Long-term results of the Latarjet procedure for anterior instability of the shoulder

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Background: The Latarjet procedure is effective in managing anterior glenohumeral instability in the short term, but there is concern for postoperative arthritis. The purpose of this study was to evaluate the long-term functional outcome after the Latarjet procedure and to assess the prevalence of and risk factors for glenohumeral arthritis after this procedure.

Materials and methods: A retrospective review was conducted of 68 Latarjet procedures at a mean of 20 years postoperatively. The mean age at surgery was 29.4 years. Functional outcome was determined by the Rowe score, subjective shoulder value, and recurrence of instability. Preoperative arthritis and postoperative radiographs were reviewed to evaluate the development or progression of arthritis.

Results: The mean Rowe score increased from 37.9 preoperatively to 89.6 at final follow-up ($P < .001$). The mean subjective shoulder value was 90.9% at final follow-up. The postoperative rate of recurrence was 5.9%. Of the 60 shoulders without arthritis preoperatively, 12 (20%) had developed arthritis at final follow-up. Among the 8 shoulders with preoperative arthritis (all stage 1), 4 (50%) demonstrated progression of arthritis at final follow-up. Overall, postoperative arthritis was stage 1 in 14.7%, stage 2 in 5.9%, and stage 3 in 8.8% of cases; no stage 4 arthritis was observed. Risk factors for postoperative arthritis were older age, high-demand sports activity, and lateral overhang of coracoid bone graft.

Conclusion: The Latarjet procedure provides excellent long-term outcomes in the treatment of recurrent anterior glenohumeral instability. Twenty years after the Latarjet procedure, arthritis may develop or progress in 23.5% of cases, but the majority of arthritis is mild.

Level of evidence: Level IV, Case Series, Treatment Study.

Keywords: Latarjet; anterior shoulder instability; long-term; glenohumeral joint; arthritis; risk factor

In 1954, Latarjet described a coracoid process transfer in which the inferior surface of the coracoid was passed through the subscapularis tendon and secured to the anteroinferior glenoid to treat anterior glenohumeral instability.\textsuperscript{20} Patte proposed that the procedure provides stability by the “triple blocking effect” (Fig. 1), which includes the...
sling effect of the conjoint tendon on the subscapularis, the bone effect of the graft, and the ligament effect of the coracoacromial ligament stump. Subsequently, Yamamoto et al. performed a biomechanical study that clarified the stabilizing mechanism of the Latarjet procedure. They reported that the primary mechanism is the sling effect at both the end-range and mid-range positions. Lesser contributions are provided by suturing the coracoacromial ligament to the capsular flap (capsular effect) at the end-range position and the glenoid bone reconstruction at the mid-range position.

Arthroscopic stabilization for anterior glenohumeral instability has been performed with increasingly good results. However, there is a substantial failure rate with an arthroscopic approach in the setting of significant glenoid bone loss, large engaging Hill-Sachs lesions, or combined glenoid and humeral bone defects. In these settings, the Latarjet procedure effectively reduces the rate of recurrent instability. A few studies have reported good results of the Latarjet procedure at long-term follow-up. However, the prevalence of glenohumeral arthritis after the Latarjet procedure has ranged from 49% to 71%.

There are several risk factors for arthritis in patients who have undergone treatment for anterior instability, including age at initial dislocation and at the time of surgery, number of preoperative dislocations, excessive anterior tissue tightening, intra-articular hardware, lateral overhang of the bone block, and longer follow-up.

However, there are few reports about the long-term risk factors for arthritis after a Latarjet procedure.

The purpose of this study was to evaluate the long-term results (minimum of 18 years) of the Latarjet procedure and to determine the prevalence of and risk factors for long-term glenohumeral arthritis after this procedure. We hypothesized that the Latarjet procedure would provide a low rate of recurrent instability with acceptable radiographic results in the long term. We also hypothesized that risk factors for postoperative arthritis would include patient factors, such as age and number of preoperative dislocations, as well as technical factors, such as position of the coracoid graft.

