COMPARATIVE OUTCOMES OF THE LATARJET PROCEDURE AND ARTHROSCOPIC BANKART REPAIR: A SYSTEMATIC REVIEW AND META-ANALYSIS OF RECURRENCE RATES AND CLINICAL SCORES

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Abstract

Background: Recurrent shoulder instability can present a significant challenge in orthopedic surgery, affecting patients' quality of life. Arthroscopic Bankart repair (ABR) and the Latarjet procedure are two widely utilized surgical techniques for stabilization, each with distinct advantages and limitations. However, the debate regarding the standard intervention in anterior shoulder dislocation still remains.

Aim: We conducted this systematic review and meta-analysis to compare the clinical and functional outcomes of ABR vs. arthroscopic Latarjet (AL) and open Latarjet (OL).

Methods: We conducted a systematic search through PubMed, Cochrane, Scopus, and Web of Science databases until January 2025, including all the studies that compare ABR vs. the Latarjet procedure (OL or AL). We conducted a meta-analysis using the Review Manager software for statistical analysis. We used risk ratio (RR) and its 95% confidence interval (CI) to compare the dichotomous outcomes while using mean difference (MD) for continuous outcomes, applying the random effect model.

Results: Twenty studies met our predefined strict criteria and were included in the meta-analysis. This study demonstrated that the Latarjet procedure (OL and AL) significantly reduced recurrence rates compared to ABR (RR = 2.84, 95% CI: 1.74–4.62, P < 0.0001). Subgroup analyses highlighted consistent findings favoring the Latarjet procedure in non-athletes (RR = 3.14) and adolescents (RR = 7.79). However, the advantage was not statistically significant among athletes (RR = 2.42, P = 0.1). Additionally, the Latarjet procedure had a lower risk of revision surgeries (RR = 3.9, 95% CI: 1.74–8.72, P = 0.0009), particularly in non-athletes and younger populations. While the Rowe score favored Latarjet significantly (MD = -4.51, P = 0.001), the ASES and SSV scores showed no statistical difference between the two procedures.

Conclusion: The Latarjet procedure demonstrates superiority over Bankart repair in reducing recurrence rates and revision surgeries, particularly in non-athletes, adolescents, and adults. These findings suggest that the Latarjet procedure may be the preferred surgical intervention for instability in these populations. However, high heterogeneity across studies, especially in clinical scores like ASES and SSV, underscores the need for further research to confirm these outcomes and address variability.

Keywords: Arthroscopic Bankart repair, Latarjet procedure, Shoulder instability, and recurrent dislocation.

Introduction

The glenohumeral joint is an articulated surface between the humeral head and the glenoid fossa of the scapula (1). Commonly known as the shoulder joint, it is characterized by the broadest range of joint mobility (2). Traumatic shoulder dislocation often leads to anterior shoulder instability, where the head of the humerus falls out of its normal socket anteriorly (3). Recurrence is a significant concern, particularly in young males and adolescents, where the incidence rate of instability can approximate 3%, with a 90% prevalence of recurrence upon engaging in contact sports (4). Subsequently, this functional impairment can affect injured people's quality of life, deny them their choice of sports participation, and raise the risk of osteoarthritis (OA) development (5,6).

While conservative management can be initially performed for older or less active populations, the surgical approach is the preferred intervention, especially in younger patients (7). Bankart repair is the standard anatomical procedure that aims to reconnect the torn labrum and its associated glenohumeral ligament to the glenoid rim (8). It is often done arthroscopically, which provides the advantage of being minimally invasive (9). However, in cases with a large bony deficit, the open Latarjet (OL) procedure can be an alternative where the non-anatomic block requires transferring the coracoid bone and its tendon to the glenoid fossa (10). Arthroscopic Bankart repair (ABR) is known for its low complication and better short-term clinical outcomes, depending on its non-invasive nature (11). Nevertheless, it can also result in a high recurrence rate, particularly with the young population (12). In contrast, OL can cause more complications due to its invasiveness while offering less recurrence privilege (13). To address these complications, the arthroscopic Latarjet (AL) technique has emerged as a less invasive alternative while maintaining the benefits of the traditional Latarjet procedure (14).

