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Clinical Outcomes, Union Rates, and Complications of Screw Versus Button Fixation in the Bristow-Latarjet Procedure for Anterior Shoulder Instability: A Systematic Review and Meta-Analysis

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Background: The Latarjet procedure is a common procedure for treating critical glenoid bone loss in anterior shoulder instability. Implants such as the screw and cortical button are widely used. The aim of this study was to compare studies on screw versus button fixation techniques in the Bristow-Latarjet procedure for anterior shoulder instability in terms of clinical outcomes, union rates, and complications.

Methods: The PubMed, Scopus, and Embase databases were searched to find comparative studies that reported outcomes of using screw versus button fixation in the Bristow-Latarjet procedure following the 2020 Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines. Studies that directly compared the screw and button fixation techniques and provided postoperative patient-reported outcomes, union rates, or complications were included. The Methodology Index for Non-Randomized Research (MINORS) criteria were used to assess the quality of the included studies. Odds ratios (ORs) were calculated for dichotomous outcomes whereas mean differences were calculated for continuous outcomes.

Results: Five articles included a total of 877 shoulders. All five studies had level 3 evidence. There was no statistically significant difference between the two techniques using the Walch-Duplay score, visual analog scale for pain, American Shoulder and Elbow Surgeons score, Simple Shoulder Test, range of motion, and graft union rates. However, the button fixation technique had statistically significantly higher recurrence rates than the screw fixation technique (OR, 0.24; 95% confidence interval, 0.10–0.58; $p = 0.001$).

Conclusions: The screw fixation technique had statistically significantly lower recurrence rates than the button fixation technique. However, there was no significant difference between screw and button fixation techniques regarding postoperative patient-reported outcomes, range of motion, graft union rates, nerve injury rates, infection rates, and reoperation rates.

Keywords: *Bristow, Latarjet, Shoulder, Screw, Button*

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Anterior shoulder dislocation is a common condition, particularly in young athletes, accounting for 23% of all shoulder injuries.[1] Recurrent shoulder dislocations are found to be 72%–100% in patients under 20 years of age, 70%–82% in patients aged 20–30 years, and 14%–22% in patients over 50 years of age, with younger patients requiring surgical treatment up to 38%.[2] There is increasing evi-

dence of anterior glenoid bone loss in recent literature.[3,4] More than 25% of glenoid bone loss is regarded as critical bone loss, which is one of the predisposing factors for recurrent anterior shoulder dislocations and the failure of arthroscopic Bankart repairs.[5-7] More than 13.5% bone loss resulted in a substantial decrease in clinical function in patients with a high level of mandatory activity and is regarded as subcritical bone loss.[8]

The Latarjet procedure, also known as the Bristow-Latarjet or Latarjet-Patte procedure, is a common procedure for treating critical glenoid bone loss in anterior shoulder instability. In 1954, Latarjet[9] reported the Latarjet procedure, which consisted of screw fixation of the coracoid process that attached conjoint tendons to the anterior glenoid edge. In 1958, Helfet[10] reported an operation called the Bristow procedure, which he had operated in 1938. In the procedure, the transferred coracoid was only sutured to the subscapularis muscle instead of a screw used in the Latarjet procedure. In 2006 and 2007, Nourissat et al.[11] and Lafosse et al.[12] published a report on the arthroscopic Latarjet procedure using screw fixation, which subsequently gained popularity. However, the use of screw fixation in Latarjet procedures raises concerns about potential complications.[13] For the treatment of anterior shoulder instabilities, surgeons are increasingly turning to the arthroscopic Bristow-Latarjet procedure because it has a low recurrence rate, especially when combined with a glenoid defect.[14,15] The coracoid process can be fixed to the glenoid using a variety of methods, including a screw and a button.[16-18] There is no agreement on the best fixation. There are concerns regarding screw-related complications in the screw fixation group.[19] These include protruding sitting screws that cause graft osteolysis and screw bending or fracture. These may cause pain because protruding screws irritate the subscapularis muscle and the abutment damages the cartilage of the humeral head.[20] A button serves as an alternate implant for the Bristow-Latarjet procedure's coracoid graft fixation.[11,12] The main concern is the biomechanical differences between screw fixation and button fixation. According to biomechanical studies by Kazum et al.[21] and Provencher et al.,[22] suture button fixation used in the Bristow-Latarjet procedure was similar to screw fixation. However, some studies have revealed that the recurrence rate of button fixation is higher than that of screw fixation.[23-25] The cortical button fixation technique was recently introduced as a reliable alternative.[26] The arthroscopic Latarjet procedure with button fixation yielded good midterm clinical outcomes.[27] The major concern with button fixation in the Bristow-Latarjet procedure is that it has poorer biomechanical properties than screw fixation.[28,29]

The purpose of this systematic review was to compare studies on screw versus button fixation in the Bristow-Latarjet procedure according to clinical outcomes, union rate, and complications. We hypothesized that button fixation would have comparable outcomes to screw fixation in the Bristow-Latarjet procedure.

METHODS

Search Criteria

The following databases were searched: PubMed, Scopus, and Embase databases to find comparative studies that reported outcomes of using screw versus button fixation in the Bristow-Latarjet procedure. These studies had to have been published between 2006 and 2022. A systematic review of the literature was carried out in accordance with the 2020 Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) statement[30] and registered to the PROSPERO International Prospective Register of Systematic Reviews (CRD42022382187). Before the literature search was carried out, the search criteria and outcome measures were established. Text searches were used as ("Latarjet" OR "Bristow-Latarjet" OR "Latarjet-Patte") AND ("screw" OR "button" OR "open" OR "arthroscop*") in these databases.

Two authors (NT, TI) independently conducted the searches and screened for titles and abstracts. Relevant studies were selected and conducted for full-text inclusion screening. The two writers then carried out the data extraction and independently assessed the included studies' methodological quality. When there was a difference of opinion throughout the article search and selection process, another author (DL), along with the two authors (NT, TI), discussed it and came to an agreement.

