



Clinical and radiological evaluation of the Bristow–Latarjet procedure in patients with 30 or more years of follow-up

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Background: The Bristow–Latarjet surgery is the procedure most performed for recurrent anterior shoulder dislocation. There are few studies with a follow-up of more than 20 years. Because it is a nonanatomical technique, there is interest in knowing the clinical and radiological results and the rates of complications in the long term.

Methods: We performed a retrospective case series study. Patients with recurrent anterior dislocation of the shoulder who underwent the Bristow–Latarjet procedure were included and followed-up clinically for at least 30 years. We evaluated clinical scores—the Rowe, Western Ontario Shoulder Instability, Single Assessment Numeric Evaluation, and visual analog scale—as well as clinical outcomes: the recurrence (dislocation or subluxation) and seizure. Screw and graft positioning were assessed by computed tomography, the degree of arthropathy by radiography, and subscapularis fatty degeneration as rotator cuff tears by magnetic resonance imaging. Both clinical scores and imaging were obtained at 30 years of surgery.

Results: Twenty-seven patients (30 shoulders) were evaluated, with a mean follow-up of 35 ± 4.5 years. The scores obtained were 88.28 ± 15.9 by Rowe, 208 ± 244.2 by the Western Ontario Shoulder Instability examination, $92.5\% \pm 10.4\%$ by the Single Assessment Numeric Evaluation, and 0.45 ± 1.3 by the visual analog scale. The recurrence rate was 13.3%, with all patients presenting subluxations and no new dislocations. All grafts were positioned below the glenoid equator. In 82.4% of the cases, the grafts were aligned with the articular surface, 5.9% were medially deviated, and 11.8% were laterally deviated. Consolidation occurred in 76.5% of the cases. The screws presented bicortical fixation in 76.5% of the shoulders and inclination in the axial plane of less than 15° in 64.7%. A total of 58.8% of the cases presented with glenohumeral arthropathy, and 75% of the magnetic resonance imagings showed the absence of fatty degeneration.

Conclusion: Bristow–Latarjet surgery demonstrates excellent clinical results in most patients after 30 years of follow-up. The recurrence rate is low, as is the complication rate. Glenohumeral arthropathy occurs in most patients without significant clinical repercussions.

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Recurrent anterior shoulder dislocation is treated surgically in most cases.¹⁷ Among the various techniques described,^{18,23} the Bristow–Latarjet surgery is among the most performed, with high

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rates of satisfactory results. In this procedure, the coracoid process is transferred and its fixation on the anterior edge of the glenoid is classically performed with 1 or 2 screws, with several modifications described.^{12,27}

Several complications are described in the short-term to medium-term follow-up, such as neurological injuries,³³ graft union failure,^{6,7,24} screw breakage or loosening, and glenohumeral arthropathy. However, there are few studies with a follow-up of more than 20 years.^{13,16,19,31} Because it is a nonanatomical technique, there is interest in knowing the clinical and radiological results and the rates of complications in the long term.

The primary objective of this study, therefore, was to describe the clinical and radiographic outcomes of patients who underwent the Bristow–Latarjet procedure at minimum 30 years of follow-up. Our hypothesis is that despite the complications and recurrence rates, Bristow–Latarjet surgery demonstrates excellent clinical results in most patients in the long term.

Methods

We performed a retrospective case series including patients who underwent surgery between January 1977 and December 1989. The procedures were performed by a senior surgeon with more than 20 years of experience in shoulder and elbow surgery.

Patients with recurrent anterior dislocation of the shoulder who underwent the Bristow–Latarjet procedure with a minimum clinical follow-up of 30 years were included. Patients who could not be contacted by telephone, e-mail, or registered mail were excluded from the study. In total, 44 patients were identified with the criteria to participate in the study.