Regarding the previous literature, Bessiere et al. followed over five years the results of ARB and OL in a cohort group of 51 pair-matched patients. They found the recurrence rate in the Latarjet group to be half of the Bankart group (12% vs 24%). Additionally, they associated lower age, bone deficit, and competitive sport with the incidence of recurrence. Thus, people of this type are more suited to perform the Latarjet procedure (15). In addition to that, Delgado et al. compare the implementation of AL to ABR for the first time in adolescents. Over two years of follow-up, they noticed one case of recurrence in the AL compared to 12 cases in ABR (5.9% vs 35.3%). They also found the majority of patients to be able to return to sports in both groups, achieving satisfactory results (16). Upon these pros and cons, the debate regarding these two procedures is still ongoing. Performing this meta-analysis will provide the literature with up-to-date evidence, comparing ABR with the Latarjet procedure (both arthroscopic and open techniques) in terms of recurrence, complications, and return to sport across various populations. Subsequently, this will offer clinicians the chance to make an informed decision on anterior shoulder instability treatment based on solid evidence.

Methods

We conducted this systematic review and meta-analysis following the principles of the Cochrane Handbook for the systematic review of interventional studies (17). Additionally, we reported it as per the PRISMA checklist (18).

Search strategy

PubMed, Cochrane, Scopus, and Web of Science were searched from inception until January 2025, using this search strategy: ("shoulder instability" OR "anterior shoulder instability" OR "recurrent shoulder instability") AND ("arthroscopic Bankart repair" OR "Bankart repair") AND ("Latarjet procedure" OR "open Latarjet" OR "arthroscopic Latarjet"). We included studies of all languages and timeframes without restriction. To ensure comprehensive coverage and reduce publication bias, references from the retrieved studies were manually reviewed through backward searching.

Eligibility criteria

Inclusion Criteria

Population: Studies involving patients with anterior shoulder instability, including both primary and recurrent cases.

Interventions: Studies comparing ABR to OL or AL without any modification or combination to any procedure.

Outcomes: Studies reporting on at least one of the following outcomes:

1. Recurrence rates or postoperative instability.

2. Total complications.

3. Functional outcomes, including patient-reported measures (e.g., Rowe score, Subjective Shoulder Value (SSV) score).

4. Return to sports rates or times.

Study Types: Randomized controlled trials (RCTs) and cohort studies that directly compare the interventions.

Exclusion Criteria

1. Studies that do not directly compare arthroscopic Bankart repair with Latarjet procedures (open or arthroscopic).

2. Case reports, editorials, commentaries, or review articles without original data.

3. Studies with insufficient or incomplete data to calculate effect sizes for the meta-analysis.

4. Studies exclusively involving other surgical procedures (e.g., remplissage, Hill-Sachs lesion management).

Screening and selection

We removed the duplicate articles that had been retrieved using EndNote software. After that, we performed title and abstract screening of the remaining articles followed by full-text screening according to our eligibility criteria. Two authors conducted the screening blindly, and third one was consulted upon disagreement.

Risk of bias assessment

The assessment of bias risk was conducted utilizing the Cochrane risk of bias tool for RCTs and ROBINS-I for non-RCTs. The ROB tool comprises seven domains: selection bias refers to sequence generation randomization and random allocation; performance bias relates to the blinding of participants and personnel; detection bias concerns the blinding of outcome assessors; attrition bias addresses incomplete outcome data; reporting bias involves selective reporting; and other risks of bias are also considered. Each domain was assigned a low, unclear, or high risk of bias according to the author's assessment.

Data extraction and Management

We extracted data from the eligible studies using a pre-designed data extraction form. The extracted information included study characteristics (e.g., study design, country, and sample size), participant demographics (e.g., age, sex, and population type), intervention details (e.g., arthroscopic Bankart repair, open Latarjet, or arthroscopic Latarjet), and clinical outcomes. Extracted outcomes included recurrence rates, time to recurrence, Rowe and ASES scores, SSV scores, VAS pain scores, revision rates, and return-to-sport rates.

Statistical analysis

The Review Manager software (RevMan 5.4) [Computer program] developed by the Cochrane Collaboration was utilized to perform the analysis. Dichotomous outcomes were calculated using the risk ratio (RR) and 95% confidence interval (CI), whereas the continuous ones were studied by calculating the mean difference (MD) and 95% CI. The results were considered statistically significant if the p-value was below 5%. Visual inspection of the forest plot was used to assess the presence of statistical heterogeneity across the studies, along with the I-squared (I2) and chi-squared (Chi2) statistics. A significant level of heterogeneity was indicated if I2 values of 50% were present. Upon heterogeneity, the random-effects model was applied.

Results

Search and selection results

Our comprehensive database search identified a total of 1,482 records. We removed 550 duplicates before conducting a title and abstract screening, which resulted in 932 studies. Among the screened articles, we excluded 897 studies for being irrelevant, leaving 35 studies that proceeded to full-text screening for eligibility. Additionally, we performed a manual review of the references from the retrieved studies. In total, we included 20 studies in our final analysis, as shown in **Figure 1**.