Eligibility Criteria

According to the following criteria, eligible studies were included: (1) comparative studies with evidence level 1 to 3; (2) English-language articles; (3) studies comparing screw and button fixation in the Bristow-Latarjet procedure, including both arthroscopic and open techniques; (4) studies reporting postoperative patient-reported outcomes, graft union rates, complications, or operative time; and (5) full-text availability. The exclusion criteria were: (1) basic science or biomechanical studies; (2) case series without a comparative group; (3) review articles; (4) surgical technique reports; (5) overlap of patient populations when the same authors or institution conducted the study; and (6) gray or unpublished literature. When two studies were

conducted on the same patient populations, the study with the highest reported participant number was chosen as the primary data source.

Data Extraction and Outcome Measures

Two authors (NT, TI) independently performed data extraction. Any conflicts were decided by another author (DL). The following characteristics were taken from each study: (1) information about the article; (2) demographic data about the patients; (3) surgical techniques; (4) the rates of graft union; (5) patient-reported outcome scores; (6) range of motion; (7) complications; and (8) operative time.

Quality Assessment

The Methodological Index for Non-Randomized studies (MINORS) criteria were used to assess the methodological quality of the included studies.[31] There are 12 quality evaluation items in the criteria. Comparative studies had a maximum MINORS score of 24. All included studies were graded independently by two authors (NT, TI) and disagreements were resolved through discussion with another author (DL).

Statistical Analysis

The retrieved data were examined using RevMan analysis version 5.4.1 (Cochrane). For continuous outcomes and dichotomous outcomes in each study, odds ratios with 95% confidence intervals (CIs) and mean differences (MDs) with CIs were utilized, respectively. Statistical heterogeneity was identified using the chi-square test. If the test result was $p < 0.1$, there was statistical heterogeneity among the included studies. A fixed-effects model was applied if there was no graphical or statistical evidence of heterogeneity. A random-effects model was applied when statistical or graphical evidence of heterogeneity was present.

RESULTS

Included Studies

The database systematic searches found 1,492 items in total and 705 duplicate articles were excluded from the retrieved articles. The remaining 787 articles had their titles and abstracts screened, which led to the rejection of 739 more articles that were not relevant to the study's goals. After retrieving and reviewing the full texts of the remaining 48 articles, it was determined that 43 articles should not have been included for a variety of reasons, including outcomes reported did not match the primary outcomes of the study and using the same cohort as other included studies. Finally, five studies[23-25,32,33] in total were included. The included studies had MINORS scores ranging from 12 to 17. Fig. 1 summarizes the PRISMA flow diagram for study selection.

Study Characteristics

We extracted data from the included studies to compare two groups of screw fixation (group S) and button fixation (group B) in the Bristow-Latarjet procedure for anterior shoulder instability. All five studies[23-25,32,33] with a total of 877 shoulders were included in the analysis. All of them were non-randomized retrospective cohort studies (level 3 evidence). Metais et al.[24] published a cohort study that

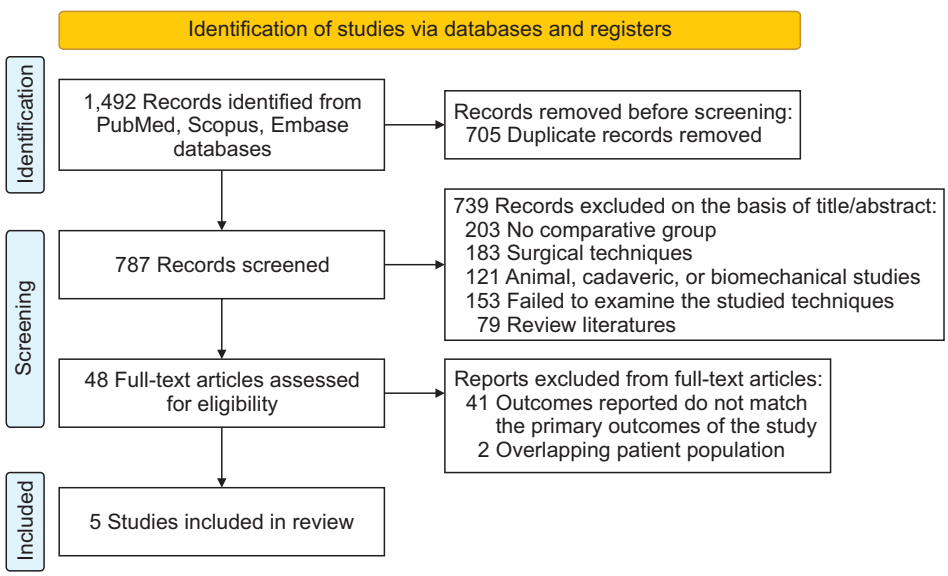


Fig. 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram showing the study selection process.

compared three groups: open screw, arthroscopic screw, and arthroscopic button fixation. Hardy et al.[23] published a cohort study that compared two groups: mini-open or arthroscopic screw and arthroscopic button fixation. Wang et al.[32] published a cohort study that compared two groups: open screw and mini-open or arthroscopic button fixation. Girard et al.[33] published a cohort study in which they compared two groups: mini-open screw and arthroscopic button fixation. Song et al.[25] reported a cohort study that compared two groups: arthroscopic screw and arthroscopic button fixation. The methodological quality of the included studies was evaluated using the MINORS criteria. The included studies had a MINORS score of 12–17, which represents a fair–good level of methodology. Tables 1 and 2 show the characteristics and details of the included studies.

Patient-Reported Outcomes

The Walch-Duplay score was reported in four studies.[23,24,32,33] The modified Rowe score was reported in four studies.[24,25,32,33] The visual analog scale (VAS) for pain was reported in three studies.[23,25,32] The VAS for instability was reported in one study.[25] The American Shoulder and Elbow Surgeons (ASES) score was reported in two studies.[25,32] The Simple Shoulder Test (SST) was reported in one study.[23] The Subjective Shoulder Value (SSV) was reported in two studies.[25,33] According to Metais et al.,[24] the mean Walch-Duplay score increased from 46 prior to surgery to 90.6 and the mean modified Rowe score increased from 46 prior to surgery to 91.1 at the final follow-up. Metais et al.[24] provided the mean Walch-Duplay and modified Rowe scores without mentioning the standard deviation (SD). Thus, the meta-analysis did not include this study. There was no statistically significant difference in the Walch-Duplay score (MD = 2.32; 95% CI, −1.57 to 6.21; $p = 0.24$) (Fig. 2A), the modified Rowe score (MD = 0.77; 95% CI, −1.42 to 2.97; $p = 0.49$) (Fig. 2B), the VAS for pain (MD = 0.01; 95% CI, −0.34 to 0.36; $p = 0.95$) (Fig. 2C), the ASES score (MD = 0.44; 95% CI, −2.72 to 3.61; $p = 0.78$) (Fig. 2D), and the SSV (MD = 0.24; 95% CI, −2.69 to 3.16; $p = 0.87$) (Fig. 2E) when comparing the screw and button fixation techniques in the Bristow-Latarjet procedure, according to the meta-analysis.

