



Arthroscopic Latarjet Versus Arthroscopic Free Bone Block Procedures for Anterior Shoulder Instability

A Proportional Meta-analysis Comparing Recurrence, Complication, and Reoperation Rates

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Background: Several arthroscopic glenoid bone augmentation techniques have been introduced to treat patients affected by anterior shoulder instability associated with critical bone loss. The efficacy of the different arthroscopic bony procedures has not been compared yet.

Purpose: To compare the recurrence, complication, and reoperation rates of the arthroscopic Latarjet (AL) and arthroscopic free bone block (ABB) procedures for anterior shoulder instability.

Study Design: Meta-analysis and systematic review; Level of evidence, 4.

Methods: A systematic search was conducted in MEDLINE/PubMed, Web of Science, and Embase to identify clinical studies reporting the outcomes of the AL and ABB procedures. The following search phrases were used: “Arthroscopic” AND “Bone Block” OR “Bone Graft,” and “Arthroscopic” AND “Glenoid Augmentation” OR “Glenoid Reconstruction,” and “Arthroscopic” AND “Latarjet” OR “Coracoid Graft” OR “Coracoid Transfer.” Exclusion criteria were <24 months of minimum follow-up, sample size <10 cases, revision after previous glenoid bone grafting, epilepsy, and multidirectional instability. Data regarding the study design, patient characteristics, surgical technique, and outcomes were extracted and analyzed. A proportional meta-analysis was conducted to compare the complication, recurrence, and reoperation rates between the 2 groups. Multiple subgroup analyses were performed to analyze the incidence of each complication and assess the weight of different fixation methods (in the whole cohort) or different graft types (in the ABB group). The modified Coleman Methodology Score was used to assess the risk of bias.

Results: Of 5010 potentially relevant studies, 18 studies regarding the AL procedure (908 cases) and 15 studies regarding the ABB procedure (469 cases) were included. The 2 groups were comparable in age ($P = .07$), sex ($P = .14$), glenoid bone loss ($P = .14$), number of preoperative dislocations ($P = .62$), proportion of primary and revision procedures ($P = .95$), length of follow-up ($P = .81$), modified Coleman Methodology Score ($P = .21$), and level of evidence ($P = .49$). There was no difference in the recurrence ($P = .88$), reoperation ($P = .79$), and complication ($P = .08$) rates. The subgroup analyses showed a higher rate of hardware-related complications for screw fixation compared with flexible fixation ($P = .01$).

Conclusion: The AL and ABB procedures had similar recurrence, reoperation, and complication rates. Screw fixation of the bone graft was related to an increased risk of complications compared with flexible fixation.

Registration: CRD42022368153 (PROSPERO).

Keywords: shoulder instability; Latarjet; bone block; recurrence

During the last few years, growing interest in arthroscopic glenoid bone grafting techniques to treat anterior shoulder instability has been observed. The development of these techniques is related to a number of factors. First, different clinical studies have reported a higher recurrence rate and

worse clinical outcomes after arthroscopic Bankart repair compared with the open Latarjet procedure.^{29,65} Second, the threshold value for glenoid bone defects considered suitable for soft tissue repair has been progressively reduced.^{16,50,52} Moreover, the introduction of the “glenoid track” concept has highlighted the importance of the humeral location of bone loss in addition to its volume.^{31,32,49} As such, several surgical techniques have been introduced to improve the results of arthroscopic treatment versus those of the widely used open Latarjet procedure. Humeral Hill-Sachs remplissage,⁴⁶ subscapularis tenodesis,³⁸ and capsular augmentation with the long head of the biceps tendon¹⁵ have all been described to improve the results of classic Bankart repair. Unfortunately, these soft tissue procedures often lead to reduced range of motion, higher postoperative pain, and an increased recurrence rate compared with the Latarjet procedure, especially in patients with glenoid bone loss >15%.^{44,61}

In this context, both the arthroscopic Latarjet (AL)³⁰ and the arthroscopic free bone block (ABB) procedures,⁴¹ introduced by different authors in 2007, aim to restore glenohumeral stability by reducing the complication rate of the open Latarjet procedure and enabling the simultaneous treatment of other joint structures. Indeed, the main advantages of arthroscopic bone graft procedures are the reduction of soft tissue iatrogenic damage, the possibility of treating posterior or superior labral tears, and the possibility of treating Hill-Sachs lesions (if off-track, even after the restoration of glenoid bone loss).

Upon a review of the literature, we found different studies that have compared the results of the open Latarjet procedure and glenoid bone grafting, showing no significant differences in terms of recurrence and clinical outcomes.⁴³ Regarding arthroscopic procedures, there is only 1 retrospective study that has compared the AL and ABB procedures.⁵⁹ When dealing with case series, it is obvious that some bias toward reporting favorable results should be considered, which is why these studies are often unlikely to have an effect on clinical practice. To the best of our knowledge, no systematic review or meta-analysis aiming to identify the best arthroscopic procedure has been published so far.