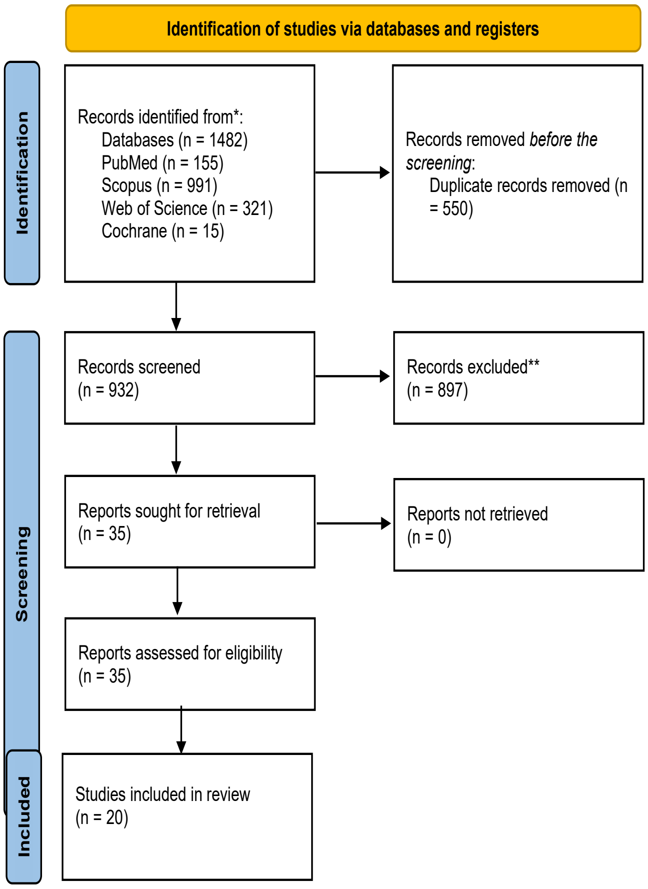

Figure 1. PRISMA flow diagram summarizing the selection process.

Risk of bias assessment

We used the Cochrane risk of bias (ROB) tool to evaluate the risk of bias of the included RCTs. Additionally, ROBINS-I (Risk of Bias in Non-Randomized Studies of Interventions) was utilized to assess all the cohorts. Two authors conducted the assessment, consulting the third upon disagreement. We noticed potential concerns in cohort studies regarding selection bias, particularly in terms of patient recruitment strategies and a lack of clear documentation for confounding adjustment in most studies, **Table 1**. The risk of bias was generally low in the two RCTs, with robust reporting of the intended outcomes. More details are summarized in **Figure 2**.

Summary of Included Studies and Patient-Reported Outcomes

Twenty studies were included, with 18 cohort studies and two RCTs. Only one study reported a comparison between ABR and AL, while the rest of the studies compared ABR versus OL among athletes and non-athletes' population, **Table 2**. Patient-reported outcomes included the Rowe, ASES, VAS, and SSV scores. Additionally, recurrence, return to sport, and total complications were reported, as shown in **Table 3.**

Clinical outcomes

Recurrence Outcomes

1. Recurrence Rate.

Seventeen studies reporting recurrence rates with a total of 2280 participants were included. The pooled analysis under the random effect model revealed a significantly higher risk ratio (RR) (RR= 2.84, 95% confidence interval (CI): [1.74, 4.62], ($P < 0.0001$, **Figure 3**), favoring the Latarjet procedure (OL and AL) over ABR. However, moderate heterogeneity among the studies was observed ($P = 0.003$; $I^2 = 56\%$, Figure 3). This heterogeneity was not resolved by sensitivity analysis. Subgroup analyses were conducted to investigate the potential influence of age, intervention, study design, and population activity and see their effect on heterogeneity.

In the non-athlete population, the pooled analysis also revealed a significantly higher risk of recurrence in Bankart repair compared to the Latarjet procedure (RR = 3.14, 95% CI: 1.93, 5.11, $P < 0.0001$, Table 4)**.** There was minimal heterogeneity among the studies ($P = 0.12$, $I^2 = 34\%$), suggesting consistent

Table 1. ROBINS-I assessing the included cohort studies.