Range of Motion

The range of motion was reported in four studies.[24,25,32,33] Four studies[24,25,32,33] reported forward flexion. Three studies[24,25,33] reported external rotation at 0° of abduction. Four

Table 1. Characteristics of Included Studies

Study	LOE	Group	Age (yr)	Clinical FU	Radiographic FU	No. of patients (%)	Imaging modality	PROs	MINORS score
Metais et al. (2016)[24]	3	S1: open screw S2: arthroscopic screw B: arthroscopic button	26 ± 8.9	22.7 ± 4.1 mo	NR	S1: 104 (27) S2: 222 (57) B: 64 (16)	NR	Walch-Duplay, modified Rowe	12
Hardy et al. (2020)[23]	3	S: mini-open or arthroscopic screw B: arthroscopic button	S: 27.8 ± 9.2 B: 27.9 ± 10.0	S: 3.4 ± 0.8 yr B: 3.3 ± 0.9 yr	NR	S: 236 (76.6) B: 72 (23.4)	NR	Walch-Duplay, SST, pain VAS	16
Wang et al. (2020)[32]	3	S: open screw B: mini-open or arthroscopic button	S: 23.2 ± 6.2 B: 23.2 ± 4.6	24.9 mo (range, 10–53 mo)	1 day, 3 mo, 6 mo, 1 yr	S: 6 (50) B: 6 (50)	CT	Walch-Duplay, modified Rowe, ASES score, pain VAS	13
Girard et al. (2022)[33]	3	S: mini-open screw B: arthroscopic button	S: 25.5 ± 8.7 B: 22.5 ± 6.8	Minimum 12 mo	6 mo, 1 yr	S: 26 (52) B: 24 (48)	CT	Walch-Duplay, modified Rowe, SSV	16
Song et al. (2022)[25]	3	S: arthroscopic screw B: arthroscopic button	S: 28.7 ± 9.5 B: 25.9 ± 9.7	3.3 ± 0.7 yr	1 day, 3 mo, 6 mo, 1 yr, final FU	S: 63 (53.8) B: 54 (46.2)	CT	Pain VAS, instability VAS, modified Rowe, ASES score, SSV	17

Values are presented as mean ± standard deviation unless otherwise indicated.
LOE: level of evidence, FU: follow-up, PRO: patient-reported outcome, MINORS: Methodological index for non-randomized studies, S: screw, B: button, NR: not reported, SST: Simple Shoulder Test, VAS: visual analog scale, CT: computed tomography, ASES: American Shoulder and Elbow Surgeons, SSV: Subjective Shoulder Value.

Table 2. Details of Included Studies

Study	Recurrence (screw/button)	Graft union (screw/button)	Inclusion	Exclusion	Surgical technique (screw)	Surgical technique (button)
Metais et al. (2016)[24]	4/4	NR	- Anterior shoulder instability managed by coracoid bone block surgery between March 2013 and June 2014 - Minimum 1-year follow-up	NR	[Group S1] Position: NR Anesthesia: NR Technique: open, deltopectoral approach Subscapularis: horizontal separation of the subscapularis Implant: 2 bicortical screws [Group S2] Position: NR Anesthesia: NR Technique: arthroscopy Subscapularis: vertical incision of the subscapularis Implant: 2 bicortical screws	[Group B] Position: NR Anesthesia: NR Technique: arthroscopy Subscapularis: vertical incision of the subscapularis Implant: 2 EndoButtons (Smith & Nephew) Additional procedure: reattachment of the anterior capsule and labrum using a single anchor
Hardy et al. (2020)[23]	6/6	NR	- Anterior shoulder instability managed by Latarjet procedure between 2013 and 2015 - Age > 18 years - Minimum 2-year follow-up	- Additional shoulder pathology (posterior or multidirectional instability, LHB pathology, rotator cuff tear, or symptomatic AC joint pathology) - Unable to speak or read French	[Group S] Position: NR Anesthesia: NR Technique: mini-open Subscapularis: NR Implant: two 4-mm or 3.5-mm cannulated cancellous screws	[Group B] Position: NR Anesthesia: NR Technique: arthroscopy Subscapularis: NR Implant: 2 TightRope buttons (Arthrex) Additional procedure: Bankart repair
Wang et al. (2020)[32]	NR	6/6	- Recurrent anterior shoulder instability - Anterior glenoid bone defect > 20% or ISIS > 6 - Treatment with a modified arthroscopic Latarjet technique - Fixed with screws or suture buttons - Minimum 1-year follow-up	- Incomplete follow-up or loss to follow-up data - Epilepsy - Neurovascular disorders of the affected shoulder	[Group S] Position: beach chair Anesthesia: GA and interscalene block Technique: open Subscapularis: subscapularis split Implant: 1 cortical screw	[Group B] Position: beach chair Anesthesia: GA and interscalene block Technique: mini-open or arthroscopy Subscapularis: subscapularis split Implant: 2 buttons Additional procedure: SLAP and Bankart repair
Girard et al. (2022)[33]	NR	26/23	- Anterior shoulder instability managed by Latarjet procedure with an arthroscopic procedure from January 1, 2018, to June 30, 2018, and with an open procedure from July 1, 2018, to December 31, 2018 - ISIS > 3 - Minimum 1-year follow-up	- History of shoulder stabilization surgery-associated injuries	[Group S] Position: beach chair Anesthesia: GA and interscalene block Technique: arthroscopy Subscapularis: subscapularis split in the direction of its fibers at the lower 2/3 of its height Implant: two 4.5-mm bicortical malleolar screws (Me'dicalex) Additional procedure: labral repair with 1 anchor placed between the screws	[Group B] Position: beach chair Anesthesia: GA and interscalene block Technique: arthroscopy Subscapularis: subscapularis split in the direction of its fibers at the lower 2/3 of its height Implant: 2 buttons Additional procedure: Bankart repair