**Materials and methods**

**Study group**

We retrospectively reviewed Latarjet procedures performed by a single surgeon (G.W.) between 1988 and 1993. The indication for Latarjet reconstruction was recurrent traumatic anterior instability with or without hyperlaxity. Contraindications included “subtle” anterior instability without a Bankart lesion (painful shoulder in the throwing athlete) and voluntary habitual anterior instability. The inclusion criteria were a minimum follow-up of 18 years and complete preoperative and postoperative functional outcome and radiographic data. The exclusion criteria were a previous failed instability repair and incomplete functional outcome and radiographic data.
Operative technique

All operations were performed by the senior author (G.W.). The patient was placed in the beach chair position, and a 4- to 5-cm vertical incision was made beginning at the tip of the coracoid process extending to the axilla. The deltopectoral interval was used to expose the coracoid. Laterally, the coracoacromial ligament was incised 1 cm from its insertion on the coracoid tip. Medially, the pectoralis minor was released from the coracoid. An osteotomy of the coracoid was performed at the junction between the horizontal and vertical aspects (Fig. 2, A). The inferior cortex of the coracoid graft was removed with a saw to create a flat bone surface for subsequent opposition to the glenoid. A 3.2-mm drill was used to create 2 holes in the graft, approximately 1 cm apart (Fig. 2, B). A subscapularis split approach was used to access the glenohumeral joint by dividing the subscapularis horizontally at the lower third of the muscle (Fig. 2, C). After the subscapularis split, the anterior glenohumeral capsule was exposed and a vertical capsulotomy was performed at the medial origin. A retractor was placed on the humeral head to expose the anterior glenoid. The anterior labrum and periosteal sleeve were then excised. The anteroinferior cortex of the glenoid was freshened with an osteotome to provide a flat cancellous bed and to promote healing of the graft. A bicortical hole was drilled in the inferior glenoid to accommodate the coracoid graft without lateral overhang. The inferior surface of the coracoid graft was then placed flush with the articular surface of the glenoid and secured with a 4.5-mm cancellous screw 35 mm in length. Once the inferior aspect of the coracoid was secured, superior fixation was achieved by drilling the superior hole through the coracoid and the glenoid. A depth gauge was used to determine screw length, and another 4.5-mm cancellous screw was inserted (Fig. 2, D). The initial screw was retightened to ensure adequate compression of the graft. Coracoid graft position was confirmed, with care taken to ensure that it lay flush to the glenoid surface without lateral overhang. Finally, with the arm in external rotation, the anterior capsule was closed by suturing it to the coracoacromial ligament stump remaining on the medial aspect of the coracoid graft.

Postoperative rehabilitation

Postoperatively, patients were placed in a sling for 2 weeks. Three days after surgery, active-assisted forward flexion and external rotation were allowed as tolerated. The sling was removed 2 weeks after surgery and self-mobilization was continued. Four weeks after surgery, patients were allowed to resume athletic conditioning of the lower extremities. Eight weeks after surgery, strengthening of the shoulder was initiated. Return to sporting activities, including contact sports, was allowed once clinical and radiographic evaluation confirmed satisfactory healing of the coracoid graft, usually at 3 months after surgery.

Clinical and radiographic evaluation

Preoperatively, all patients underwent a physical examination, and functional outcome was assessed with the Rowe score. In this
system, outcomes are graded excellent when the score is 90 to 100 points, good when it is 75 to 89 points, fair when it is 51 to 74 points, and poor when it is ≤50 points. Basic demographic data, activity, and number of preoperative dislocations were also recorded. Postoperatively, patients were examined at 6 weeks, 3 months, and 6 months after surgery. At a minimum of 18 years after surgery (mean, 20 years), we attempted to recontact the patients. For those patients in the local area or those willing to travel to our institution, a detailed physical and radiographic examination was performed in person. Eight of the 60 patients returned for this examination. For those patients who lived far from our institution, a detailed questionnaire was sent and an order was provided to obtain radiographs. The questionnaire included self-assessed range of motion, strength, stability, activity, satisfaction, and subjective shoulder value (SSV). This questionnaire was used to calculate the postoperative Rowe score and recurrence of instability.