Study ID	D1	D2	D3	D4	D5	D6	D7	Overall judgment
Bessière et al 2014 (19)	*	*	*	*	**	**	*	*
Bessière et al 2013 (15)	*	*	*	*	*	**	*	*
Woodmass et al 2022 (20)	**	***	*	**	*	**	*	**
Waltenspül et al 2022 (21)	*	*	*	*	**	**	*	*
Rai et al 2021 (22)	**	**	*	*	*	**	*	**
Maman et al 2020 (23)	***	*	*	*	***	**	**	***
Xu et al 2019 (24)	**	*	*	*	**	*	*	**
Jeon et al 2018 (25)	**	**	*	*	**	**	*	**
Zimmerman et al 2016 (26)	***	**	*	*	**	*	*	***
Davey et al 2022 (27)	**	**	*	*	*	*	*	**
Rossi et al 2021 (28)	***	**	*	*	*	**	*	**
Perret et al 2021 (29)	***	**	*	*	*	**	*	**
Laboute et al 2021 (30)	*	*	*	*	**	**	*	**
Hurley et al 2021 (31)	**	*	*	*	*	*	*	*
Min et al 2023 (32)	***	**	**	*	*	**	*	***
Delgado et al 2024(16)	**	**	*	*	*	**	*	**

D1: Confounding bias, D2: Selection bias, D3: Classification of interventions, D4: Deviations from intended interventions bias, D5: Missing data bias, D6: Measurement of outcomes bias, and D7: selection of the reported result bias. * = Low risk, ** = Moderate risk and * = High risk.**

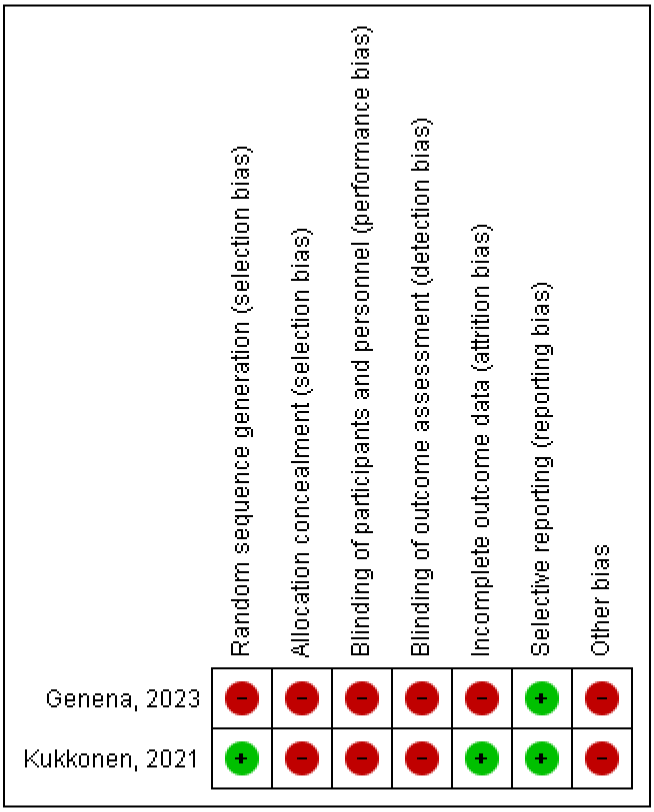

Figure 2. Risk of bias summary (ROB tool).

findings across non-athletes. However, the recurrence rate did not reach a statistically significant value among the athletes' group (RR = 2.42, 95% CI: 0.85, 6.89, P =0.1, Table 4**),** with high heterogeneity (P = 0.005, I^2 = 70%).

Additionally, upon performing subgroups based on age, the pooled analysis favoured the latarjet procedure in adults and adolescents (RR = 2.52, 95% CI: 1.52, 4.18, P =0.0003, and RR = 7.79, 95% CI: 2.54, 23.93, P =0.0003, respectively, **Table 4**.

We also noticed the superiority of OL over ABR in terms of recurrence rate (RR = 2.75, 95% CI: 1.66, 4.56, P < 0.0001, **Table 4**). However, the increased risk of recurrence among ABR did not reach the statistically significant value, not favoring either AL or ABR (RR = 6, 95% CI: 0.85, 42.39, P =0.07, **Table 4**).

2. Mean Time to Recurrence (years).

Five studies reported the mean time to recurrence, with the pooled analysis revealing no statistically significant difference between the Bankart repair and Latarjet procedures (RR = -0.27, 95% CI: -0.76, 0.21; P = 0.27, Figure 4). A high degree of heterogeneity was observed (P < 0.0001; I^2 = 90%, **Figure 4**).

Subgroup analyses showed varying results. Among non-athletes, the mean time to recurrence was longer in the Bankart group, but the difference was not statistically significant (RR = -0.53, 95% CI: -1.94, 0.88; P = 0.46, Table 4). Similarly, in the athlete subgroup, the pooled analysis revealed no significant difference between the two procedures (RR = -0.03, 95% CI: -0.34, 0.28; P = 0.85, Table 4).