The purpose of this systematic review was to compare recurrence, complication, and reoperation rates after the AL and ABB procedures. We hypothesized that no difference would be observed between the 2 treatment groups.

METHODS

Registration

The study's protocol was registered online in the PROSPERO (International Prospective Register of Systematic Reviews) database (CRD42022368153). This study followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines.³⁴

Search Strategy

To identify clinical studies investigating the arthroscopic treatment of anterior shoulder instability with either the AL or the ABB procedure, we used a combination of the following keywords for the article search: “Arthroscopic” AND “Bone Block” OR “Bone Graft,” “Arthroscopic” AND “Glenoid Augmentation” OR “Glenoid Reconstruction,” and “Arthroscopic” AND “Latarjet” OR “Coracoid Graft” OR “Coracoid Transfer.”

Study Selection

There were 2 reviewers (A.C. and R.G.) who performed an independent literature search in 3 electronic databases: MEDLINE/PubMed, Web of Science, and Embase. The titles and abstracts were reviewed for all search results, and potentially eligible studies were selected. Results were then cross-checked. In the case of disagreement, a third author (P.M.) was involved until a consensus was reached. Included articles underwent a full-text review. Finally, the reference lists of included articles and review studies were screened for any additional articles that were not identified in the database search.

Eligibility Criteria

The inclusion criteria were longitudinal studies (retrospective and prospective) evaluating the treatment outcomes of the AL or ABB procedure in patients affected by isolated anterior shoulder instability, published in peer-reviewed journals in English, with no limitation concerning the publication date. The exclusion criteria included the following: case reports, expert opinions, previous systematic reviews, letters to the editor, and cadaveric studies; descriptions of surgical techniques without clinical results; studies with <24-month minimum follow-up; studies that included different treatment methods in which data for the AL or

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ABB procedure alone could not be extrapolated; articles with a sample size <10 cases; revision procedures after previous treatment methods including some form of bone management (open or arthroscopic Latarjet, bone block, Eden-Hybinette, etc); cases with an established diagnosis of epilepsy; patients affected by multidirectional instability; and studies with missing data regarding the complication, recurrence, and reoperation rates. For studies by the same author(s) and with potential overlapping, we selected the one with the largest sample size and excluded the others from analysis.

Data Extraction

There were 2 reviewers (R.G. and P.M.) who independently extracted relevant data from the included articles and recorded them onto Excel spreadsheets (Version 2007; Microsoft). The 2 Excel files were then matched, with the senior author (A.C.) arbitrating in the case of disagreement. Data extracted included the following: study design, level of evidence, patient characteristics, number of preoperative dislocations, previous instability surgery, type and level of sport, bone loss, preoperative and postoperative functional outcomes, imaging modality, type of graft and fixation technique, return to sport, recurrence of instability after surgery, and complication and reoperation rates.

Regarding complications, we focused on the following: persistent apprehension, hardware-related complications, graft-related complications, glenohumeral arthritis, infections, nerve palsy, and graft malposition. Graft nonunion, complete graft resorption, and graft fracture were all included as graft-related complications. Local pain stimulated by direct pressure over scar tissue, clicking, and screw pullout or breakage were all considered hardware-related complications.

Quality Assessment

To evaluate the quality of studies included, we utilized the modified Coleman Methodology Score (mCMS), which assesses the risk of bias within studies based on 10 factors and yields a total score between 0 and 100. A score of 100 implies that the study avoids chance, biases, and confounding factors to a great extent. Each study was individually and independently assessed by 2 reviewers (R.G. and P.M.) to calculate the mCMS. Each reviewer performed this process twice. The senior author arbitrated any disagreement between the 2 reviewers.

Outcome Measures

The main outcome assessed in this study was the recurrence rate after the AL and ABB procedures. Secondary outcomes were the complication and reoperation rates.

Statistical Analysis

Data were reported as the mean \pm SD or number (percentage). The distribution of variables was assessed using the Shapiro-Wilk test. Comparisons between the 2 groups were

performed using the Student *t* test (continuous normally distributed variables), Wilcoxon rank-sum test (continuous non-normally distributed variables), and chi-square test (categorical variables). Because a traditional pairwise meta-analysis was not feasible (because of the design of the studies included), a proportional meta-analysis was conducted to pool data regarding the overall complication rate, the recurrence rate, and the reoperation rate. The “metaprop” command was used to compute 95% CIs using score statistics and the exact binomial test and incorporated the Freeman-Tukey double arcsine transformation of proportions. Heterogeneity among studies was assessed using the I^2 statistic, and a random-effects model was applied in all cases. Metaregression (“metareg” module) was used to compare pooled proportions between the 2 groups.

Multiple subgroup analyses were conducted as follows: in the whole cohort, studies in which screws had been used to fix the graft and studies in which nonmetallic fixation methods had been adopted were compared; in the ABB group, studies in which an autograft was used versus those in which an allograft was chosen were compared; finally, the incidence of each type of complication (postoperative apprehension, graft-related complications, graft malposition, hardware-related complications, progression of osteoarthritis, infections, and nerve palsy) was compared between the 2 groups (AL vs ABB). The level of significance was set at $P < .05$. Statistical analysis was performed using SPSS (Version 20.0; IBM).

