Arthroscopic Latarjet: Suture-Button Fixation Is a Safe and Reliable Alternative to Screw Fixation

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Purpose: To evaluate mid-term clinical outcomes, complications, bone-block healing, and positioning using suture-button fixation for an arthroscopic Latarjet procedure. Methods: Patients with traumatic recurrent anterior instability and glenoid bone loss underwent guided arthroscopic Latarjet with suture-button fixation. We included patients with anterior shoulder instability, glenoid bone loss >20%, and radiographic and clinical follow-up minimum of 24 months. Patients with glenoid bone loss <20% or those that refused computed tomography imaging were excluded. Bone-block fixation was accomplished with 2 cortical buttons connected with a looped suture (4 strands). The looped suture was tied posteriorly with a sliding-locking knot. After transfer of the bone block on the anterior neck of the scapula, compression (100 N) was obtained with the help of a tensioning device. Clinical assessment was performed at 2 weeks, 3 months, 6 months, and then yearly with computed tomography completed at 2 weeks and 6 months to confirm bony union.

Results: A consecutive series of 136 patients underwent arthroscopic Latarjet with 121 patients (89%; mean age 27 years) available at final follow-up (mean follow-up, 26 months; range, 24-47 months). No neurologic complications or hardware failures were observed; no patients had secondary surgery for implant removal. The transferred coracoid process healed to the scapular neck in 95% of the cases (115/121). The bone block did not heal in 4 patients; it was fractured in 1 and lysed in another. Smoking was a risk factor associated with nonunion (P < .001). The coracoid graft was positioned flush to the glenoid face in 95% (115/121) and below the equator in 92.5% (112/121). At final follow-up, 93% had returned to sports, whereas 4 patients (3%) had a recurrence of shoulder instability. The subjective shoulder value for sports was 94 ± 3.7%. Mean Rowe and Walch-Duplay scores were 90 (range, 40-100) and 91 (range, 55-100), respectively. Conclusions: Suture-button fixation is an alternative to screw fixation for the Latarjet procedure, obtaining predictable healing with excellent graft positioning, and avoiding hardware-related complications. There was no need for hardware removal after suture-button fixation. The systematic identification of the axillary and musculocutaneous nerves reduced risk of neurologic injury. A low instability recurrence rate and excellent return to pre-injury activity level was found. Suture-button fixation is simple, safe, and may be used for both open and arthroscopic Latarjet procedure. Level of Evidence: Level IV, therapeutic case series.

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The Latarjet procedure is becoming increasingly popular among surgeons for treatment of complex recurrent anterior shoulder instability and to allow patients to return to high-risk sports.1 The procedure is most often indicated in young patients (<20 years) practicing overhead or contact sports at a competitive level, with significant glenohumeral bone loss (>20% of the glenoid surface), or in the case of failed previous stabilization.2,3 For this high-risk patient population, it has been shown that results of the Latarjet procedure outperforms those of arthroscopic soft-tissue stabilization procedures such as a Bankart repair.4,5

In his original technique, published in 1954, Michel Latarjet described a coracoid transfer performed through a
horizontal split in the subscapularis, advocating a single screw fixation of the coracoid process positioned flush with the anteroinferior glenoid rim.6 Gilles Walch popularized the technique and recommended the use of 2 AO malleolar screws to build a strong biomechanical construct and increase the chance of bone-block healing.7 Recently, Lafosse et al8 described an all-arthroscopic Latarjet technique using 2 metallic cannulated screws for bone-block fixation. Although there has been much recent enthusiasm regarding the Latarjet procedure, either open or arthroscopic, the technique remains difficult, with a steep learning curve and a high rate of complication (up to 30% at 3-month follow-up).9-14

A significant proportion of complications after the Latarjet procedure is related to screw fixation.10,13 Bone-block malpositioning is not rare and is related to the tendency for screw obliquity, leading to shoulder pain and osteoarthritis resulting from humeral head impingement.7,15 Hardware failures (screw bending or pullout) and bone-block fractures or nonunion are other typical complications.9,10,12 Of the 7% reoperation rate found in a systematic review by Griesser et al,12 35% were for removal of symptomatic hardware or malpositioned screws (screw loosening, prominence in the joint, or breakage). Proximal graft resorption is also frequent and exposes the superior screw to possible subscapularis tearing or erosion, humeral head impingement, and potential cartilage wear.5,16,17

