a prospective randomized clinical study. Arthroscopy 2003;19:722-31.
21. Warner JJ, Gill TJ, O'hollerhan JD, Pathare N, Millett PJ. Anatomical glenoid reconstruction for recurrent anterior glenohumeral instability with glenoid deficiency using an autogenous tricortical iliac crest bone graft. Am J Sports Med 2006;34:205-12.
22. Helfet AJ. Coracoid transplantation for recurring dislocation of the shoulder. J Bone Joint Surg Br 1958;40-B:198-202.
23. Binnet MS, Gurkan I, Karakas MA, Fazeli AR. Modified Bristow procedure: Is it effective in recurrent instabilities of the shoulder? [Article in Turkish] Acta Orthop Traumatol Turc 1998;32:8-14.
24. Latarjet M. Treatment of recurrent dislocation of the shoulder. [Article in French] Lyon Chir 1954;49:994-7.
25. Burkhart SS, De Beer JF, Barth JR, Cresswell T, Criswell T, Roberts C, Richards DP. Results of modified Latarjet reconstruction in patients with anteroinferior instability and significant bone loss. Arthroscopy 2007;23:1033-41.
26. Walch G, Boileau P. Latarjet-Bristow procedure for recurrent anterior instability. Tech Shoulder Elbow Surg 2000;1: 256-61.

27. Hovelius L, Saeboe M. Neer Award 2008: Arthropathy after primary anterior shoulder dislocation – 223 shoulders prospectively followed up for twenty-five years. J Shoulder Elbow Surg 2009;18:339-47.
28. Hovelius L, Sandström B, Sundgren K, Saebö M. One hundred eighteen Bristow-Latarjet repairs for recurrent anterior dislocation of the shoulder prospectively followed for fifteen years: study I – clinical results. J Shoulder Elbow Surg 2004;13:509-16.
29. Burkhart SS, De Beer JF. Traumatic glenohumeral bone defects and their relationship to failure of arthroscopic Bankart repairs: significance of the inverted-pear glenoid and the humeral engaging Hill-Sachs lesion. Arthroscopy 2000;16:677-94.
30. Garth WP Jr, Slappey CE, Ochs CW. Roentgenographic demonstration of instability of the shoulder: the apical oblique projection. A technical note. J Bone Joint Surg Am 1984;66:1450-3.
31. Rokous JR, Feagin JA, Abbott HG. Modified axillary roentgenogram. A useful adjunct in the diagnosis of recurrent instability of the shoulder. Clin Orthop Relat Res 1972;(82):84-6.
32. Pavlov H, Warren RF, Weiss CB Jr, Dines DM. The roentgenographic evaluation of anterior shoulder instability. Clin Orthop Relat Res 1985;(194):153-8.
33. Detterline AJ, Provencher MT, Ghodadra N, Bach BR Jr, Romeo AA, Verma NN. A new arthroscopic technique to determine anterior-inferior glenoid bone loss: validation of the secant chord theory in a cadaveric model. Arthroscopy 2009;25:1249-56.
34. Ghodadra N, Gupta A, Romeo AA, Bach BR Jr, Verma N, Shewman E, et al. Normalization of glenohumeral articular contact pressures after Latarjet or iliac crest bone-grafting. J Bone Joint Surg Am 2010;92:1478-89.
35. Allain J, Goutallier D, Glorion C. Long-term results of the Latarjet procedure for the treatment of anterior instability of the shoulder. J Bone Joint Surg Am 1998;80:841-52.