RESULTS

Search Results

The flow diagram for studies included is presented in Figure 1. A total of 5010 studies were found through a computer search and manual screening of reference lists across databases. After the removal of duplicates and the application of exclusion criteria, 33 studies (including 35 series of patients) were finally included in this review (19 series of patients treated with the AL procedure[§] and 16 series of patients treated with the ABB procedure^{||}, some studies included two series of patients). Overall, 2 studies were comparative including 2 separate cohorts of patients treated with the AL or ABB procedure (1 comparing different methods of fixation for AL and 1 comparing different methods of fixation for ABB), and each cohort was included in our review.

Study Characteristics

Overall, 908 cases underwent the AL procedure, and 469 cases underwent the ABB procedure. Patient characteristics of and preoperative risk factors for recurrence in the 2 groups are reported in Table 1.

[§]References 1, 8, 10, 12-14, 17, 23, 26, 28, 33, 35, 40, 51, 53, 57, 59, 63.

^{||}References 2, 3, 5, 6, 22, 25, 37, 39, 47, 54-56, 58-60, 62.

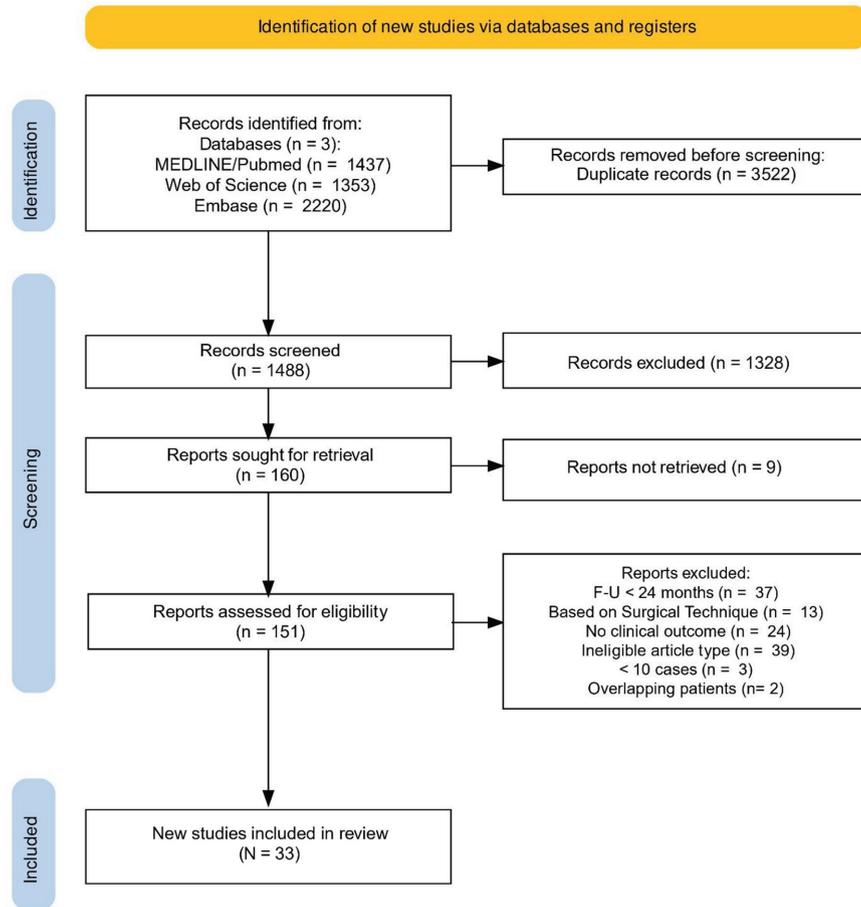


Figure 1. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram showing the search process that was carried out in selecting the studies for the final review. F-U, follow-up.

TABLE 1
Characteristics of AL and ABB Groups^a

	AL	ABB	P Value
Studies, n	18	15	—
Cases, n	908	469	—
Mean sample size	47.8	29.3	.006
Mean age, y	28.0	29.3	.07
Male/female sex, n	731/177	376/93	.17
Primary n-% revision procedure n-%	740 -81.5%/168- 18.5%	344-73.3%/125-26.7%	.95
Glenoid bone loss	16.5% [597/908]	19.7% [347/469]	.14
Contact/overhead sport, n	447 [610/908]	131 [251/469]	.0008
No. of preoperative dislocations	10.7 (3-45) [615/908]	13.6 (5-3) [231/469]	.62
Follow-up, mo	37.7 (26.8-76.4)	40.6 (24.7-96.0)	.81
Modified Coleman Methodology Score	68.9 (60-82)	67.4 (56-80)	.21
Mean level of evidence	3.5	3.6	.49

^aData are presented as n (%) or mean (range) unless otherwise indicated. When there were missing data among different articles, the number of cases for which data were reported is included as a ratio between square brackets. ABB, arthroscopic free bone block; AL, arthroscopic Latarjet.