Further subgroup analysis based on age demonstrated a significant difference favoring the Bankart repair among adolescents (one study) (RR = -2.0, 95% CI: -2.65, -1.35; P < 0.0001, Table 4). However, among adults, the mean time to recurrence did not differ significantly between the two interventions (RR = 0.02, 95% CI: -0.22, 0.26; P = 0.86, **Table 4**).

3. Revision for Instability

Across 11 studies, the pooled analysis revealed a significantly higher risk of revision for instability in the Bankart repair group compared to the Latarjet procedure (RR = 3.9, 95% CI: 1.74, 8.72; P = 0.0009), Figure 5). Moderate heterogeneity was observed (P = 0.07; I^2 = 41%, **Figure 5**).

Subgroup analyses highlighted a significant difference favouring the Latarjet procedure in the non-athlete population (RR = 5.67, 95% CI: 2.55, 12.57; P < 0.0001, Table 4). Conversely, in the athlete population, the difference in revision rates between Bankart and Latarjet was not statistically significant (RR = 2.35, 95% CI: 0.41, 13.55; P = 0.34, Table 4).

Subgroup analysis by age demonstrated that both adults and adolescents experienced higher revision rates with Bankart repair, with the pooled estimates favouring the Latarjet procedure in both groups. Among adults, the RR for revision was (RR= 3.45, 95% CI: 1.49, 7.99, p=0.004, Tab**le** 4), while in adolescents, the RR was substantially higher at (RR=11.51, 95% CI: 1.60, 83.03, p=0.02, Table 4).

When sub grouped by study design, the analysis revealed consistent findings favouring the Latarjet procedure. Cohort studies reported a RR of 3.83 (95% CI: 1.63, 9.04), p=0.002, **Table 4**, while RCTs showed a higher but not statistically significant RR of 6.67 (95% CI: 0.35, 126.36), P= 0.21, Table 4.

These findings indicate the superiority of the Latarjet procedure in reducing the need for revision surgeries, particularly in younger patients and across different study designs. However, the wide confidence interval in RCTs reflects a degree of uncertainty, likely due to the smaller number of included trials (one study).

Table 2. Summary of included studies.

Study ID	Country	Design	Group	Population	Sample size (shoulder)	Age, M (SD or range)	Male sex (%)	Follow-up (years)
Bessière et al 2014	France	Cohort study	ABR	Nonathletic	93	26.00 (14-45)	85 (91.4)	6
			OL		93	26.00 (16-46)	89 (95.7)	
Bessière et al 2013	France	Cohort study	ABR	Nonathletic	51	26.00 (14-45)	44 (86.3)	5
			OL		51	25.00 (16-45)	49 (96.1)	
Woodmass et al 2022	USA	Cohort study	ABR	Nonathletic	787	41.30 ± 16.80	518 (65.8)	2
			OL		75	32.80 ± 11.50	59 (78.7)	
Waltenspül et al 2022	Switzerland	Cohort study	ABR	Nonathletic (adolescents)	35	16.40 ± 1.60	19 (54.3)	12.2
			OL		31	16.70 ± 1.20	25 (80.6)	
Kukkonen et al 2022	Finland	RCT	ABR	Nonathletic (young males)	62	21.40 ± 2.70	62 (100)	2
			OL		59		59 (100)	
Rai et al 2021	Nepal	Cohort study	ABR	Nonathletic	41	28.80 ± 10.35	32 (78)	2.7
			OL		40	27.10 ± 70	34 (85)	
Maman et al 2020	Israel	Cohort study	ABR	Nonathletic	215	24.90 (15-40)	191 (88.8)	7.8
			OL		27	29.20 (19-40)	25 (92.6)	
Xu et al 2019	China	Cohort study	ABR	Nonathletic	53	29.80 ± 4.31	33 (62.3)	4.8
			OL		52	31.20 ± 6.12	34 (65.4)	
Jeon et al 2018	Korea	Cohort study	ABR	Nonathletic	118	25.60 ± 5.10	104 (88.1)	2.4
			OL		31	27.40 ± 50	26 (83.9)	
Zimmerman et al 2016	Switzerland	Cohort study	ABR	Nonathletic	271	28.20 ± 11.30	67 (24.8)	10
			OL		93	30.80 ± 11.40	88 (94.6)	
Davey et al 2022	Ireland	Cohort study	ABR	Athletes	103	24.70 ± 7.30	98 (95.1)	4.2
			OL		97	23.10 ± 4.80	96 (98.9)	
Rossi et al 2021	Argentina	Cohort study	ABR	Athletes	80	23.90 (16-33)	80 (100)	3.3
			OL		50	24.70 (16-31)	50 (100)	
Perret et al 2021	Australia	Cohort study	ABR	Athletes	58	22.80 (18-33)	58 (100)	9.5
			OL		32	23.50 (13-30)	32 (100)	
Laboute et al 2021	France	Cohort study	ABR	Athletes	39	24.30 ± 4.00	35 (89.7)	4
			OL		80	22.90 ± 3.60	73 (91.3)	
Hurley et al 2021	Ireland	Cohort study	ABR	Athletes	80	26.70 ± 8	76 (95)	4
			OL		40	26.40 ± 9	38 (95)	
Hurley et al 2021 (2)	Ireland	Cohort study	ABR	Athletes	62	22.10 ± 4.20	62 (100)	4
			OL		62	22.10 ± 4.90	62 (100)	
Min et al 2023	USA	Cohort study	ABR	Nonathletic	25	26.40 ± 5.40	23 (92)	3.5
			OL		23	25.20 ± 5.10	22 (95.7)	
Genena et al 2023	Egypt	RCT	ABR	Nonathletic	15	28.6 (18-41)	15 (100)	1.1
			OL		15		15 (100)	
Ghayyad et al 2024	Iran	Cohort study	ABR	Nonathletic	66	34.90 ± 9.30	54 (81.9)	4.8
			OL		67		64 (95.5)	
Delgado et al 2024	Spain	Cohort study	ABR	Nonathletic (adolescents)	34	16 (11-18)	30 (88.2)	9
			AL		17	16 (14-19)	17 (100)	