Table 2. Continued

Study	Recurrence (screw/button)	Graft union (screw/button)	Inclusion	Exclusion	Surgical technique (screw)	Surgical technique (button)
Song et al. (2022)[25]	0/1	62/52	- Anterior shoulder instability managed by inlay Bristow procedure - Anterior glenoid bone defect > 10% - Participation in high-demand (collision and overhead) sports with a glenoid defect < 10% - Failure after Bankart repair	- Epilepsy - Multidirectional instability - Additional shoulder pathology (LHB pathology, rotator cuff tear, or symptomatic AC joint pathology) - < 2-year follow-up	[Group S] Position: beach chair Anesthesia: GA and interscalene block Technique: arthroscopy, inlay Bristow procedure Subscapularis: subscapularis split on the level of 5 o'clock Implant: one 3.5-mm screw Additional procedure: Bankart repair using two 2.9-mm Pushlock anchors (Arthrex)	[Group B] Position: beach chair Anesthesia: GA and interscalene block Technique: arthroscopy Subscapularis: subscapularis split on the level of 5 o'clock Implant: 2 Tight Rope buttons (Arthrex) Additional procedure: Bankart repair using two 2.9-mm Pushlock anchors (Arthrex)

NR: not reported, LHB: long head of biceps tendon, AC joint: acromioclavicular joint, ISIS: Instability Severity Index Score, GA: general anesthesia, SLAP: superior labral anterior posterior.

studies[24,25,32,33] reported external rotation at 90° of abduction. Three studies[24,25,32] reported internal rotation at 90° of abduction. One study[33] also described internal rotation with spine reaching. There was no statistically significant difference for postoperative forward flexion (MD = –0.17; 95% CI, –2.75 to 2.40; $p = 0.90$) (Fig. 3A), external rotation at 0° of abduction (MD = 1.54; 95% CI, –2.80 to 5.88; $p = 0.49$) (Fig. 3B), external rotation at 90° of abduction (MD = –1.41; 95% CI, –4.92 to 2.10; $p = 0.43$) (Fig. 3C), and internal rotation at 90° of abduction (MD = 0.80; 95% CI, –2.67 to 4.27; $p = 0.65$) (Fig. 3D). Girard et al.[33] reported internal rotation as T9 level for both groups.

Graft Union

Three studies[25,32,33] reported the graft union rates of both screw and button fixation techniques. The overall graft union rates for the screw and button fixation techniques were 98.9% and 96.4%, respectively. There was no statistically significant difference between the two techniques (OR, 2.70; 95% CI, 0.39–18.91; $p = 0.32$) (Fig. 4, Table 2).

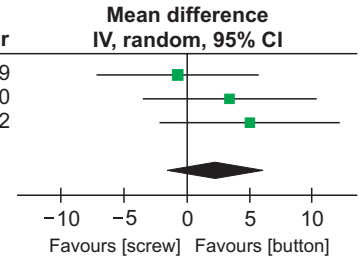
Complications

Recurrence rates were reported in three studies.[23-25] Three studies reported rates of nerve injury and infection. Four studies[23-25,33] reported reoperation rates. One study[24] reported complex regional pain syndrome. In the study conducted by Hardy et al.,[23] it was observed that out of the 236 patients who underwent screw fixation, 14 individuals (5.9% of the cases) required reoperation. The indications for reoperation in this group included hardware removal in 8 cases, arthrolysis in 3 cases, the Eden-Hybinette procedure in 2 cases, and hematoma removal in 1 case. On the other hand, no reoperation was reported in the button fixation group. In the study conducted by Metais et al.,[24] it was found that out of 104 patients in the open screw fixation group, 2 required hematoma removal. Furthermore, screw removal was performed in 3 out of 104 patients in the open screw fixation group and in 6 out of 222 patients in the arthroscopic screw fixation group. In the study conducted by Girard et al.,[33] it was reported that out of a total of 26 patients in the mini-open screw fixation group, 1 patient experienced infection and another patient developed a hematoma that required reoperation. The reoperation involved surgical debridement and lavage. In the study conducted by Song et al.,[25] it was observed that one patient out of 54 in the button fixation group experienced recurrent instability and subsequently underwent revision surgery using the Eden-Hybinette procedure. Additionally, in the screw fixation group consisting of 63 patients, one patient had a postoperative screw pullout, necessitating

A Walch-Duplay

Study or subgroup	Screw Mean	SD	Total	Button Mean	SD	Total	Weight	Mean difference IV, random, 95% CI	Year
Hardy 2019	70.4	25.6	236	71.1	23.4	72	37.9%	−0.70 [−7.02, 5.62]	2019
Wang 2020	91.7	4.1	6	88.3	7.5	6	32.3%	3.40 [−3.44, 10.24]	2020
Girard 2022	93	10	26	88	15	24	29.8%	5.00 [−2.13, 12.13]	2022
Total (95% CI)			**268**			**102**	**100.0%**	**2.32 [−1.57, 6.21]**	

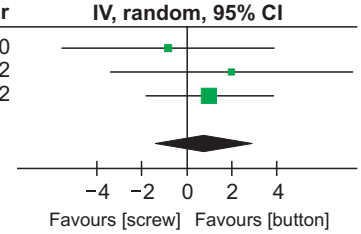
Heterogeneity: Tau^2 = 0.00; Chi^2 = 1.52, df = 2 (p = 0.47); I^2 = 0%
Test for overall effect: Z = 1.17 (p = 0.24)



B Modified Rowe

Study or subgroup	Screw Mean	SD	Total	Button Mean	SD	Total	Weight	Mean difference IV, random, 95% CI	Year
Wang 2020	92.5	4.2	6	93.3	4.1	6	21.8%	−0.80 [−5.50, 3.90]	2020
Girard 2022	95	8	26	93	11	24	16.7%	2.00 [−3.37, 7.37]	2022
Song 2022	95.2	6	63	94.2	8.9	54	61.5%	1.00 [−1.80, 3.80]	2022
Total (95% CI)			**95**			**84**	**100.0%**	**0.77 [−1.42, 2.97]**	

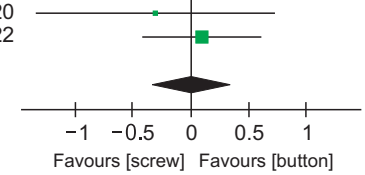
Heterogeneity: Tau^2 = 0.00; Chi^2 = 0.66, df = 2 (p = 0.72); I^2 = 0%
Test for overall effect: Z = 0.69 (p = 0.49)