At baseline, the 2 groups were comparable in terms of mean age at surgery ($P = .07$), sex ($P = .14$), glenoid bone loss ($P = .14$), proportion of primary and revision procedures ($P = .95$), number of preoperative dislocations ($P =$

.62), length of follow-up ($P = .81$), mCMS ($P = .21$), and level of evidence ($P = .49$). Conversely, the 2 groups differed in terms of mean sample size (47.8 cases in AL group vs 29.3 cases in ABB group; $P = .006$) and number of

TABLE 2
Primary Outcomes According to Treatment, Type of Fixation, and Type of Graft^a

	Treatment			Fixation			ABB Graft		
	AL	ABB	P Value	Screw	Flexible	P Value	Autograft	Allograft	P Value
Recurrence									
Nonweighted	3.6	3.8	.89	4.0	3.0	.71	3.8	3.8	.90
Weighted	2.0	2.0	.88	2.0	2.0	.99	3.2	1.0	.15
Reoperation									
Nonweighted	4.0	4.9	.81	4.8	3.6	.56	5.8	4.7	.95
Weighted	2.0	2.0	.79	3.0	1.0	.17	4.3	2.0	.17
Complication									
Nonweighted	15.2	27.8	.10	20.4	22.0	.68	25.3	30.5	.88
Weighted	14.0	25.0	.08	18.0	18.0	.97	25.1	22.0	.74

^aData are presented as percentages. ABB, arthroscopic free bone block; AL, arthroscopic Latarjet.

patients participating in contact or overhead sports (447/610 in AL group vs 131/251 in ABB group; *P* = .0008). However, the latter was reported only in 21 studies (12 studies for AL including 610 cases vs 9 studies for ABB including 251 cases).

Clinical outcomes were reported very heterogeneously among the different studies. The Rowe score, Western Ontario Shoulder Instability Index, Walch-Duplay score, Constant score, and University of California, Los Angeles, shoulder score were used in 21, 10, 6, 4, and 3 studies, respectively.

Surgical Techniques

Some technical differences could be observed within each group (AL and ABB) in this review. In the AL group, coracoid fixation was achieved with 1 screw, 2 screws, or 2 buttons in 20.3% (*n* = 184), 48.6% (*n* = 441), and 31.2% (*n* = 283) of cases, respectively. In the ABB group, the type of graft was autologous, cadaveric, or allogenic (xenograft) in 41.4% (*n* = 194), 47.1% (*n* = 221), and 11.5% (*n* = 54) of cases, respectively. The bone graft was fixed with 2 screws, 4 buttons, suture anchors, or bone impact (J-graft) in 59.7% (*n* = 280), 20.3% (*n* = 95), 16.8% (*n* = 79), and 3.2% (*n* = 15) of cases, respectively. Surgical times were reported only in 7 studies, and no statistical analysis was performed for this variable.

Recurrence, Complication, and Reoperation Rates

We did not observe any significant difference in the recurrence (*P* = .89) and reoperation (*P* = .81) rates between the 2 groups, even when pooled proportions were compared (*P* = .88 and *P* = .79, respectively) (Table 2 and Figures 2 and 3).

The weighted recurrence and reoperation rates were 2.0% in both the AL group and the ABB group. Moreover, no difference was observed between the types of revision procedure performed, with isolated hardware removal (*P* = .84), open stabilization (*P* = .35), and arthroscopic stabilization (*P* = .76) being the more frequent revision

procedures reported in both groups. Overall, the rate of complications in the ABB group (25.0%) and the AL group (14.0%) was not significantly different (*P* = .08) (Table 2 and Figure 4).

Looking at the type of complication, we did not find any difference for persistent positive apprehension (*P* = .95), hardware-related complications (*P* = .47), graft-related complications (*P* = .20), progression of osteoarthritis (*P* = .24), infections (*P* = .91), nerve palsy (*P* = .40), and graft malposition (*P* = .60) between the 2 groups (Table 3). Total graft resorption was observed in 0.2% and 4.0% of cases in the AL and ABB groups, respectively. Because of the small numbers available, no statistical analysis was performed for this specific type of complication.

Subgroup Analysis

No difference could be observed when analyzing the technique of graft fixation (screw vs flexible methods) as an independent variable for the recurrence rate (*P* = .99), reoperation rate (*P* = .17), and complication rate (*P* = .97) (Table 2). However, there was a significantly greater risk of hardware-related complications in patients for whom fixation was achieved using screws (3.6%) compared with flexible methods (0.4%) (*P* = .01) in the whole cohort (Table 3).

In the ABB group, the type of graft used did not influence the complication rate (Table 2). However, a trend toward a greater incidence of persistent apprehension was observed with an allograft in contrast to an autograft (*P* = .10) (Table 3).