In all patients, the same radiologic protocol was used preoperatively and postoperatively (Fig. 3). Radiographs were obtained before surgery, immediately after surgery, at 3 months postoperatively, and at the time of final follow-up (18-22 years; average, 20 years). True anterior-posterior views of the glenohumeral joint were taken under fluoroscopic control in neutral and internal and external rotation to determine the degree of glenohumeral arthritis (Fig. 4). Arthritis was graded into 4 stages according to the Samilson and Prieto classification as modified by Buscayret et al. In this modified classification, stage 1 consists of humeral or glenoid osteophytes <3 mm, stage 2 consists of osteophytes 3 to 7 mm with slight irregularity of the glenohumeral joint, stage 3 consists of osteophytes >7 mm with glenohumeral joint space narrowing and sclerosis, and stage 4 consists of complete glenohumeral joint space loss. On the basis of this staging, we recorded preoperative arthritis, progression of arthritis in patients with arthritis before surgery, and postoperative development of arthritis in patients without arthritis before surgery. Finally, comparative glenoid profile views were taken to assess anterior bone loss and fracture of the glenoid preoperatively and to assess bone union and the position of the coracoid process postoperatively. The position of the coracoid graft was assessed on the immediate postoperative films. A flush position was defined as having the lateral aspect of the graft within 1 mm of the glenoid surface. Medial or lateral overhang was consequently defined as the lateral aspect of the graft positioned >1 mm medial or lateral to the glenoid surface, respectively. The radiographs were assessed by a single observer who was blinded to the patient’s history.

Statistical analysis

Preoperative and postoperative Rowe scores were compared with the Mann-Whitney U test. The association of the patient’s characteristics and glenohumeral arthritis were evaluated with the Wilcoxon rank sum test and Pearson χ² tests. To identify the risk factors for osteoarthritis, a multivariate statistical analysis was also conducted. The level of significance was set at P ≤ .05.

Results

During the study period, 334 Latarjet procedures were performed; 266 shoulders did not have complete follow-up, leaving a total of 68 shoulders in 60 patients available for this study. The average age at the time of surgery was 29.4 years (16-58 years). There were 49 men (54 shoulders) and 11 women (14 shoulders). Thirty-nine of the procedures were on the dominant extremity. Sixty-three patients had recurrent dislocations, 5 had recurrent subluxations, and 30 had both subluxations and dislocations before surgery. Sixty-one patients (89.7%) participated in sports (26 patients [38.2%] competitively and 35 patients [51.4%] recreationally), and 13 patients (19.1%) were classified as participating in contact collision sports.

Preoperatively, a fracture of glenoid was present in 24 shoulders (35.3%), a bone defect of glenoid was present in 15 shoulders (22.1%), and a Hill-Sachs lesion was present in 56 shoulders (82.4%). Eight patients (11.8%) demonstrated glenohumeral arthritis before surgery that was stage 1 in all cases.

Functional outcome

The mean follow-up was 20 years (18-22 years). The mean Rowe score increased from 37.9 preoperatively to 89.6
postoperatively \( (P < .001) \). The mean SSV at final follow-up was 90.9\% (40\%-100\%). Forty-one patients (60.3\%) had no pain, 18 (26.5\%) had pain during athletic activities, and 9 (13.2\%) had pain during activities of daily living. Fifty-five patients (80.9\%) were very satisfied, 10 patients (14.7\%) were satisfied, and 3 patients (4.4\%) were disappointed with the result. The disappointed group included patients who had shoulder pain during sports or were apprehensive during activities of daily living. Fifty-seven patients (93.4\%) returned to sports at the same level, and 5 patients (8.2\%) switched to another type of sport or participated at a lower level because of their shoulder.

**Recurrence of instability**

Postoperative recurrence developed in 4 of 68 shoulders (5.9\%), with dislocation in 2 shoulders (2.9\%) after a new traumatic episode and subluxation in 2 shoulders (2.9\%) (Table I). The coracoid graft was positioned medially in the 2 shoulders with redislocation. One of the patients with recurrent subluxation had a well-positioned coracoid graft but experienced subluxation with overhead tennis activity. The other patient with recurrent subluxation reinjured himself skiing and had a large glenoid defect preoperatively.

One patient who had a large glenoid defect and in whom the coracoid graft had been positioned medially underwent revision with an Eden-Hybinette procedure. He was 43 years old at the initial surgery and redislocated twice 2 years postoperatively. His shoulder remained stable after the revision procedure.