C Pain VAS

Study or subgroup	Screw Mean	SD	Total	Button Mean	SD	Total	Weight	Mean difference IV, random, 95% CI	Year
Hardy 2019	1.3	1.8	236	1.3	2.1	72	41.9%	0.00 [−0.54, 0.54]	2019
Wang 2020	1.2	0.8	6	1.5	1	6	11.5%	−0.30 [−1.32, 0.72]	2020
Song 2022	1.3	1.4	63	1.2	1.4	54	46.6%	0.10 [−0.41, 0.61]	2022
Total (95% CI)			**305**			**132**	**100.0%**	**0.01 [−0.34, 0.36]**	

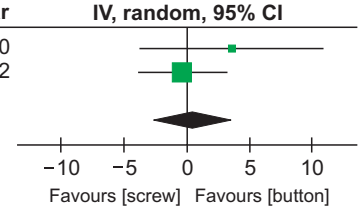
Heterogeneity: Tau^2 = 0.00; Chi^2 = 0.47, df = 2 (p = 0.79); I^2 = 0%
Test for overall effect: Z = 0.07 (p = 0.95)



D ASES

Study or subgroup	Screw Mean	SD	Total	Button Mean	SD	Total	Weight	Mean difference IV, random, 95% CI	Year
Wang 2020	91.1	6.1	6	87.5	6.7	6	19.0%	3.60 [−3.65, 10.85]	2020
Song 2022	90.3	9.4	63	90.6	9.9	54	81.0%	−0.30 [−3.82, 3.22]	2022
Total (95% CI)			**69**			**60**	**100.0%**	**0.44 [−2.72, 3.61]**	

Heterogeneity: Tau^2 = 0.00; Chi^2 = 0.90, df = 1 (p = 0.34); I^2 = 0%
Test for overall effect: Z = 0.27 (p = 0.78)



E SSV

Study or subgroup	Screw Mean	SD	Total	Button Mean	SD	Total	Weight	Mean difference IV, random, 95% CI	Year
Girard 2022	93	11	26	93	12	24	20.9%	0.00 [−6.40, 6.40]	2022
Song 2022	87.7	9.1	63	87.4	9	54	79.1%	0.30 [−2.99, 3.59]	2022
Total (95% CI)			**89**			**78**	**100.0%**	**0.24 [−2.69, 3.16]**	

Heterogeneity: Tau^2 = 0.00; Chi^2 = 0.01, df = 1 (p = 0.93); I^2 = 0%
Test for overall effect: Z = 0.16 (p = 0.87)

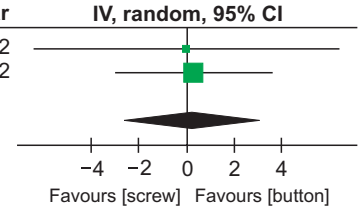


Fig. 2. Forest plot comparing the patient-reported outcomes between techniques. (A) Walch-Duplay score. (B) Modified Rowe score. (C) Visual analog scale (VAS) for pain. (D) American Shoulder and Elbow Surgeons (ASES) score. (E) Subjective Shoulder Value (SSV). SD: standard deviation, IV: inverse variance, CI: confidence interval.

refixation in the operating room.

The overall recurrence rates of screw and button fixation techniques were 1.6% and 5.8%, respectively. The definition of recurrence was not standardized across studies. In Hardy et al.'s study,[23] recurrence was defined as a new episode of dislocation that necessitated reduction by someone else. In Song et al.'s study,[25] recurrence of instability was characterized by re-dislocation resulting from