Contrary to what could have been expected with improved visualization, the arthroscopic Latarjet technique did not reduce the rate of hardware and neurologic complications.13,18,19 Arthroscopic drilling and insertion of screws strictly parallel to the glenoid surface can be technically challenging, and even more dangerous than with the traditional open technique.20 Furthermore, it appears that the complication rates do not decrease with more surgical experience.9,21

The purpose of this prospective study was to evaluate clinical outcomes, complications, bone-block healing, and positioning using suture-button fixation for an arthroscopic Latarjet procedure with more than 2 years of follow-up. Our hypotheses were that (1) suture-button fixation would obtain an excellent rate of bone union with accurate bone-block positioning, and (2) the complication rate (infection, nerve damage, hematoma) would be equal to or lower than the reported rates with the traditional Latarjet using screw fixation (no need for hardware removal as a secondary procedure).

Methods

Study Design

This prospective clinical and computed tomography (CT) scan study was approved by institutional review board no. 2016-04, and informed consent was obtained from all patients. All procedures were performed at a single institution by the lead author (P.B.). The inclusion criteria were: (1) traumatic recurrent anterior instability of the shoulder; (2) presence of an anterior glenoid bone defect involving >20% of the glenoid surface, as measured on preoperative 3-dimensional CT scan or during diagnostic arthroscopy;9,22 (3) arthroscopic coracoid bone-block procedure in the lying position (Latarjet) with suture-button fixation associated with an anterior glenoid labrum repair; and (4) radiological and clinical follow-up over a minimum of 24 months with CT scan performed 2 weeks and at least 6 months after surgery to evaluate bone-block healing and positioning. We excluded patients with glenoid bone loss <20%, those who had an isolated cortical Hill-Sachs lesion, and those who refused to participate or to have CT scan imaging. Our surgical indications for arthroscopic Latarjet using cortical buttons in patients with anterior glenohumeral instability were patients with Instability Severity Index Score >3 and glenoid bone loss (>20%). In cases with a combined large Hill-Sachs lesion, a remplissage procedure was performed in conjunction with the Latarjet. Patients with a history of previous shoulder stabilization were accepted for this study.

Surgical Technique: Guided Arthroscopic Latarjet Procedure

Under general anesthesia and interscalene block, patients were positioned in a “lazy beach chair” (30-40°) and the arm placed on a movable support (Spider Limb Positioner, Smith & Nephew, Andover, MA) without traction. The arthroscopic-guided technique has been described in detail by Boileau et al.10,22 The procedure includes 5 major steps (Fig 1): (1) coracoid preparation, drilling, and osteotomy; (2) glenoid preparation and drilling; (3) subscapularis splitting after nerve protection; (4) coracoid transfer and fixation; and (5) Bankart repair.22
Instrumentation. In this arthroscopic technique, specific instrumentation has been developed to allow matching of the glenoid and coracoid drill holes (Fig 2). A motorized rasp is used to abrade the glenoid neck and under surface of the coracoid process, whereas a motorized saw is used to osteotomize the coracoid. Specific spreaders are used to split the subscapularis muscle. The axillary and musculocutaneous nerves are identified by following the “3 sisters” vascular bundle medially and systematically protected with a nerve retractor first, and then with the anterior spreader during subscapularis splitting. Suture buttons are used to fix the bone block, and a labral repair is systematically performed with suture anchors (number of anchors depended on patient anatomy).

Technique. In addition to the standard posterior portal, 5 anterior portals are created during the procedure and a 70° scope is used to enhance visualization. The coracoid is prepared and drilled with a 2.8-mm bit using the specific coracoid guide (Smith & Nephew) and osteotomized 1.5 to 2.0 cm from its tip. A 2.8-mm hole is drilled across and parallel to the glenoid from back to front at 5 o’clock using a specific glenoid drill guide (Smith & Nephew). After careful identification of the axillary and musculocutaneous nerves, the subscapularis muscle is split horizontally using 2 spreaders: 1 coming from the back and 1 coming from the front. The fixation is made using 2 round, 6.5-mm, slightly convex titanium buttons, connecting with a loop of continuous suture forming 4 parallel strands (Bone-Link, Smith & Nephew). The coracoid button has a peg to prevent the suture from deviating from the coracoid and cutting through the bone, whereas the posterior glenoid button has single hole. The looped suture was tied posteriorly with a sliding-locking knot (Nice Knot), which is bulky enough and cannot pass through the hole of the posterior button. A specific suture tensioner (Smith & Nephew) was used to increase bone compression to 100 N (Fig 3).