**Radiographic results**

On initial postoperative radiographs, the coracoid graft was positioned medially in 5 patients (7.4\%), flush with the glenoid in 54 patients (79.4\%), and with lateral overhang in 9 patients (13.2\%). Pseudarthrosis of the coracoid graft occurred in 1 shoulder (1.5\%). This patient did not experience recurrent instability. However, at the time of final follow-up, she was 61 years old and her clinical result was poor because of stage 2 arthritis and a rotator cuff tear. Screw fracture was identified in 1 shoulder (1.5\%) at 3 years after surgery, but the coracoid graft was united and the clinical result was excellent. Screw loosening occurred in 2 shoulders (2.9\%), and both of them were removed.

Progression of preoperative arthritis was identified in 4 of the 8 shoulders (50\%) with preoperative arthritis; the arthritis was stage 2 in 2 shoulders and stage 3 in 2 shoulders. Postoperative arthritis in the patients without preoperative arthritis (Samilson-Prieto classification). (A) A normal shoulder without arthritis. (B) Stage 1: humeral or glenoid osteophyte <3 mm. (C) Stage 2: humeral or glenoid osteophyte 3 to 7 mm. (D) Stage 3: humeral or glenoid osteophyte >7 mm.
Risk factors associated with arthritis

The 16 shoulders that had postoperative arthritis or progression of preoperative arthritis were compared with the 52 shoulders that had no arthritis or no progression of preoperative arthritis to clarify the risk factors of postoperative arthritis. These were evaluated with the Wilcoxon rank sum test and Pearson χ² test. Patient characteristics included the length of follow-up, age at the time of surgery and at the time of final follow-up, number of dislocations and subluxations, type of sporting activity, and postoperative Rowe score and SSV (Table III). Radiographic characteristics included preoperative fracture of glenoid or glenoid bone loss and postoperative position of coracoid graft (Table IV). There were significant differences in the age at the time of final follow-up (P = .005), high-demand sports activity (P = .001), SSV (P = .005), and lateral overhang of the coracoid graft (P < .001).

On multivariate logistic regression analysis, older age at the time of final follow-up, high-demand sports, and lateral overhang of the coracoid graft were significantly associated with postoperative arthritis.

Discussion

The present study shows that the Latarjet procedure provides excellent long-term clinical results (mean Rowe score was 89.6 points and mean SSV was 90.9%) at a mean of 20 years postoperatively. The prevalence of postoperative development of arthritis and progression of preoperative arthritis was only 23.5%, which was mild arthritis (stage 1 or 2) in 14.7% or severe arthritis (stage 3) in 8.8%.

Others have previously reported on the long-term results of the Latarjet procedure. Singer et al³² reported on 14 Bristow-Latarjet procedures with a mean follow-up of 20.5 years. They demonstrated an excellent or good Rowe score in 93% despite a 71% rate of glenohumeral arthritis in the involved shoulders. Allain et al² reported on 58 Latarjet procedures with a mean follow-up of 14.3 years. They reported good or excellent results in 88% according to the Rowe score. Sixty-two percent of the patients had postoperative arthritis, and severe arthritis was seen in 36%. Hovelius et al¹⁵,¹⁶ reported on the outcomes of 118 Bristow-Latarjet reconstructions at a mean follow-up of 15.2 years. They reported 98% good or excellent Rowe scores and a 13.8% recurrence of instability (including subluxations). Forty-nine percent of their patients had arthritis at final follow-up.

Despite the satisfactory clinical outcomes of the Latarjet procedure, the high prevalence of postoperative arthritis after the procedure is concerning. Our rate of postoperative development of arthritis and progression of arthritis (23.5%) was relatively lower than in the aforementioned reports (49%-71%). Notably, we did not identify any stage 4 arthritis (complete obliteration of the glenohumeral joint space). Even our patients with arthritis demonstrated good clinical outcomes (Table II). However, we presume that this relates to the fact that none of our patients had stage 4 arthritis. This difference in arthritis is unlikely to be related to the patient population because the patient demographics are similar between the cohorts. We believe that the surgical technique therefore has a substantial influence on the long-term development of arthritis after coracoid transfer. In the studies by Allain et al and Singer et al,²,³² patients underwent a tenotomy of the subscapularis muscle, which was reattached after coracoid grafting. This approach may lead to an external rotation deficit after the subscapularis is repaired, which may lead to arthritis in the long term because of change in glenohumeral joint contact forces. Allain et al² described a mean 20° loss of external rotation postoperatively overall and a mean 29° loss of external rotation in 18 patients in whom they repaired the