The clinical scores were categorized into excellent, good, fair, and poor, as proposed by Schroder et al.³¹

Surgical procedure and rehabilitation

General anesthesia was used, with the patients oriented in the supine position with a cushion placed under the scapular region of the side to be operated on. The deltopectoral approach was used, with medial retraction of the cephalic vein, together with a narrow band of fibers of the deltoid muscle. Osteotomy of the coracoid process was performed approximately 2 cm from its apex with a curved osteotome. The fibers of the pectoralis minor muscle and the coracoacromial ligament were detached. The hole in the coracoid was made manually in the direction of the longitudinal axes using a cutting punch. The middle portion of the subscapularis muscle was incised, with a split parallel to its fibers. The glenoid labrum and remaining scar tissue were resected, and the anterior border of the glenoid and neck of the scapula were visualized. The neck of the scapula was drilled with a 3.5-mm drill bicortically and as parallel as possible to the plane of the articular surface. The graft was preferably fixed in the standing position (Bristow technique), with a screw of adequate size used to transfix the posterior cortex. The screws used were noncannulated, cancellous type, and 3.9 mm in diameter. With the arm in lateral rotation, the joint capsule and the subscapularis muscle were sutured laterally to the graft. The patients wore thoracobrachial bandages for 30 days, and gradual rehabilitation was initiated after this period to gain range of motion and muscle strengthening. Full return to usual activities and sports was 3–6 months after surgery.

Evaluated outcomes

The Rowe score was used as the primary outcome measure.^{26,29} For secondary outcomes, we used the Western Ontario Shoulder Instability (WOSI),² Single Assessment Numeric Evaluation (SANE),³⁶ and the visual analog scale for pain¹¹ scales. The scores were categorized into excellent, good, fair, and poor, as proposed by Schroder et al.³¹

We also evaluated the recurrence rate (dislocation or subluxation), rate of patients with an episode of postoperative seizures, and range of motion. Imaging outcomes were evaluated as well at 30 years of surgery.

Variables analyzed

Factors intrinsic to the patient: sex, age, dominance, ligamentous laxity (Beighton score³ ≥ 4), and history of seizure.

Factors related to sport activity: type of sport performed (contact or collision sport and noncontact sport), level of sport participation³⁵ (recreational, low-level or high-level competitive), and return to previous sports activities.

Injury-related factors: affected side, mechanism of first dislocation, number of dislocations, age at first dislocation episode, and age at surgical intervention.

Intervention-related factors: time between first dislocation and surgical treatment.

Recurrence was classified as absent or present and categorized as dislocation or subluxation—defined by complete or incomplete dislocation of the glenohumeral joint. The apprehension test at 90° of abduction was also assessed.

Return to sport was assessed at 12 months and categorized as return at the same level, return at a lower level, or no return. The condition of patients to perform sports activities was also evaluated, categorized as without limitation, with mild or moderate limitation and abandonment of sports practice.

The passive range of motion of the shoulder was assessed with the patient in the orthostatic position. Elevation, abduction, and lateral and medial rotation were assessed. The rotations were evaluated at 0° of abduction and flexion. All measurements were performed with a goniometer, except for medial rotation, which was evaluated according to the position of the patient's hand in relation to the vertebral spinous processes and then converted to continuous numbers using a scale of 1–19 (T1 to T12 are equivalent to 1–12, L1 to L5 are equivalent to 13–17, the sacrum is 18, and the greater trochanter is 19).²²

The following clinical complications were evaluated: neurological deficits (axillary, musculocutaneous and suprascapular nerves), infections (superficial or deep), hematoma, and joint stiffness.

Radiological evaluation

Computed tomography (CT) was used to evaluate the inclination of the screw in relation to the axis of the glenoid articular surface; position of the graft in relation to the glenoid equator; lateral inclination of the screw in relation to the glenoid surface; signs of nonunion or fracture of the graft; and signs of loosening, breakage, or bending of the screw (Fig. 1).

Radiography was used to evaluate glenohumeral arthropathy according to the classification by Samilson and Prieto³⁰ (Fig. 2).

Magnetic resonance imaging (MRI) was performed on a 1.5 T scanner, and the axial, sagittal oblique, and coronal oblique views were evaluated. The variables analyzed were fatty infiltration of the rotator cuff muscles according to the classification by Goutallier et al.¹⁴ (Fig. 3) and the integrity of the rotator cuff tendons (categorized as complete, tendinopathy, partial rupture, and total rupture). The images were interpreted and read by the lead author.