DISCUSSION

The first result of this study was that both the AL and the ABB procedures were safe and effective in the treatment of anterior shoulder instability. Even in cases of critical bone loss, the risk of recurrence of instability after these arthroscopic techniques (2.0% for both AL and ABB) was very similar to what has been reported after the open Latarjet procedure (~4%).^{20,21}

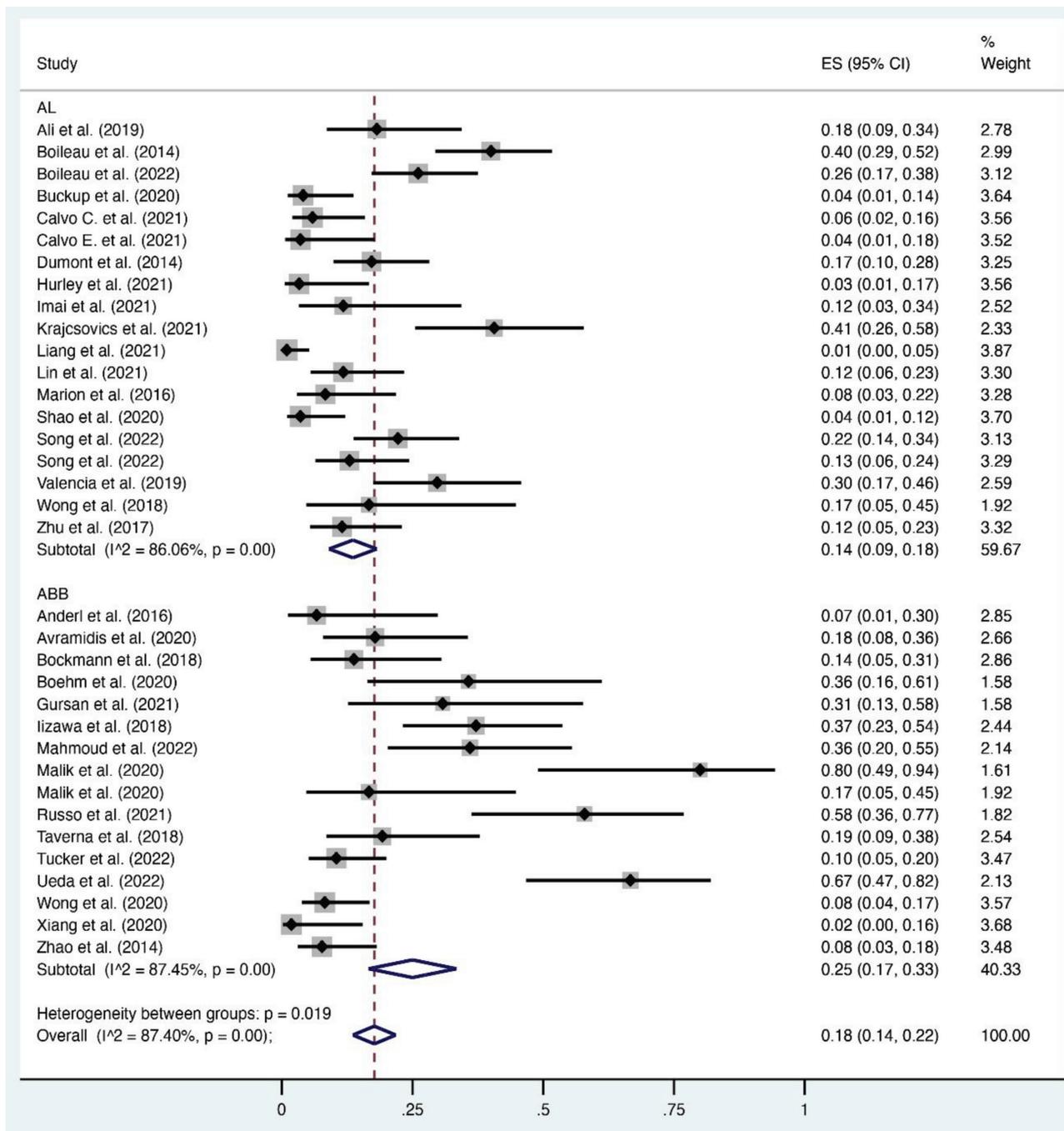


Figure 2. Proportional meta-analysis investigating the recurrence rate in patients who have undergone the arthroscopic Latarjet (AL) and arthroscopic free bone block (ABB) procedures for anterior shoulder instability. ES, effect size.