<table>
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<tr>
<th>Table I</th>
<th>Patients with recurrence</th>
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<tr>
<td>Age at surgery, sex</td>
<td>Timing</td>
</tr>
<tr>
<td>17, M</td>
<td>2 years</td>
</tr>
<tr>
<td>43, M</td>
<td>2 years</td>
</tr>
<tr>
<td>20, M</td>
<td>5 years</td>
</tr>
<tr>
<td>21, F</td>
<td>19 years</td>
</tr>
</tbody>
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Glenoid defect, +, significant bone loss sign was shown on comparative glenoid profile views¹¹; Hyperlaxity, +, external rotation at side more than 90 degree bilaterally.

<table>
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<tr>
<th>Table II</th>
<th>Postoperative clinical results by stage of postoperative osteoarthritis</th>
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</thead>
<tbody>
<tr>
<td>Stage of OA at final follow-up</td>
<td>Rowe score</td>
</tr>
<tr>
<td>No OA (n = 48)</td>
<td>90.7</td>
</tr>
<tr>
<td>Stage 1 (n = 10)</td>
<td>89</td>
</tr>
<tr>
<td>Stage 2 (n = 4)</td>
<td>78.8</td>
</tr>
<tr>
<td>Stage 3 (n = 6)</td>
<td>85.8</td>
</tr>
</tbody>
</table>

OA, osteoarthritis; SSV, subjective shoulder value.
subscapularis with an overlapping technique. Singer et al\(^{32}\) described that 86% of patients had an external rotation deficit, and their mean external rotation was only 19° in the patients with grade 3 arthropathy. We used a horizontal subscapularis splitting technique that does not require reattachment of the tendon. Maynou et al\(^{21}\) recently described improved functional outcomes and greater preservation in external rotation in patients who underwent a subscapularis split compared with a tenotomy during the Latarjet procedure. Therefore, the subscapularis split approach may contribute to our lower rate of long-term arthritis. However, because we did not measure external rotation in the majority of patients, this cannot be confirmed. Finally, Allain et al\(^{2}\) described lateral overhang of the coracoid graft in 53% of their patients and noted that this position was associated with the development of arthritis. In the current study, the coracoid graft was positioned laterally in only 13% of cases.

Graft technique may also affect recurrence of instability and subsequent arthritis. In the study by Hovelius et al\(^{16}\), for instance, a Bristow-Latarjet technique was used in which the base of the coracoid was opposed to the glenoid with a single screw. They observed a 13.4% rate of recurrence. We used a classic Latarjet technique in which the inferior surface of the coracoid was secured to the glenoid with 2 screws. This technique provides a more anatomic restoration of glenoid bone stock compared with the Bristow technique and therefore may more accurately restore glenohumeral joint contact forces. In addition, this technique may relate to our recurrence rate of only 5.9%. Our low recurrence rate may partially account for our lower rate of postoperative arthritis.

### Table III

<table>
<thead>
<tr>
<th>Follow-up period (months)</th>
<th>Postoperative OA or progression of OA (n = 16)</th>
<th>No OA or no progression of OA (n = 52)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>243</td>
<td>240</td>
<td>.461</td>
</tr>
<tr>
<td>Age at surgery (years)</td>
<td>34.4</td>
<td>27.8</td>
<td>.107</td>
</tr>
<tr>
<td>Age at final follow-up (years)</td>
<td>54.4</td>
<td>46.9</td>
<td>.048</td>
</tr>
<tr>
<td>Sports activity</td>
<td>Competitive 4 (25%)</td>
<td>Competitive 22 (42.3%)</td>
<td>.213</td>
</tr>
<tr>
<td></td>
<td>High demand 8 (50%)</td>
<td>High demand 5 (9.6%)</td>
<td>.001</td>
</tr>
<tr>
<td>No. of dislocations/ subluxations</td>
<td>3.3/4.3</td>
<td>5.6/4.4</td>
<td>.125/.857</td>
</tr>
<tr>
<td>Postoperative Rowe score</td>
<td>86.3</td>
<td>90.3</td>
<td>.148</td>
</tr>
<tr>
<td>SSV (%)</td>
<td>85.2</td>
<td>92.1</td>
<td>.005</td>
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</table>

SSV, subjective shoulder value.