After graft position was checked, the Bankart repair allowed placing the bone block in an extra-articular position, and also functions in an attempt to reduce the potential rotation of the bone block (Fig 4). At the end of the procedure, the tensioner was removed, and 3 square knots (surgeon’s knots) were tied (in addition to the Nice Knot) to complete the bone-block fixation.

Postoperative Management
Postoperative radiographs were taken to evaluate correct graft position (Fig 5). The arm was immobilized for 2 weeks in a neutral rotation sling to allow healing of the conjoint tendon in the muscular part of the subscapularis (and not its tendinous part). After 2 weeks, pendulum exercises started (5 times/day,

Fig 2. Different steps of the procedure (right shoulder). (A) Coracoid drilling with the coracoid drill guide seen passing through the north portal. (B) Glenoid drilling from posterior to anterior with the glenoid drill guide seen passing from posterior to anterior along the glenoid face and hooking the anterior glenoid. (C) Subscapularis split viewed anteriorly showing posterior spreader beginning the split. (D) Coracoid transfer. (E) Coracoid positioning viewed from inside the joint. (F) Conjoint tendon passing through the subscapularis (sling effect) with axillary and musculocutaneous nerve bundle well visualized (>).
5 minutes/session) and the brace was removed at night; patients were encouraged to use their arm for activities of daily living. After 4 weeks, the sling was completely removed and formal rehabilitation with a physiotherapist started. Abduction and external rotation were avoided during the first 6 weeks after surgery. Swimming pool therapy was encouraged. No heavy lifting (>10 lb) was allowed for the first 12 weeks. Return to sports activities, including collision and contact-overhead sports, was allowed between 3 and 6 months postoperatively, according to the functional recovery of each patient and ensuring there was no clinical apprehension.

**Clinical Assessment**

Any intra- or postoperative complications that occurred were recorded including hematoma, infection, neurologic injury, redislocation, or hardware failure. Patients were seen postoperatively at 2 weeks; 3, 6, 12 months; and then annually. All patients were examined by observers (orthopaedic fellows or residents) different than the operating surgeon. Clinical evaluation included range of motion (active forward elevation, internal rotation, external rotation), apprehension testing, and functional outcomes (Rowe score and Walch-Duplay score). We use a modified version of the subjective shoulder value for sport, expressed as a percentage of a 100% normal shoulder regarding sport practice. Subjective patient outcome was also graded with satisfaction: very satisfied, satisfied, medium satisfaction, not satisfied, or disappointed. Recurrent dislocation or subluxation and return to sport, and at what level compared with preinjury, were documented.

**Fig 3.** Coracoid bone graft compression and fixation. (A) After transfer of the bone block on the anterior neck of the scapula, the posterior button is slid over the suture and a sliding-locking knot (Nice Knot) is tied. (B) Bone compression (100 N) is obtained with the help of a tensioning device. (C) Three additional square knots (surgeon’s knots) are tied at the back of the shoulder to definitely lock the construct.

**Fig 4.** Bankart repair and control of bone graft rotation. (A) Reattachment of the anterior labrum with 2 anchors (1 at 3 o’clock and 1 at 5 o’clock) to the glenoid rim avoids potential rotation of the bone graft. (B) Reattachment of the labrum, which places the coracoid bone block in an extra-articular position.
CT Scan Evaluation

The positioning and bone union of the coracoid transfer were assessed on a CT scan available for all patients at a minimum 15 days and 6 months postoperatively. Long-term CT scans (mean, 27.5 months; range, 12-41) were also available for 28 patients. Two- and 3-dimensional glenoid en face views and an axial view were acquired with the humeral head, subtracted according to the method described by Sugaya et al and using OsiriX software. The ideal position of the bone block was defined as under the equator and flush to the anterior glenoid rim. The bone block was considered too lateral if it went beyond the glenoid rim by more than 3 mm and it was judged to be medial if it was medial to the rim by more than 5 mm. Nonunion was defined as a visible radiolucent line, but 1 that measured <5 mm. The radiolucent line was >5 mm, the bone block was considered to have migrated. Inter- and intraobserver reliability was not assessed; however, each file was reviewed by 2 orthopaedic fellows and consensus reached.