The comparison between the AL and ABB procedures showed similar rates of recurrence, reoperations, and complications. However, it should be emphasized that the statistical analysis performed to investigate the overall complication rate in the 2 groups led to a *P* value of .08, which could be interpreted as a potential tendency toward increased complications after the ABB procedure compared with the AL procedure. Interestingly, total graft resorption was reported in 4.0% of cases in the ABB group versus

0.2% in the AL group. Graft resorption after the Latarjet procedure has already been evaluated in previous studies,^{18,48,64} which confirmed that partial osteolysis is very common (especially in the upper portion of the graft) and highlights the role of mechanical loading of the humeral head on the graft and the vascular supply provided by the conjoint tendon in coracoid healing. For the ABB procedure, graft resorption has been frequently reported, and it was previously associated with the origin of the graft, with

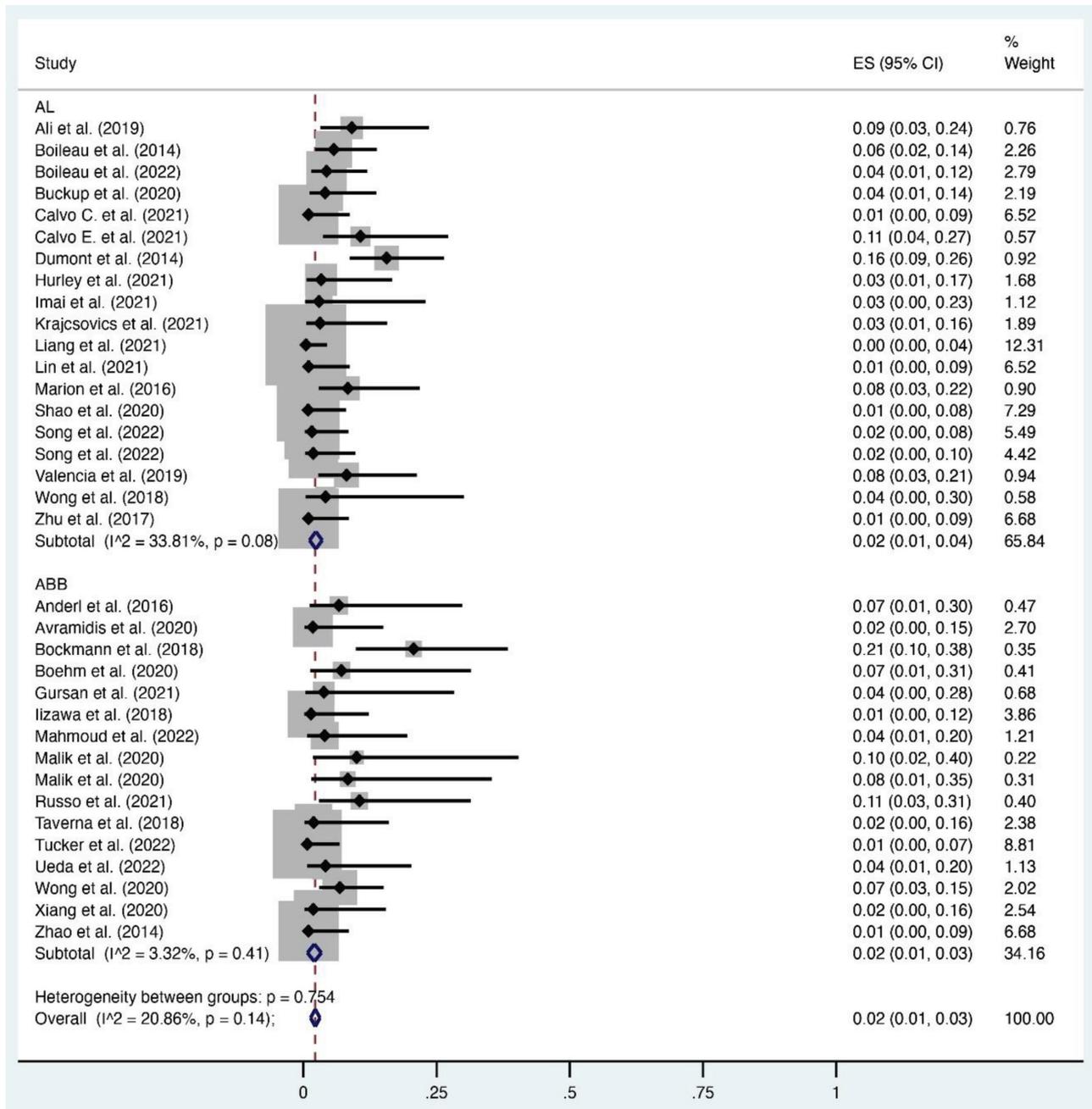


Figure 3. Proportional meta-analysis investigating the reoperation rate in patients who have undergone the arthroscopic Latarjet (AL) and arthroscopic free bone block (ABB) procedures for anterior shoulder instability. ES, effect size.

allografts being held responsible for this phenomenon.^{7,47} Of note, in this review, the type of graft (autograft or allograft) did not affect the complication rate. Moreover, considering that glenoid bone defects were comparable in the 2 groups, we suggest that the role of the conjoint tendon in graft loading or vascularization should be better investigated in the future. In any case, the clinical consequences of graft resorption are questionable because there is no clear evidence to demonstrate that graft osteolysis has a clinical effect on the patient.^{17,36} On the other hand,

considering the high rate of graft resorption (especially in the ABB group), the prominence of screw heads could irritate soft tissue and the humeral head’s cartilage in the long run, causing pain, osteoarthritis, and the need for hardware removal.^{45,64}

In this study, the reoperation rate after the AL and ABB procedures was similar, with some differences associated with technical details. Several studies investigated, both biomechanically and clinically, the differences between screw and button fixation of the coracoid graft in the Latarjet