RCT: randomized controlled trial; M: mean; SD: standard deviation, ABR: arthroscopic Bankart repair, OL: open Latarjet and AL: arthroscopic Latarjet.

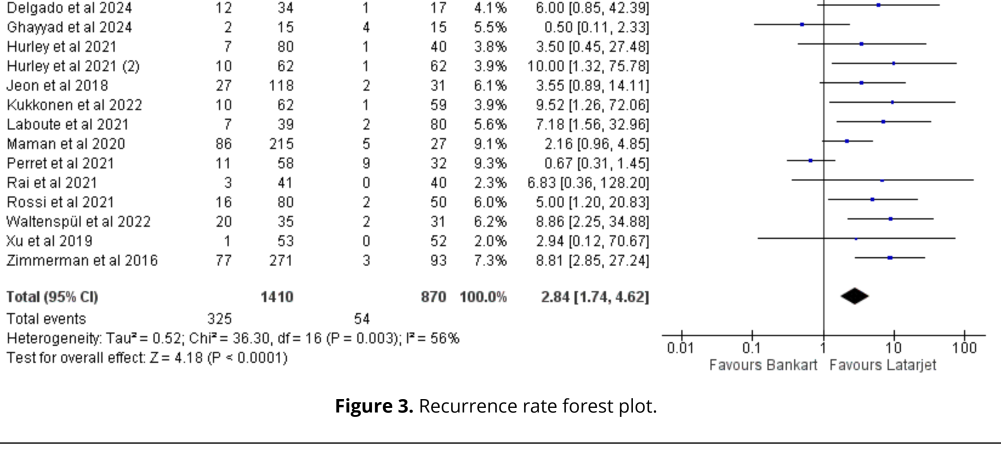

Figure 3. Recurrence rate forest plot.

Table 3. Patient reported outcomes.