### Table IV

<table>
<thead>
<tr>
<th>Position of coracoid graft</th>
<th>Postoperative OA or progression of OA (n = 16)</th>
<th>No OA or no progression of OA (n = 52)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medial 1 (6.3%)</td>
<td>9 (56.3%)</td>
<td>15 (28.8%)</td>
<td>.161</td>
</tr>
<tr>
<td>Flush 8 (50%)</td>
<td></td>
<td>9 (17.3%)</td>
<td>.416</td>
</tr>
<tr>
<td>Lateral overhang 7 (43.7%)</td>
<td></td>
<td>2 (3.8%)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

OA, osteoarthritis.

because an increasing number of dislocations has been associated with glenohumeral arthritis.\(^7\)

We observed a medialized position of coracoid graft in 2 of 4 shoulders with recurrence. Furthermore, one patient had a large glenoid bone defect and the other had hyperlaxity. Large glenoid defects and hyperlaxity have previously been associated with recurrent instability.\(^5\) Whereas these factors are beyond the surgeon’s control, it appears that anatomic coracoid graft positioning is important to prevention of recurrent instability.

Postoperative arthritis after treatment of glenohumeral instability has ranged from 35% to 71% at long-term follow-up.\(^2,9,10,12,15,22,26,28,29,32\) Reported risk factors for arthritis have included age at initial dislocation and at the time of surgery, number of preoperative dislocations, excessive anterior tissue tightening, intra-articular hardware, lateral overhang of the bone block, and longer follow-up.\(^2,4,7,10,12,15,22,23,26,28,29,36,37\) Our results confirm these findings, particularly older age at the final follow-up and lateral overhang of the coracoid graft. With respect to older age, the natural history of the glenohumeral joint must be considered. However, because the natural history of a healthy glenohumeral joint has not been well defined, we cannot compare the prevalence of arthritis in the normal population to that in our patients who underwent a Latarjet procedure. Kavaja et al\(^{18}\) reported the long-term results of 74 arthroscopic Bankart repairs with mean follow-up of 13 years and also obtained radiographs of the nonaffected shoulder. Their patient population was similar to that of our study, with a mean age of 29 years at the time of surgery. They identified arthritis in 22% of nonaffected shoulders, which was similar to our prevalence of postoperative arthritis and progression of preoperative arthritis (23.5%). This suggests that postoperative arthritis is caused not only by the Latarjet procedure but also by the natural history of the glenohumeral joint. We also observed that contact sports were associated with an increased risk for development of arthritis in the long term despite a low rate of recurrence. It is possible that these individuals subject their shoulder to more microtrauma of the articular surface,
which results in arthritis in the long term; this may be particularly important because the Latarjet reconstruction does not reproduce the normal anatomy of the glenohumeral joint. Lateral overhang of the coracoid graft is a well-known risk factor for postoperative arthritis.2,18 Therefore, from a technical standpoint, the most important variable within the surgeon’s control is to avoid lateral overhang of the coracoid graft.

There are several limitations to this study. This was a retrospective review, and because of the length of follow-up, a limited percentage of patients returned for evaluation. The low follow-up rate is a significant weakness and has the potential to introduce bias because of incomplete study results. We did not have a comparison or control group. Hovelius et al17 reported a comparative study of Bristow-Latarjet and Bankart repair during a 17-year follow-up and concluded that a Bristow-Latarjet repair was more reliable than a Bankart repair with anchors. We, however, did not compare alternative procedures, so we cannot comment if the Latarjet procedure offers a better long-term result or a lower risk of arthritis compared with other procedures. Also, because we did not compare approaches or assess external rotation, we cannot prove that a subscapularis split technique is superior to a tenotomy. The small number of patients with radiographic evidence of arthritis also made statistical analysis of data difficult. Furthermore, we used plain radiographs to detect arthritis. A computed tomography scan may more accurately detect arthritis, and further studies with such evaluation may be useful.

**Conclusion**

The Latarjet procedure provides excellent long-term functional outcome. The prevalence of postoperative development of arthritis and progression of preoperative arthritis is 23.5% at 20 years of follow-up, but the majority of arthritis is mild. Risk factors for development of osteoarthritis after Latarjet reconstruction include old age at final follow-up, high-demand sports activity, and lateral overhang of the coracoid graft.

**Disclaimer**

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**References**