Statistical Analysis

The statistical analysis was performed with StatView 5.0 (SAS Institute, Cary, NC). The quantitative data were expressed as the mean ± standard deviations (range). The Agostino-Pearson test was used to determine whether the data were normally distributed. Qualitative variables are described by sample size and percentages. Qualitative variables were compared using the χ²-square or Fisher exact test. Quantitative variables were compared using the Student t or the Mann-Whitney test, depending on whether the variable was normally distributed. The Spearman correlation test was used to determine the relationship between 2 variables. The level of significance was set at P < .05.

Results

Demographics

Between December 2012 and June 2015, 136 patients underwent a guided arthroscopic Latarjet procedure with suture-button fixation by the senior author (P.B.); 121 (89%) patients (103 males; mean age, 27 years) were prospectively followed with a mean follow-up of 26 months (range, 24-47), and had CT scan imaging performed 2 weeks and 6 months after surgery or further. Fifteen patients had moved from the region and were unable to return for follow-up and were thus excluded. Thirteen patients (11%) had a history of unsuccessful prior shoulder stabilization (1 open Bankart repair, 8 arthroscopic Bankart repairs, and 4 arthroscopic Hill-Sachs remplissage plus Bankart repairs). Four patients had associated pathologic processes (3 superior labral anteroposterior type III lesions and 1 partial-thickness supraspinatus tear) that were treated during the same procedure. A total of 113 patients were involved in sports before injury, and 82% were practicing contact or overhead, high-risk sports. Seventy-nine patients (71%) played at a competitive level. Patient demographics are summarized in Tables 1 and 2.

Complications and Revision Surgery

Five temporary postoperative hematomas were observed (none requiring intervention), but no neurologic complications, infections, or hardware failures were recorded (Table 3). At last follow-up, 4 patients (3%)
had a traumatic recurrent shoulder instability episode (1 dislocation and 3 subluxations) at a mean of 7 months (range, 5-12). The bone block was positioned too low in 1 patient, leading to subluxation above the graft, and failure to obtain coracoid bone-block healing was present in 2 of 4 patients. Three patients had revision surgery in the form of arthroscopic Bankart rerepair and Hill-Sachs remplissage. At final follow-up for the patients with recurrence, 2 were still satisfied with the procedure, 1 had medium satisfaction, and we did not have long-term follow-up results for the final patient.

**Functional Results**

At latest follow-up, the mean Rowe and Walch-Duplay scores were 90 (range, 40-100) and 91 (range, 55-100), respectively. No significant restriction (loss >20°C) in range of active motion was found after surgery in terms of forward elevation, external rotation, and internal rotation.

**Return to Sports and Subjective Results**

At last follow-up, 93% (105/113) had returned to sport, and 70% returned to their sports at the same or higher level within 1 year after surgery. The mean subjective shoulder value for sports was 94 ± 3.7% (range, 80 to 100). All patients, except the 4 who had a recurrence of anterior instability, were satisfied or very satisfied with the procedure. On apprehension testing, 115/121 had no apprehension at final follow-up.

**Graft Position**

The coracoid graft was positioned flush to the glenoid surface in 95% (115/121) and below the equator (Fig 6) in 92.5% (112/121) (Table 4).

**Graft Union**

At final follow-up, the transferred coracoid process healed to the scapular neck in 95% of cases (115/121) (Figs 6 and 7). Failure to obtain coracoid bone-block healing was recorded in 5% (6/121): 4 nonunions (3%), 1 migration, and 1 osteolysis. Smoking was a risk factor associated with nonunion (P < .001). One patient with bone-block healing had a fracture of the tip of the transferred coracoid. Ten patients, operated upon early in the series, had a nonunion at 6 months, but had healed at final follow-up (Fig 8).

**Graft Remodeling**

Comparing the CT scans images performed at 2 weeks and 6 months or later, we observed that the bone graft showed some remodeling (Fig 7). In the vertical plane, we observed some remodeling of the proximal part of the coracoid bone grafts that led normalizing the glenoid morphology. In the axial plane, we observed that the grafts that had initially slight lateral overhang (1-3 mm) were <1 mm lateral overhang at last follow-up. Of the 6 patients with lateral overhang on the 2-week CT scan, 5 remodeled in the axial plane to have lateral overhang <1 mm on the CT performed at 6 months or later. In none of these cases with remodeling were there any hardware-related complications.