Statistical analysis

Continuous variables were tested for normality using the Shapiro-Wilk test and for homogeneity using the Levene test. Categorical variables are expressed as absolute values and percentages. Continuous variables are represented as the mean, standard deviation, median, interquartile range, and maximum and minimum values. For data analysis, SPSS version 21.0 (IBM Corp., Armonk, NY, USA) software was used, with a significance level of 5%.

Results

In a total of 44 patients, 27 patients (30 shoulders) with a minimum follow-up of 30 years were evaluated. Twelve were lost to follow-up, 3 died from causes unrelated to the surgery, and 2

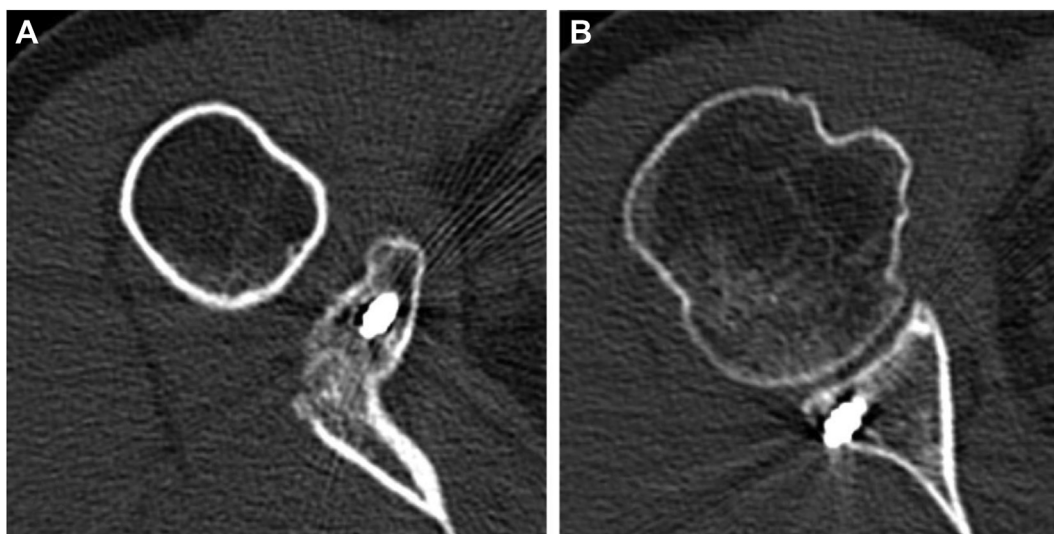


Figure 1 Healed coracoid graft.