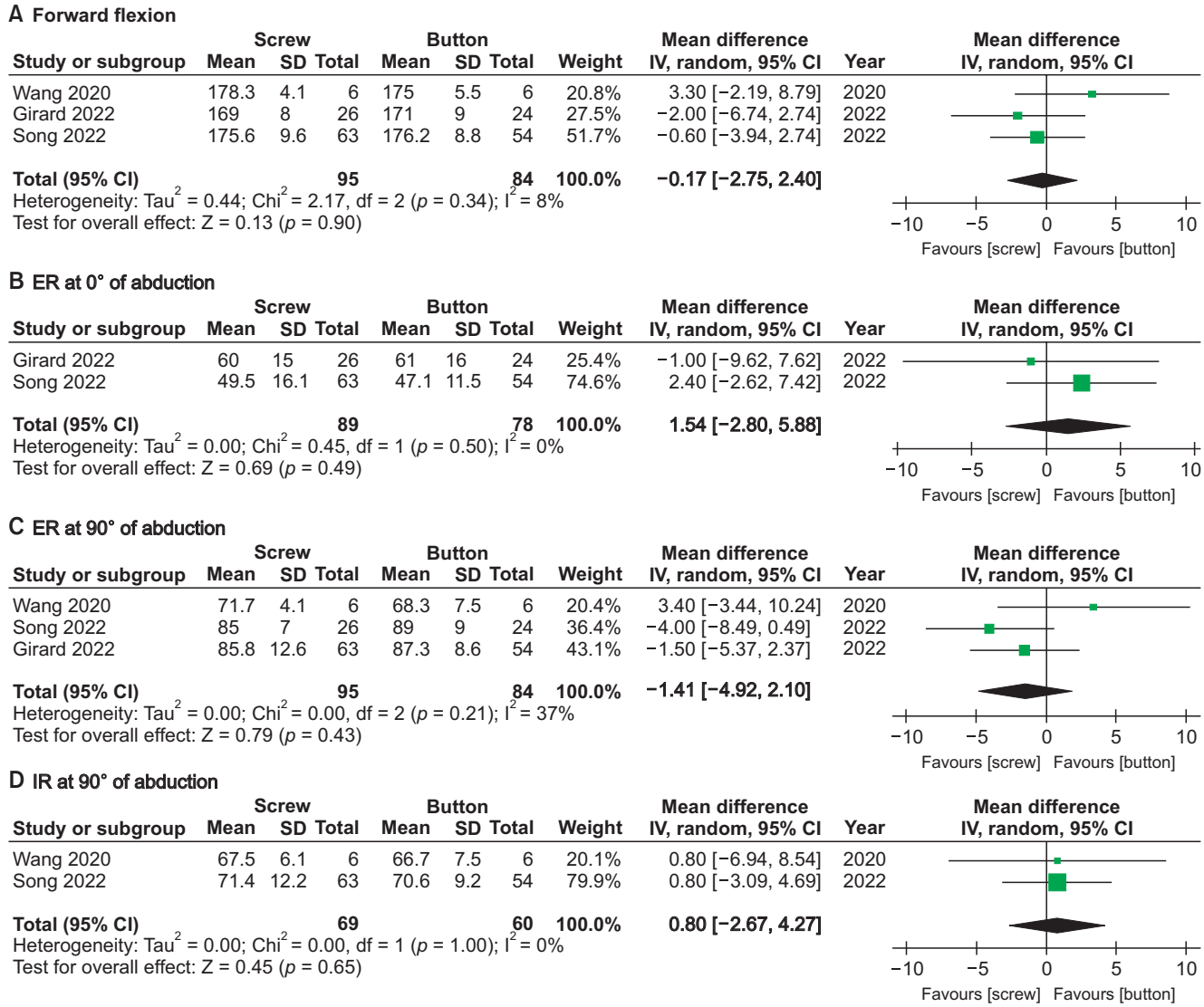


Fig. 3. Forest plot comparing the range of motion between techniques. (A) Forward flexion. (B) External rotation (ER) at 0° of abduction. (C) ER at 90° of abduction. (D) Internal rotation (IR) at 90° of abduction. SD: standard deviation, IV: inverse variance, CI: confidence interval.

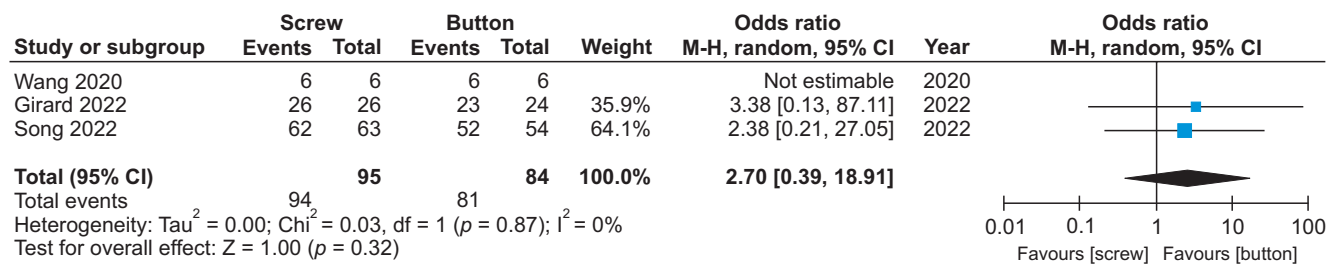


Fig. 4. Forest plot comparing the graft union rates between techniques. M-H: Mantel-Haenszel, CI: confidence interval.

an accident and requiring surgical intervention. Metais et al.[24] did not provide a specific definition for recurrence. This study found that the recurrence rates of button fixation techniques were significantly higher than those of screw fixation techniques (OR, 0.24; 95% CI, 0.10–0.58; $p = 0.001$) (Fig. 5A, Table 2).

The overall nerve injury rates of screw and button fixation techniques were 1.9% and 1.4%, respectively.