**Discussion**

The principal finding of this study is that suture-button fixation can be a safe and reliable alternative to screw fixation for the Latarjet procedure, obtaining predictable healing with excellent graft positioning, and avoiding hardware-related complications. Using a systematic, guided arthroscopic Latarjet procedure with suture-button fixation, we achieved a bone-block healing rate of 95%, accurate positioning of the graft (95% axial, 92% sagittal), and a return to sport in 93%. There were no neurologic complications, no hardware-related complications, a 3% recurrence rate, and 2.5%
The systematic identification of the axillary and musculocutaneous nerves reduced risk of neurologic injury. Suture-button fixation is simple, safe, and may be used for both open and arthroscopic Latarjet procedure.

In the traditional Latarjet technique (open or arthroscopic), the gold standard for fixation of the transferred coracoid is the use of 2 bicortical screws. Although mechanically sound, screw fixation is also a significant source of hardware and neurologic complications. Although the frequency of arthroscopic Latarjet is increasing, the use of the scope has not made screw management easier, and the rate of complications associated with screw fixation has remained similar or even higher than with the open technique. Even experienced and well-trained arthroscopic surgeons are facing these complications: a recent article by Athwal et al9 reported a 24% rate of problems and complications at 3 months following the arthroscopic Latarjet procedure. More intriguing is that in 2 recent studies reporting the results of arthroscopic Latarjet, the complication rates did not decrease when comparing the early surgical patients with those whom they treated later with more surgical experience.9,21 These complications may be important enough to warrant reoperation in young sport patients: in a long-term follow-up series of arthroscopic Latarjet performed by Lafosse, screws had to be removed in 12.5% of patients. In a recent study reporting the results of block augmentation (91% of coracoid transfer) in a military population, perioperative complications occurred in 25% (including 12.5% of neurologic complications), and 18% of the patients needed a secondary surgical procedure. Our results with suture-button fixation suggest it as a potential alternative to screw fixation for the Latarjet procedure, obtaining successful bone graft union while avoiding complications often associated with screws such as graft fracture or the need for hardware removal.

The most pertinent finding of the present study is that suture-button fixation at least equals the performance of screw fixation reported in the literature, allowing a bone-block healing rate of 95%, as verified on CT scan images. Butt et al, in a systematic review of 1,658 patients operated on with an open Latarjet technique and screw fixation, reported a mean rate of nonunion or graft migration of 10.1% using radiographs. Shah et al were able to obtain postoperative CT scans in 60% of their patients, which identified a 28% rate of

### Table 4. Coracoid Bone Graft Position on Computed Tomography Scans Performed 6 Months After Surgery

<table>
<thead>
<tr>
<th>Vertical position</th>
<th>(Correct Position)</th>
<th>Subequatorial</th>
<th>Equityal</th>
<th>Supra-equatorial</th>
<th>Horizontal position</th>
<th>flush to glenoid rim</th>
<th>Medial to glenoid rim</th>
<th>Lateral to glenoid rim</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical position</td>
<td></td>
<td>92.5% (112/121)</td>
<td>5.8% (7/121)</td>
<td>1.7% (2/121)</td>
<td></td>
<td>95% (115/121)</td>
<td>0</td>
<td>5% (6/121)</td>
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Fig 6. Three-dimensional computed tomography images showing end face views of the glenoid after arthroscopic Latarjet with suture-button fixation (right shoulder). Computed tomography performed at 2 weeks shows correct position of the graft in the vertical plane (below the equator), whereas the 3-dimensional computed tomography image performed at 6 months is showing complete bone healing (arrowhead) and remodeling (arrow) of the bone graft so that the glenoid morphology is almost normalized.

Table 4. Coracoid Bone Graft Position on Computed Tomography Scans Performed 6 Months After Surgery.
delayed union, fibrous union, or nonunion. Our nonunion rate of 5%, evaluated on CT, compares favorably. As shown in a previous study, the use of a tensioner is mandatory when using suture-button fixation to increase compression on the bone graft and is 1 of the keys to success to improve the healing rate.31 Our radiological results support that suture-button fixation has adequate strength for predictable bone-block healing. This is not surprising and could be expected from previous biomechanical data.32,33 A biomechanical study of coracoid graft fixation showed the median ultimate load to failure of 2 bicortical screws to be 202 N (range, 95-300 N).32 Although no biomechanical study has specifically evaluated suture-button fixation through the coracoid, studies in distal biceps fixation found load to failure of up to 440 N.33