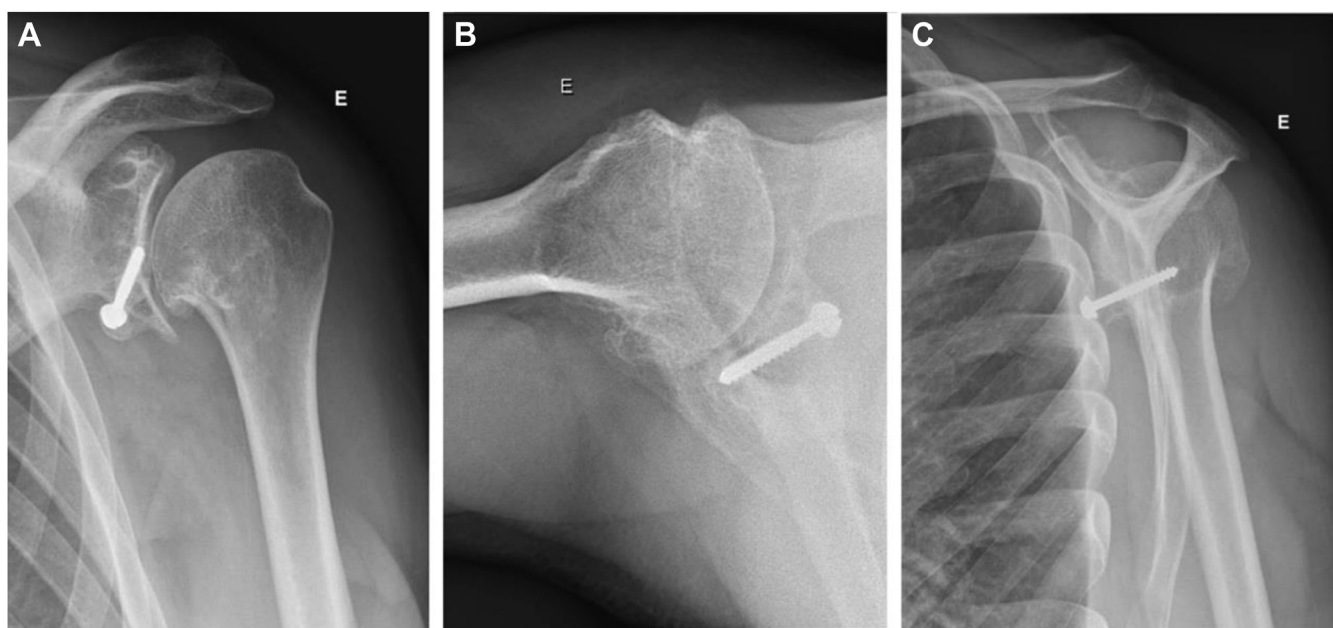


Figure 2 Radiography with moderate glenohumeral arthropathy (3–7 mm).

refused to participate in the study. The majority were men with the dominant side affected. All patients practiced some type of sports activity before surgery, 25 (83.3%) of which were contact or collision sports. Regarding the level of sports practice, in 14 (46.7%) participants, the level was highly competitive. The general data of the sample can be seen in [Table I](#).

On average, patients were aged 19 years at the time of the first dislocation, aged 19.3 years at surgery, and aged 56.5 years at the time of writing this paper, with a mean of 3.8 dislocation episodes before surgery. The data can be seen in [Table II](#).

In 66.7% of the patients, there was a return to the same sports level 1 year after surgery, and 30 years after the procedure, 83.3% maintained recreational sports practice ([Table III](#)).

The patients presented a mean score of 88.3 on the Rowe scale, 208.1 on the WOSI scale, 92.5 on the SANE scale, and 0.5 on the visual analog scale 30 years or more after the procedure. All

patients presented complete forward elevation and satisfactory range of motion. Lateral and medial rotation can be seen in [Table IV](#). Lateral rotation and medial rotation were measured with the shoulder abducted 90°.

Most patients had excellent results, as shown in [Fig. 4](#).

X-rays and CT were performed in 14 patients (17 shoulders), accounting for 56.7% of the sample. The majority had a well-positioned graft with properly inserted screws. A total of 58.8% of the shoulders presented with arthropathy. The data can be seen in [Table V](#).

Only 8 shoulders (26.7% of the sample) were available for MRI examination. The subscapularis was intact in all patients, with a low degree of fatty degeneration ([Table VI](#)). Supraspinatus rupture occurred in 3 (37.5%) patients, of which only 1 (12.5%) was complete.

We observed 4 cases of recurrence (13.3%). Apprehension was a complaint of 1 patient (3.3%). Recurrence episodes occurred