Study ID	Group	Recurrence, %	Mean time to recurrence, years	Revisions for instability, n	Rowe score, mean±SD	SSV, mean ± SD	VAS pain score (last follow-up), mean ± SD	ASES score, mean ± SD	Return to sport (RTS)	RTS time, months	Total complication, %
Bessière et al 2014	ABR	20 (21.5)		6	68 ± 15.8	87.00 ± 15					6 (6.45)
	OL	9 (9.6)		2	78 ± 15	90.00 ± 11.7					7 (7.52)
Bessière et al 2013	ABR	12 (23.5)	2.10 ±1.21	2		87.70 ± 22.5	2.10 ± 1.75	88.00 ± 8.5	32\49 (65)		0
	OL	6 (11.7)	1.90 ± 1.5	1		90.90 ± 17.5	1.62 ±1.25	85.00 ± 13	36\50 (72)		2 (3.92)
Woodmass et al 2022	ABR						1.22 ± 1.84	88.06 ± 15.61			
	OL						0.71 ± 1.10	92.25 ± 10.16			
Waltenspül et al 2022	ABR	20 (57.1)	4.00 ± 1.44	13		85.90 ± 17.40		91.50 ± 13.6			2 (5.71)
	OL	2 (6.4)	6.00 ± 1.25	1		86.20 ± 16.60		93.0 ± 9.3			4 (12.9)
Kukkonen et al 2022	ABR	10 (16.1)		3		87.50 ± 4.2					0
	OL	1 (1.7)		0		82.50 ± 4.5					0
Rai et al 2021	ABR	3 (7.3)		2	84.15 ± 19.55 (20-100)			85.37 ± 10.83			0
	OL	0		0	89.23 ± 16.24 (35-100)			87.43 ± 10.31			2 (5)
Maman et al 2020	ABR	86 (40)		5		84.80 ±13.3	1.8	86			7 (3.2)
	OL	5 (18.5)		0		81.50 ±15	1.3	91.2			1 (3.7)
Xu et al 2019	ABR	1 (1.9)			92.36 ± 1.51	50.00 ± 22.5		92.12 ± 1.83			2 (3.7)
	OL	0			96.23 ± 2.10	50.00 ±17.5		91.54 ± 2.38			2 (3.8)
Jeon et al 2018	ABR	27 (22.9)		23	90.90 ± 15.40		0.60 ± 0.70				
	OL	2 (6.4)		0	91.10 ± 16.10		0.70 ± 0.70				
Zimmerman et al 2016	ABR	77 (28.4)	2.72 ± 3.00	57		82.04 ± 17.02					2 (0.7)
	OL	3 (3.2)	2.51 ± 2.85	1		88.77 ± 14.63					3 (3.22)
Davey et al 2022	ABR	4 (3.9)	1.48 ± 0.28	5		86.50 ± 19.20	1.70 ± 1.90				3 (2.9)
	OL	6 (6.1)	1.64 ± 0.36	8		85.90 ± 14.40	2.10 ± 2.00				2 (2.06)
Rossi et al 2021	ABR	16 (20)		13	89.70 ± 19						3 (3.75)
	OL	2 (4)		2	88.40 ± 25						3 (6)
Perret et al 2021	ABR	11 (19)		11					50\58 (86.2)	10.85 ± 2.06	1 (1.72)
	OL	0		0					26\32 (81.3)	10.55 ± 7.23	5 (15.62)
Hurley et al 2021	ABR	7 (8.75)			80.10 ± 19	84.80 ± 17.40	2.40 ± 2.20		65\80 (81.3)	6.4 ± 2.7	0
	OL	1 (2.5)			87.60 ± 13.10	85.30 ± 12.00	1.90 ± 1.80		32\40 (80)	5.9 + 2.5	0
Hurley et al 2021 (2)	ABR	10 (16.1)			82.20 ± 20.80	83.80 ± 21.70	1.40 ± 1.60		53\62 (88.3)	5.6 ± 2.2	
	OL	1 (1.61)			90.50 ± 12.20	87.60 ± 13.20	1.80 ± 1.80		58\62 (93.5)	5.5 ± 2.7	
Genena et al 2023	ABR	0			74 ± 18.80						
	OL	0			85.30 ± 15.80						
Ghayyad et al 2024	ABR	2 (3)									0
	OL	4 (6)									0
Laboute et al 2021	ABR	7 (17.9)	1.20±0.76						30\34 (88.2%)	6.4 ± 2.3, n=33	0
	OL	2 (2.5)	1.04±0.77						72\74 (97.3%)	5.1 ± 2.4, n=76	0
Delgado et al 2024	ABR	12 (35.3)		8	68.3±69.7	66.7±69.7			29\34 (85.3%)		0
	AL	1 (5.9)		1	83.3±36.4	83.3±24.3			16\17 (94.1%)		0
Min et al 2023	ABR										0
	OL										2 (8.69)

VAS, visual analog scale; ASES, American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form; SSV, Subjective Shoulder Value; SD, standard deviation ABR: arthroscopic Bankart repair, OL: open Latarjet and AL: arthroscopic Latarjet.

Table 4. Subgroup of outcomes.