Another pertinent finding of the present study is that using suture-button fixation with a systematic, guided technique allows accurate bone-block positioning, flush to the glenoid rim in 95% and subequatorial in 92%. These results are better than those reported in the literature for the Latarjet procedure with screw fixation.18,28,34 The rates of graft malpositioning with open Latarjet have ranged from 21% to 67%.15,26,28,34 Using an arthroscopic technique, Kany et al 34 demonstrated malpositioning of the graft in 13% of their cases at the end of their learning curve (19% during the full period of study). This high rate of bone-block malpositioning with screw fixation may be explained by the frequent obliquity of the screw trajectory and the rigidity of the mechanical construct.35,36 As a result, the most frequent malposition of the transferred coracoid with screw fixation is lateral overhang, which predisposes to humeral impingement and early-onset arthritis.13,15,28 Our results demonstrate that the risk of such malpositioning can be reduced with suture-button fixation.

Osteolysis is known to occur after iliac crest bone graft or coracoid transfer regardless of method of fixation, and our results are consistent with this.16 in the vertical plane, we observed what we consider a physiological remodeling process that led to restoration of a more natural glenoid anatomy (i.e., restoration of the “pear shape” of the glenoid as the proximal portion of the graft is resorbed, whereas the structural inferior portion remains intact). Although the exact biomechanics of this process needs to be further investigated, we believe
that such remodeling occurs in accordance to Wolff’s law, resulting in a physiological reduction of stress on the upper part of the bone graft, whereas the lower portion is exposed to constant mechanical stress (Fig 6). Interestingly, we also found some remodeling in the axial plane. Of the 6 patients with some degree of lateral (>3 mm) bone block at 2 weeks, 5/6 remodeled to no lateral overhang (<3 mm) (Fig 7). It is our interpretation that the cortical suspension fixation device that we use initially allows some flexibility to the construct; this is an advantage compared with the rigid fixation provided by the screws.

Another advantage of the described suture-button (low-profile implant) fixation technique is the avoidance of hardware complications, such as screw head impingement, breakage or migration, or coracoid fractures for up to 2 years of follow-up. We observed a single tip coracoid postoperative fracture associated with excessive decortication of the undersurface of the coracoid. By contrast, intra- and postoperative fractures of the coracoid graft are commonly encountered adverse events associated with screw fixation, which can occur in up to 7%. These complications are more common in women with small coracoid processes and in older patients (>40 years) with poor bone quality.28,37 Coracoid fracture or migration has been shown to be associated with an overly narrow space between the drill holes and screws and/or excessive tightening of the screws.7,13 The single and small (2.8 mm) drilling hole needed for suture-button fixation is clearly an advantage when compared with the larger (3.2 mm) double drilling holes needed for screw fixation.32 Although it could be argued that a single point of fixation, as provided by our suture-button fixation technique, may be unable to provide rotational stability, thereby creating a weak biomechanical construct, the results of our study counteract this assumption. We believe reattachment of the anterior labrum with 2 anchors (1 at 3 o’clock and 1 at 5 o’clock) to the glenoid rim helps reduce the potential rotation of the bone block (Fig 4). Finally, this type of fixation does

**Fig 8.** Multiplanar computed tomography reconstructions showing late bone-block healing. (A) Six months after surgery, the bone graft has not united; because the patient had no pain and a stable shoulder, she was allowed to go back to sport without any restriction. (B) Computed tomography scan performed 3 years after surgery demonstrate complete bone graft healing.
not burn any bridges and can allow relatively easier revision surgery (when compared with screw fixation) in case of need.

Another important finding of the present study is that no neurologic injuries were observed. The reported rate of neurologic injury after coracoid transfer with screw fixation ranges from 2% to 12%. Neurologic complications can be devastating in young, healthy, sportive patients in the case of a persistent deficit. The close proximity the brachial plexus anteriorly (in particular, the axillary and musculocutaneous nerves) and suprascapular nerve posteriorly put these nerves at risk. Even experienced surgeons may face neurologic complications: Gartsman, in a consecutive series of 416 open Latarjet procedures performed by 3 specialized shoulder surgeons, reported a neurologic injury rate of 3.1%. Delaney et al, performing a neuromonitoring study of the open Latarjet procedure with screw fixation, found that the high-risk stages were glenoid exposure and coracoid graft placement. Our technique involves a systematic identification of the axillary and musculocutaneous nerves and protection with specifically designed subscapularis spreaders placed both anteriorly and posteriorly. Further, our drilling guides help ensure our cortical button is positioned parallel and flush to the glenoid face; as such, we did not identify any suprascapular nerve injuries. In addition, glenoid drilling is made from posterior to anterior and remained inside the glenohumeral joint capsule anteriorly, which makes this potentially dangerous step safe.