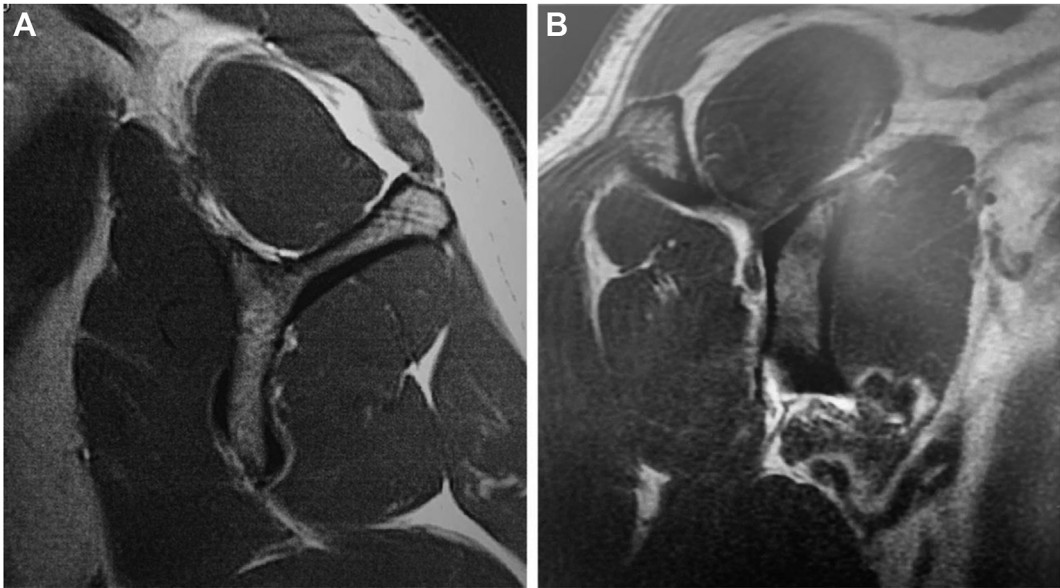


Figure 3 Inferior third of subscapular with Goutallier 2.

Table I
General characteristics of the surgical sample.

	N (%)
Male sex	29 (96.7%)
Mechanism of the first episode	
Traumatic	18 (60%)
Atraumatic	11 (36.7%)
Convulsion	1 (3.3%)
Affected dominant side	18 (60%)
Affected right side	18 (60%)
Ligament laxity	14 (46.7%)
Prior sports activity	
Contact/collision	25 (83.3%)
No contact	5 (16.7%)
Previous sport level	
Recreational	10 (33.3%)
Low-grade competitive	6 (20%)
High-grade competitive	14 (46.7%)

Table II
Data regarding age, follow-up time, and number of dislocations.

	Mean	SD	Median	IQR
Age at first dislocation episode (yr)	19.3	2.9	19	5
Age at surgery (yr)	21.8	3.1	22	4
Number of dislocations before surgery	3.8	4.8	2	6
Current age (yr)	56.5	4.4	56	6
Follow-up time (yr)	35	4.5	35	6

SD, standard deviation; IQR, interquartile range.

between 1 and 2 years after surgery. Surgical revision was required in only 1 case to remove a loose screw and correct instability, with repair of the Bankart lesion associated with capsuloplasty. All shoulders with recurrence had low scores on the Rowe scale, one with 50 points and the others with 55 points. None of the cases presented with neurological lesions, stiffness, or infection.

Discussion

Our study showed that the Bristow–Latarjet procedure led to excellent long-term clinical outcomes in most patients, with a

Table III
General characteristics of the sample after surgery.

	n (%)
Return to the same sports level after 1 year	20 (66.7)
Sports practice 30 years or more after the surgery	
Contact/collision	2 (6.7)
No contact	23 (76.7)
Does not practice	2 (6.7)
Did not disclose	3 (10)
Athletic level 30 years or more after the surgery	
Recreational	25 (83.3)
Low-grade competitive	0 (0)
High-grade competitive	0 (0)

Table IV
Results of the clinical scales and the amplitude of medial and lateral rotation after 30 years of follow-up.

	Mean	SD	Median	IQR
Rowe	88.3	15.9	95	20
WOSI	208.1	244.2	100	230
SANE	92.50%	10.40%	99%	10%
VAS	0.5	1.3	0	0
Medial rotation (°)	10.7	2.9	12	5
Lateral rotation (°)	60.9	22	60	35

SD, standard deviation; IQR, interquartile range; WOSI, Western Ontario Shoulder Instability; SANE, single assessment numeric evaluation; VAS, visual analog scale.