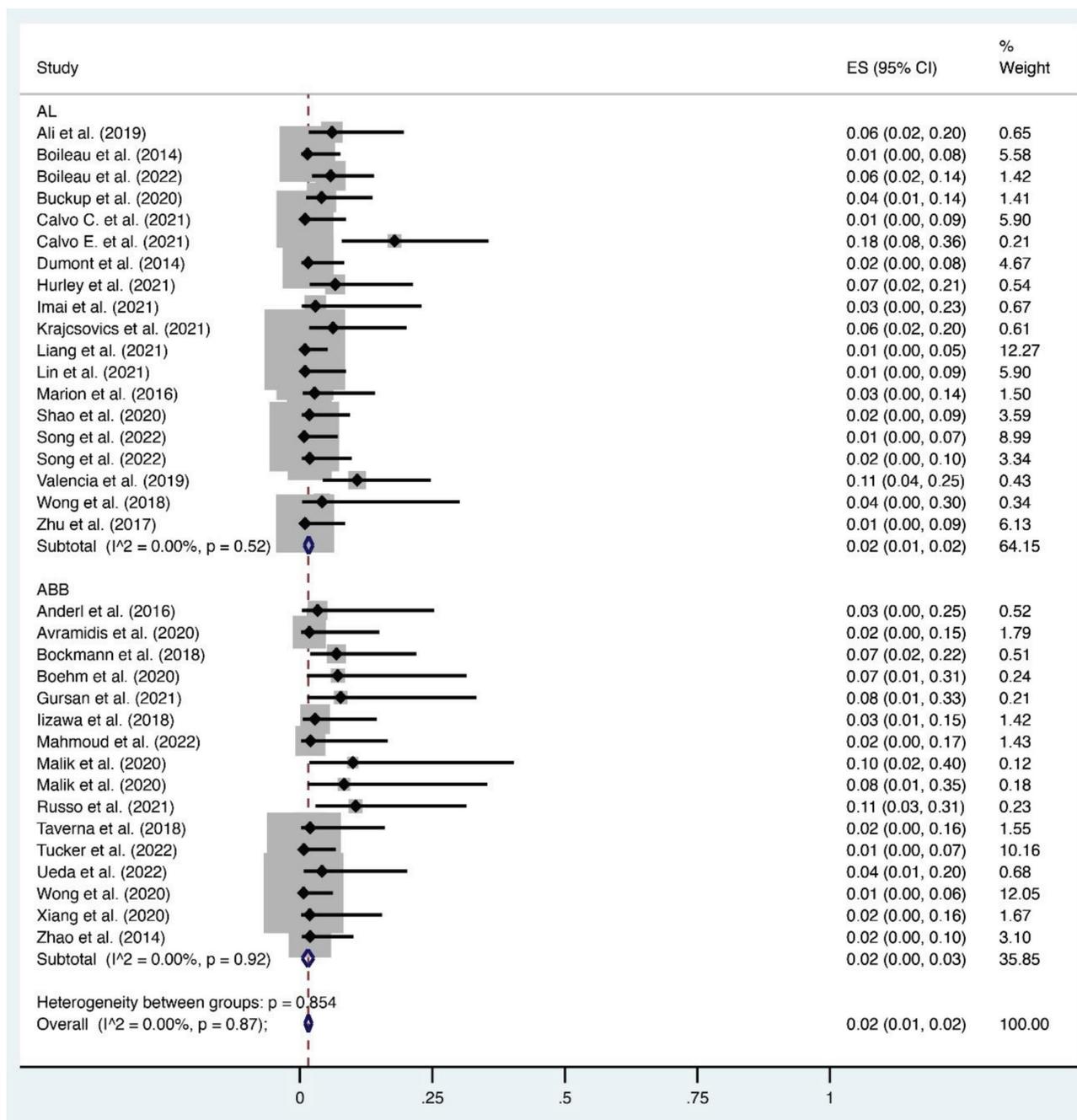


Figure 4. Proportional meta-analysis investigating the complication rate in patients who have undergone the arthroscopic Latarjet (AL) and arthroscopic free bone block (ABB) procedures for anterior shoulder instability. ES, effect size.

procedure, concluding that, despite stronger fixation provided by screws, no differences in terms of clinical outcomes could be detected between the 2 methods of fixation.^{9,11,45} In this meta-analysis, hardware-related complications were more frequent in patients treated with screws (3.6%) than in those for whom flexible fixation methods (0.4%) were used ($P = .01$), independent from the type of surgery performed (AL or ABB). For this reason, we recommend using button fixation to reduce the potential effect of prominent screws, especially in the ABB group.