Finally, we found that the use of suture-button fixation for arthroscopic Latarjet resulted in a stable shoulder in all but 4 of our patients. Our recurrence rate of 3% compares well with those reported in the literature (2% to 14%) for both open and arthroscopic Latarjet using screw fixation. In a recent long-term study with a mean of 20 years’ follow-up, Walch et al reported a recurrence rate of 5.9%. Although longer follow-up is needed to definitely show maintenance of stability, our current results are encouraging. In the revision setting, we have had successful results in performing a combined revision Bankart repair and remplissage procedure, which may be due to the sling effect is still typically being present because the transferred conjoint tendon remains in the subscapularis split. Further, the purpose of surgically treating anterior instability is not just to obtain a stable shoulder, but also allows the patient to return to preinjury activity levels. As demonstrated by Boulaine et al, even when recurrent dislocation rates remain low, many patients do not return to preinjury levels following an arthroscopic stabilization. In our series, 94% of the patients were able to successfully return to athletic activities, including contact and overhead, with 70% returning at the same level or higher sports, without recurrent instability.

In our large series, we have demonstrated the potential for excellent clinical outcomes using a guided arthroscopic Latarjet with suture-button fixation. This is still a technically demanding procedure that will have some degree of a learning curve. Kany et al evaluated their learning curve prospectively with 104 patients, comparing their first 30 patients with their last 30 (with 44 procedures in between). They noted 3 complications during their initial phase (2 bone-block fractures and 1 malpositioned screw) and none in their second phase. Their accuracy of positioning the bone block significantly improved in their second cohort of patients, and their surgical duration decreased from 103 to 76 minutes. Many studies have similarly found a decrease in operative time when analyzing their learning curves. Such a learning curve needs to be kept in further perspective by remembering that there have been learning curves demonstrated for other arthroscopic procedures including hip arthroscopy and arthroscopic rotator cuff repairs. Although it is true that there is a learning curve associated with the arthroscopic Latarjet, it should not be prohibitive considering the success with other arthroscopic procedures.

Strengths of our prospective case series include the low number of patients lost to follow-up and the use of CT scan images which are more accurate than x-rays for evaluating bone graft positioning and healing and hardware complications. Another strength of our study is that all patients have been followed and examined by observers different than the operating surgeon.

**Limitations**

The limitations of our study include those inherent to any retrospective review (of prospectively collected data), including the lack of a control group. Our relatively short length of follow-up (mean, 26 months) may underestimate the complication rate; however, neurologic complications, when present, are typically observed within the 2 first postoperative weeks. The same is often true for hardware complications, which frequently are observed early after surgery. Another limitation, as mentioned previously, is that we may have underestimated the rate of postoperative recurrence of instability, which may increase with longer follow-up. As shown in 2 recent reports, however, recurrence after a Latarjet procedure typically occurs within the first 2 years. In a paired analysis of 186 patients, Bessiere et al noted that one-half of the recurrences after arthroscopic Bankart occurred after 2 years, whereas the results remained stable after 1 year in patients operated on with open Latarjet. Another possible limitation of the present study is that all patients were operated on by a surgeon with
extensive experience in shoulder arthroscopy and a large surgical volume of arthroscopic Latarjet procedures; nonfellowship-trained surgeons and physicians who perform in low volumes may not be able to replicate the results early in their learning curve.43,44

**Conclusions**

Suture-button fixation is an alternative to screw fixation for the Latarjet procedure, obtaining predictable healing with excellent graft positioning and avoiding hardware-related complications. There was no need for hardware removal after suture-button fixation. The systematic identification of the axillary and musculocutaneous nerves reduced risk of neurologic injury. A low instability recurrence rate and excellent return to preinjury activity level was found. Suture-button fixation is simple, safe, and may be used for both open and arthroscopic Latarjet procedure.

**Acknowledgments**

A video of the technique is available upon request to the corresponding author.

**References**