mean value of 88 on the Rowe scale. These data are in agreement with those presented by other authors, who reported values between 82 and 95.^{5,16,31} Excellent clinical results were also observed in most patients using the WOSI and SANE scales, as described by Schroder et al.³¹ The values observed by us (208 and 92.5%, respectively) are also in agreement with those of other articles with similar methodology, with WOSI scores ranging from 86 to 376^{13,31} and 83% with the SANE scale.³¹ We observed a recurrence rate of 13.3% (4/30), all with subluxation. This value is similar to that described by other authors. Allain et al¹ reported a rate of 10.7%, and similar to our study, there were no cases of complete dislocation. Torg et al³⁴ described recurrence in 8.5% of cases (3.8% dislocation and 4.7% subluxation),

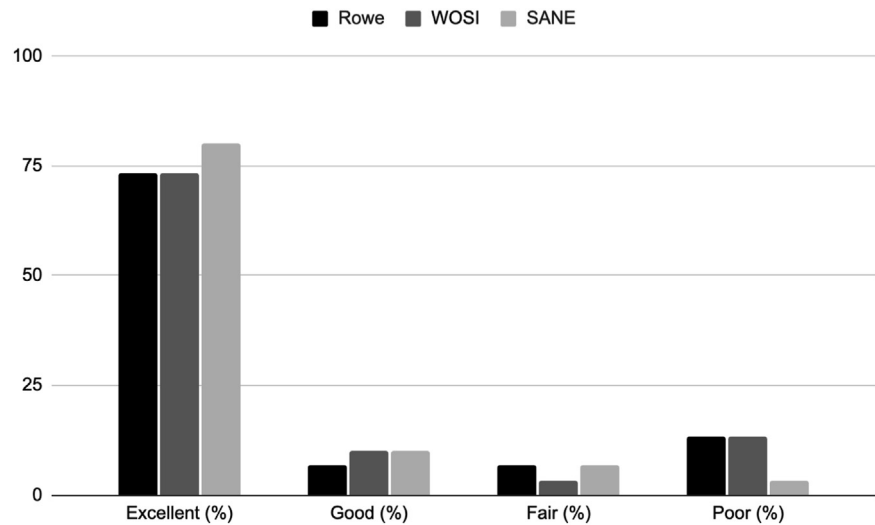


Figure 4 Results of clinical scales categorized according to Schroder et al.³¹

Table V
Radiographic and tomographic characteristics related to the positioning of the graft, screws, and arthropathy (n = 17).

	n (%)
Inferior to the glenoid equator	17 (100)
Position relative to the glenoid border	
Aligned	14 (82.4)
Medial	1 (5.9)
Side	2 (11.8)
Consolidation	
Yes	13 (76.5)
No	3 (17.7)
Fibrous union	1 (5.9)
Inclination less than 15° (perpendicularity to the prepared surface)	11 (64.7)
Bicortical fixation	13 (76.5)
Appearance of the screws	
Adequate	12 (70.6)
Loose	1 (5.9)
Broken	2 (11.8)
Crooked	1 (5.9)
Postinstability arthropathy	
Normal	7 (41.2)
Mild	6 (35.3)
Moderate	2 (11.8)
Severe	2 (11.8)

Table VI
Quality of the subscapularis on magnetic resonance imaging (n = 8).

	n (%)
Integrity	
No changes	6 (75)
Tendinopathy	2 (25)
Rupture	0 (0)
Goutallier classification	
0	6 (75%)
1	1 (12.5%)
2	1 (12.5%)

Hovellius et al²⁰ 13.6% (3.4% dislocation and 10.2% subluxation), and Schroder et al³¹ 15.4% (9.6% dislocation and 5.8% subluxation). In our series, we also observed 1 patient (3.8%) with a positive anterior apprehension test. Guiotti Filho et al¹⁶ described 11% of patients with this symptom but no cases of dislocation or subluxation. There is controversy in reporting apprehension test as a failure of the procedure, and according to the meta-analysis by Hurley et al,²¹

this finding is present in 9.9% of cases. We did not consider the feeling of apprehension as a form of recurrency, but we believe that standardization of its evaluation is important. We believe that seizure is a symptom that is often overlooked and that it is not specifically evaluated by most clinical scales, except for the Rowe.^{26,29}