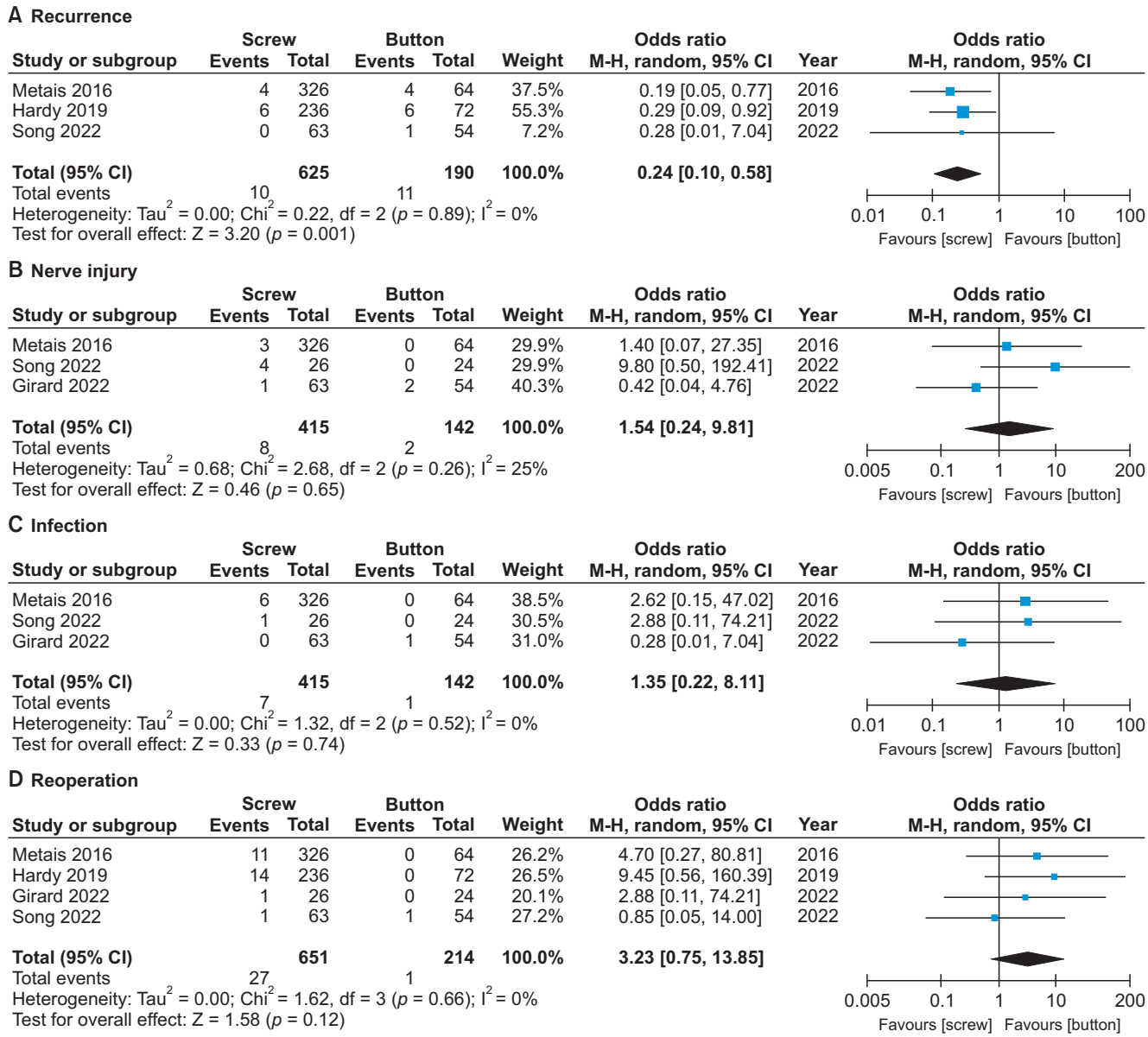


Fig. 5. Forest plot comparing the complications between techniques. (A) Recurrence. (B) Nerve injury. (C) Infection. (D) Reoperation. M-H: Mantel-Haenszel, CI: confidence interval.

There have been reports of injuries to the axillary nerve, musculocutaneous nerve, and suprascapular nerve. The total number of nerve injuries in the reviewed studies was as follows: suprascapular nerve = 2, musculocutaneous nerve = 4, and axillary nerve = 4 out of a total of 877 shoulders. There was no significant difference in nerve injury between the two groups (OR, 1.54; 95% CI, 0.24–9.81; $p = 0.65$) (Fig. 5B).

The overall infection rates of screw and button fixation techniques were 1.7% and 0.7%, respectively. The infection rates between screw and button fixation techniques were not statistically significantly different (OR, 1.35; 95% CI, 0.22–8.11; $p = 0.74$) (Fig. 5C). Two patients with complex regional pain syndrome were found in the arthroscopic screw fixation group in the study by Metais et al.,[24] which is the only study to report this complication.

The overall reoperation rates of screw and button fixation techniques were 4.1% and 0.5%, respectively. This study found that the reoperation rates between screw and button fixation techniques were not statistically significantly different (OR, 3.23; 95% CI, 0.75–13.85; $p = 0.12$) (Fig. 5D).

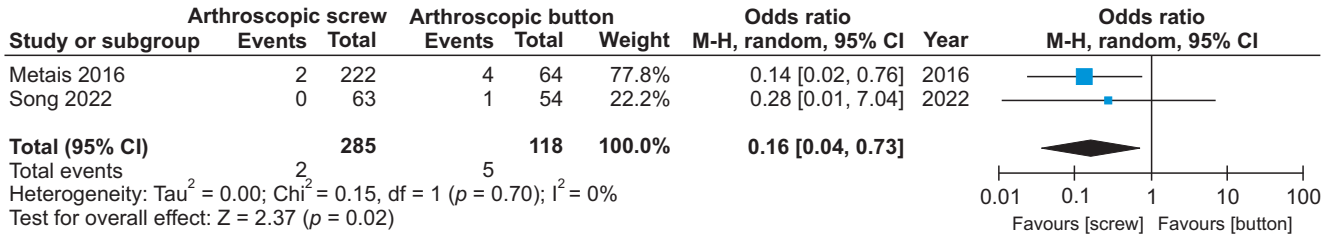


Fig. 6. Forest plot of stratified subgroup analysis comparing the recurrence between arthroscopic screw fixation and arthroscopic button fixation techniques. M-H: Mantel-Haenszel, CI: confidence interval.

Operative Time

The operative time was recorded in one study by Girard et al.,[33] which reported the operative time from skin opening to skin closure. The mean operative times in the arthroscopic button group were 102.7 ± 16.4 minutes and 60.5 ± 9.2 minutes in the open screw fixation group (p = 0.001).

Return to Sports

There was only one study by Song et al.[25] that reported on return-to-sport outcomes. According to their findings, at the 3-year follow-up, 97.4% of patients (114 out of 117) had successfully returned to sport, with 80% (94/117) achieving this milestone within 1 year. Additionally, at the 3-year follow-up, 90.6% of patients (106/117) reached a level of sports performance that was either superior or equal to their preoperative level.

Stratified Subgroup Analysis (Arthroscopic Screw Fixation Versus Arthroscopic Button Fixation)

In Metais et al.'s study,[24] recurrence was observed in 2 out of 222 patients in the arthroscopic screw fixation group, 4 out of 64 patients in the arthroscopic button fixation group, and 2 out of 104 patients in the open screw fixation group. In Song et al.'s study,[25] no recurrences were reported in the arthroscopic screw fixation group out of 63 patients, while one recurrence was observed in the arthroscopic button fixation group out of 54 patients. Hardy et al.[23] reported a recurrence rate of 6 out of 72 patients in the arthroscopic button fixation group and 6 out of 236 patients in the mini-open or arthroscopic screw fixation group. However, no studies were included in the analysis that reported the outcomes of open-button fixation. The stratified subgroup analysis revealed a notable trend in the higher recurrence rates of arthroscopic button fixation techniques compared to arthroscopic screw fixation techniques (OR, 0.16; 95% CI, 0.04–0.73; p = 0.02) (Fig. 6).

DISCUSSION

The most important finding of this review is that the recurrence rates of the button fixation technique were significantly higher than those of the screw fixation technique. Nevertheless, there was no significant difference in postoperative patient-reported outcomes, range of motion, graft union rates, nerve injury rates, infection rates, or reoperation rates between screw and button fixation techniques in the Bristow-Latarjet procedure for recurrent anterior shoulder instability.

The overall recurrence rates of screw and button fixation techniques were 1.6% and 5.8%, respectively. Recurrence definitions varied among studies. Hardy et al.[23] defined it as a new dislocation requiring reduction by someone else. Song et al.[25] considered recurrence as redislocation due to an accident requiring surgery. Metais et al.[24] did not provide a specific definition. While Song et al.[25] reported no significant difference between the two groups, Metais et al.[24] and Hardy et al.[23] discovered that the recurrence rates in the button fixation group were greater than those in the screw fixation group. According to Metais et al.,[24] recurrences occurred in 4 of the 326 patients who underwent screw fixation and 4 of the 64 patients who underwent button fixation. According to Hardy et al.,[23] 6 of 236 patients in the screw fixation group and 6 of 72 patients in the button fixation group experienced a recurrence. According to Song et al.,[25] there were no recurrences in any of the 63 patients receiving screw fixation, and there was only one of the 54 patients receiving button fixation. As a result of our meta-analysis, screw fixation techniques had significantly lower recurrence rates than button fixation techniques (OR, 0.24; 95% CI, 0.10–0.58; p = 0.001). The arthroscopic technique is more challenging, and buttons may have inferior biomechanical properties; therefore, their recurrence rates were higher than those of screw fixation.