Despite the similar outcomes, the ABB procedure has a few theoretical advantages compared with the AL procedure. First, avoiding subscapularis split and coracoid osteotomy generally reduces surgical times and the risk of bleeding and postoperative shoulder hematoma. Second, the absence of the attached conjoint tendon certainly facilitates the correct position of the bone block. Both factors could theoretically reduce the learning curve and facilitate the propagation of the surgical procedure. Unfortunately, the lack of data on surgical times in primary studies

TABLE 3
Complications According to Treatment, Type of Fixation, and Type of Graft^a

	Treatment			Fixation			ABB Graft		
	AL	ABB	P Value	Screw	Flexible	P Value	Autograft	Allograft	P Value
Persistent apprehension	3.9	2.3	.95	3.4	2.6	.51	1.9	3.3	.10
Hardware-related complication	3.1	1.8	.47	3.6	0.4	.01	1.7	2.3	.77
Graft-related complication	5.3	13.7	.20	6.5	14.2	.42	11.9	15.0	.62
Glenohumeral arthritis	1.1	6.0	.24	4.7	0.6	.20	8.4	1.2	.70
Infection	0.4	1.2	.91	1.1	0.0	.10	1.9	0.0	.25
Nerve palsy	0.8	0.7	.40	0.8	0.5	.69	1.2	0.0	.23
Graft malposition	4.2	4.6	.60	4.3	4.6	.56	6.0	3.3	.69

^aData are presented as percentages. ABB, arthroscopic free bone block; AL, arthroscopic Latarjet.

included in this meta-analysis did not allow us to draw conclusions about this topic. However, a previous study by Moga et al⁴² reported a shorter learning curve and better graft positioning with the ABB procedure compared with the AL procedure. Of course, potential drawbacks of the ABB procedure, that is, the increased graft-related complication rate, the cost of an allograft, or donor-site morbidity, should be taken into account in the decision making of the clinician.

When interpreting the results of this review, baseline differences in the sample size and frequency of participation in sports with a high risk of dislocations in the AL and ABB groups should be considered potential sources of bias. With regard to the mean sample size, we believe that the comparison of weighted rates performed using a proportional meta-analytic method and subsequent metaregression might have partially overcome the difference at baseline. The presence of a larger number of patients participating in contact or overhead sports in the AL group could be interpreted by considering 2 factors. First, data on the practice of at-risk sports have been reported less frequently in the ABB group (251 cases [53.5%]) than in the AL group (610 cases [67.2%]). Second, some studies comparing Latarjet and Bankart repair have demonstrated a higher loss of external rotation for the anatomic procedure,²⁷ which is why some authors recommend the Latarjet procedure to treat patients involved in sports requiring a high degree of external rotation.⁴ This preference could represent a selection bias in our analysis.

Limitations

This study has several limitations. First, we acknowledge that preoperative bone loss was measured and reported in different ways by different authors. In particular, to assess bone loss, 26 studies used computed tomography (CT) alone, 3 studies used both CT and magnetic resonance imaging, 3 studies used either CT or magnetic resonance imaging, and magnetic resonance arthrography was used in only 1 study. Also, the mean value of glenoid bone loss, measured either using the PICO (population, intervention, control, and outcomes) method or best-fit circle method (Sugaya method), was precisely reported in 24 series (12 AL [597 cases] and 12 ABB [347 cases]), whereas in 8 series, a specific minimum

amount of glenoid bone loss was used as an inclusion criterion. In 3 series, glenoid bone loss was not specified. Second, data regarding humeral bone loss were sparse and poorly reported. The presence of a Hill-Sachs lesion was evaluated in 22 articles (13 AL and 9 ABB). Among these, in 7 studies, the authors did not describe how humeral bone loss was assessed; in 5 studies, the Hill-Sachs lesion was defined, on the basis of intraoperative findings, as engaging or not engaging (however, a dynamic evaluation was probably performed before Bankart repair); and in 10 studies, it was preoperatively measured with CT using different methods. We recognize the need for the standardization of bone loss measurement, which must include both glenoid and humeral sides. Third, in this study, patient-reported outcome measures were not included. Unfortunately, the heterogeneity in terms of clinical outcome scales adopted in primary studies would make it very difficult to draw reliable conclusions. Recently, a consensus conference on shoulder instability took place,²⁴ but there is still no indication in the direction of the standardization of patient-reported outcome measures for the evaluation of surgically treated patients or bone defects. Fourth, even though statistical heterogeneity was not significant in the assessment of recurrence and reoperation rates, analysis of the complication rate revealed a significant *I*² value (heterogeneity) among studies (Figure 4). Although this probably reflects true heterogeneity in reporting complications (with an effect size of 1%-80%) (see Figure 4), we acknowledge that this should be taken into account to interpret our findings. Last, in this study, we were only able to pool nonrandomized studies, which reduces the strength of our findings. As a matter of fact, of 33 studies, no study was prospective and comparative, which reflects the lack of high-quality studies dealing with the AL and ABB procedures. In this context, we believe that this review may represent a useful overview on the state of the art of these techniques, providing weighted measures about the risk of complications, recurrence, and reoperations after the index procedure.

CONCLUSION

The AL and ABB procedures had similar rates of recurrence, reoperations, and complications. Screw fixation of

the bone graft was related to an increased risk of complications compared with flexible fixation.

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