All cases of recurrence occurred between 1 and 2 years after surgery, following a traumatic event. Schroder et al,³¹ in turn, described a mean time between surgery and recurrence of 7 years in their series. Hovellius et al²⁰ also describe late cases of relapse. Only 2 cases (6.7%) required reoperation, 1 due to instability (3.3%). The rate of reoperations due to instability ranges from 0.8%²⁰ to 11.5%,³¹ with a mean of 1.6% according to the meta-analysis by Hurley et al.²¹

We observed that 58.8% of the shoulders had arthropathy (35.3% mild, 11.8% moderate, and 11.8% severe). These values are higher than those described by the meta-analysis by Hurley et al,²¹ which included studies with 10 years of follow-up and showed that 38.7% of cases had arthropathy (26.5% mild, 6.1% moderate, and 6.1% severe). In studies with longer follow-up, the presence of arthropathy occurred in 33.3%-71% of the sample.^{13,16,32} Most patients do not complain of pain, which can be indirectly confirmed by the high levels of satisfaction and high scores obtained on the clinical scales. According to the meta-analysis by Hurley et al,²¹ only 1 patient (0.12%) required shoulder arthroplasty.

We also observed that the incidence of subscapularis fatty infiltration was low and did not exceed Grade 2 of the Goutallier classification. We also did not observe any rupture of this tendon. The absence of significant changes in the subscapularis indicates the safety of the procedure. Supraspinatus rupture occurred in 37.5% of the patients, of which only 12.5% were complete. We believe that supraspinatus tears are not related to Bristow–Latarjet surgery and that these findings are due to the normal aging process. Few studies have evaluated the integrity of the rotator cuff tendons and subscapularis fatty infiltration by MRI after Bristow–Latarjet surgery. Caubère et al⁴ evaluated 20 shoulders 1 year after surgery, and Ernstbrunner et al⁸ examined 42 patients with a follow-up of 8.4 years. Nikulka et al²⁸ evaluated 22 patients 30 years after Bankart repair. Notably, although only 26.7% of our sample underwent postoperative MRI, to our knowledge, this study had the longest evaluation in this regard.

In our sample, 64.7% of the screws had an inclination of less than 15°, and 76.5% had bicortical fixation. Screws were damaged or



Figure 5 Nonhealed coracoid graft and broken screw.

failed in 5 (30%) patients, including 1 (5.9%) partial loose, 1 (5.9%) complete loose, 2 (11.8%) broken, and 1 (5.9%) bent (Fig. 5). Complications related to screws are reported in 4.7% to 14% of operations.^{9,34} Ferlic and DiGiovine⁹ described that the screw breaks in 4% of cases, bends in 2%, and loosens in 2%. In addition, in 8% of cases, there is a need for a new surgical procedure for screw removal.^{9,31} Schroder et al³¹ described that 4% of the cases had screws invading the articular surface.

Other complications, such as infection and hypertrophic scarring, have a low incidence in the literature.^{10,15,32,33,37} In our sample, 1 patient presented with a hypertrophic scar that required a new surgical procedure for correction.

Our study has some limitations. The rate of patients lost to follow-up or unable to participate totaled 38.6%, a high rate but justifiable for a study with long-term evaluation. Similar studies have reported a loss to follow-up rate between 14% and 77%.^{13,16} A comparison between preoperative and postoperative values according to the clinical scales was not possible because they were not applied preoperatively. Radiological evaluation was not performed in all patients, with 56.7% of shoulder undergoing radiography and CT and 26.7% of the patients undergoing MRI. Image analysis was performed by only 1 evaluator, and it was thus not possible to describe the interobserver and intra-observer agreement, as in other studies.^{4,8,16} We did not perform isokinetic analysis, as proposed by some authors.²⁵ Finally, due to the limited sample size, multivariate analysis was not feasible, which makes the search for prognostic factors difficult.

Conclusion

Bristow–Latarjet surgery demonstrates excellent clinical results in most patients after 30 years of follow-up. The recurrence rate is low, as is the complication rate. Glenohumeral arthropathy occurs in most patients without significant clinical repercussions.

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