This comparative study did not establish that the cortical button arthroscopic technique benefited the open

screw technique in terms of clinical outcomes, range of motion, and union rate. However, because of the difficulties of the arthroscopic procedure, the arthroscopic button fixation group took longer operation time (102 vs. 60 minutes) than mini-open screw fixation.[33]

By using the mortise-and-tenon construction method as their model, Lin et al. developed the inlay Bristow procedure. The mortise-and-tenon construction is a traditional woodworking joint technique that involves joining two pieces of wood together. It consists of two parts: the mortise and the tenon. The mortise is a rectangular or square hole that is typically cut into one piece of wood. The tenon, on the other hand, is a corresponding projection or tongue that is formed on the end of the other piece of wood. The tenon is designed to fit snugly into the mortise, creating a strong and secure joint. This technique may improve the coracoid graft union.[34] The arthroscopic inlay Bristow technique resulted in a significant rate of graft healing, improved clinical outcomes, and a high percentage of return to sports after a minimum 3-year follow-up.[34] Song et al.[25] compared inlay-Bristow procedure fixation with screws and buttons. Regarding postoperative clinical scores, the level of return to sports, range of motion, graft union, or reoperation rates, there were no significant differences between the groups with a 3-year follow-up. In total, 97.4% of the cases showed bone union.

The overall reoperation rates of screw and button fixation techniques were 4.1% and 0.5%, respectively. In the button fixation group, only one patient in a study by Song et al.[25] had a reoperation due to recurrent instability and underwent the Eden-Hybinette procedure. According to Metais et al.,[24] two patients in the screw fixation group required debridement because of a hematoma, and nine patients required screw removal because of screw-related problems. According to Hardy et al.,[23] one patient in the screw fixation group required debridement because of a hematoma, eight patients required screw removal because of screw-related problems, three patients required arthrolysis because of stiffness, and two patients underwent the Eden-Hybinette procedure because of recurrent instability. Girard et al.[33] reported that one patient in the screw fixation group received debridement due to hematoma, and Song et al.[25] reported that one patient in the screw fixation group received screw revision due to a screw-related problem. A meta-analysis found that the reoperation rates between screw and button fixation techniques were not significantly different (OR, 3.23; 95% CI, 0.75–13.85; p = 0.12).

The overall nerve injury rates of screw and button fixation techniques were 1.9% and 1.4%, respectively. The axillary nerve, musculocutaneous nerve, and suprascapular nerve have all been reported injured. Metais et al.[24] found two suprascapular nerve injuries and one musculocutaneous nerve injury in the arthroscopic screw fixation group, but no nerve injuries in the open screw or arthroscopic button fixation groups. Girard et al.[33] reported four axillary nerve injuries in the mini-open screw fixation group and no nerve injuries in the arthroscopic button fixation group. Song et al.[25] reported one musculocutaneous nerve injury in the arthroscopic screw fixation group and two musculocutaneous nerve injuries in the arthroscopic button fixation group. However, all nerve injuries recovered on their own within 12 weeks.

The overall infection rates of screw and button fixation techniques were 1.7% and 0.7%, respectively. Metais et al.[24] found 6 of the 326 infections in the screw fixation group but no infections in the button fixation group. Girard et al.[33] found no infections in the arthroscopic button fixation group and one infection in the mini-open screw fixation group. The arthroscopic button fixation group had one infection, while the arthroscopic screw fixation group had none, according to Song et al.[25] According to our meta-analysis, there was no significant difference in infection rates between screw and button fixation techniques (OR, 1.35; 95% CI, 0.22–8.11; p = 0.74).

To the best of our knowledge, this is the first meta-analysis to analyze patient-reported outcomes, range of motion, graft union rates, and complication rates in the Bristow-Latarjet procedure using screw and button fixation. The present study demonstrated that screw and button fixation techniques achieved similar clinical and radiological outcomes. However, button fixation techniques had higher recurrence rates compared to the screw fixation group. Furthermore, the arthroscopic button technique required more operative time.[33,35,36]

This study has some limitations. First, there are differences in the included studies' follow-up durations, surgical techniques, and demographic characteristics. Second, the results may have been influenced by the inherent biases of each included study, as is the case with any systematic review, and some articles may have been excluded due to the search terms used. Third, there could be reporting and publication bias given that this meta-analysis includes retrospective studies. This systematic review did not assess the potential for publication bias due to the inclusion of fewer than five studies. Fourth, the literature search yielded level III non-randomized retrospective studies, which were included in this systematic review. It is crucial to acknowledge that the overall quality of the studies included in this review was assessed as low.

Therefore, careful interpretation of the results is warranted. Fourth, it is complicated to compare studies because of the variety of clinical outcome indicators used. Finally, the Bristow-Latarjet procedure encompasses various surgical techniques, including the choice between screw and button fixation, as well as the approach (arthroscopic, open, or mini-open). It is important to note that the arthroscopic Bristow-Latarjet procedure presents a steep learning curve. In an attempt to address this limitation, a stratified subgroup analysis was conducted comparing arthroscopic screw and arthroscopic button fixation techniques. However, due to the limited number of studies available (only two), the analysis revealed a trend toward higher recurrence rates in the arthroscopic button fixation group compared to the arthroscopic screw fixation group. Additionally, in the arthroscopic technique, it is not possible to suture the inferior glenohumeral ligament and the coracohumeral ligament during the Bristow-Latarjet procedure. This omission of the capsular effect in the "triple blocking" effect can potentially impact the outcome.

In the Bristow-Latarjet procedure for recurrent anterior shoulder instability, there was no significant difference in the postoperative patient-reported outcomes, range of motion, graft union rates, nerve injury rates, infection rates, and reoperation rates between screw and button fixation techniques. However, the button fixation technique had significantly higher recurrence rates than the screw fixation technique.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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