Outcome	Subgroup	(RR or MD and 95% CI)
Recurrence rate	**Non-athletes**	**(3.14 (1.93, 5.11, P < 0.0001)**
	Athletes	**(2.42 (0.85, 6.89, P =0.1)**
	Adults	**(2.52 (1.52, 4.18, P =0.0003)**
	Adolescents	**(7.79 (2.54, 23.93, P =0.0003)**
	ABR vs OL	**(2.75 (1.66, 4.56, P < 0.0001)**
	ABR vs AL	**(6 (0.85, 42.39, P =0.07)**
Mean Time to Recurrence (years).	**Non-athletes**	**(-0.53 (-1.94, 0.88; P = 0.46)**
	Athletes	**(-0.03 (-0.34, 0.28; P = 0.85)**
	Adults	**(0.02 (-0.22, 0.26; P = 0.86)**
	Adolescents	**(-2.0 (-2.65, -1.35; P < 0.0001)**
Revision for Instability	**Non-athletes**	**(5.67 (2.55, 12.57; P < 0.0001)**
	Athletes	**(2.35 (0.41, 13.55; P = 0.34)**
	Adults	**(3.45 (1.49, 7.99, p=0.004)**
	Adolescents	**(11.51 (1.60, 83.03, p=0.02)**
	Cohort Studies	**(3.83 (1.63, 9.04, p= 0.002)**
	RCTs	**(6.67 (0.35, 126.36, P= 0.21)**
Rowe score	**ABR vs OL**	**(-4.43 (-7.17 to -1.68, p=0.002)**
	ABR vs AL	**(-15.00 (-44.13, 14.13, p=0.31)**
	Cohort Studies	**(-4.23 (-6.98, -1.49, p=0.003)**
	RCTs	**(-11.30 (-23.73, 1.13, p=0.07)**
	Non-athletes	**(-5.47 (-8.85, -2.10, p=0.001)**
	Athletes	**(-2.41 (-8.66, 3.84, p=0.45)**
ASES score	**Adults**	**(-0.74 (-3.72, 2.24, p=0.63)**
	Adolescents	**(-1.50 (-7.07, 4.07, p=0.60)**
SSV score	**Adults**	**(-0.82 (-4.43, 2.79, p=0.66)**
	Adolescents	**(-3.54 (-16.29, 9.21, p=0.59)**
	Cohort Studies	**(-2.07 (-4.32, 0.19, p=0.07)**
	RCTs	**(5.00, (3.45, 6.55, p<0.00001)**
	Non-athletes	**(-1.07 (-5.62, 3.49, p=0.65)**
	Athletes	**(-0.81 (-3.88, 2.27, p=0.61)**
VAS score	**Non-athletes**	**(0.27 (-0.18, 0.73, p=0.24)**
	Athletes	**(-0.15 (-0.68, 0.39, p=0.59)**
RTS rate	**Non-athletes**	**(0.91 (0.78,1.05, p=0.20)**
	Athletes	**(0.95 (0.88, 1.02, p=0.15)**
	ABR vs OL	**(0.94 (0.88, 1.01, p=0.11)**
	ABR vs AL	**(0.91 (0.75,1.09, p=0.29)**
Total complications	**Non-athletes**	**(0.54 (0.29,1.03, p=0.06)**
	Athletes	**(0.51(0.13,1.97, p=0.33)**

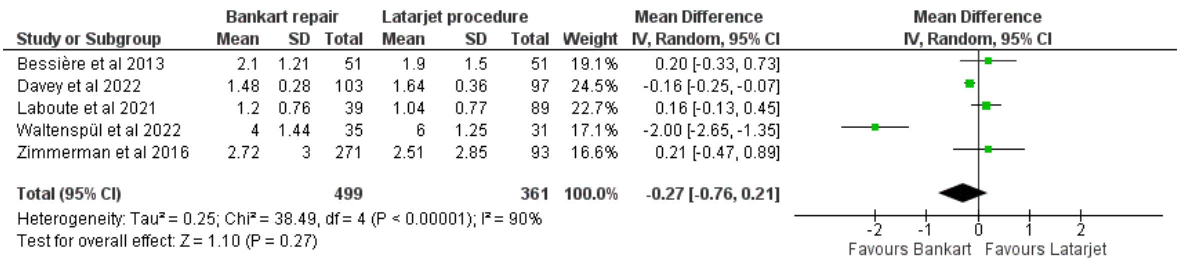

Figure 4. Mean time to recurrence forest plot.

Clinical scores

1) **Rowe score**

Across nine studies, the pooled analysis of the Rowe score demonstrated a significant overall MD of -4.51 (95% CI: -7.21 to -1.82, p=0.001, Figure 6), favouring the Latarjet procedure over the Bankart repair. However, moderate heterogeneity was observed among the studies (heterogeneity: p=0.04, I^2=51%, **Figure 6**).

Subgroup analyses were conducted to explore potential sources of heterogeneity:

ABR vs OL: The pooled MD was -4.43 (95% CI: -7.17 to -1.68, p=0.002, **Table 4**), favoring OL over ABR.

ABR) vs AL: The analysis revealed a non-significant MD of -15.00 (95% CI: -44.13 to 14.13, p=0.31, **Table 4**).

When studies were categorized based on study design:

Cohort Studies: A significant MD of -4.23 (95% CI: -6.98 to -1.49, p=0.003, **Table 4**) was observed.

RCTs: The MD was -11.30 (95% CI: -23.73 to 1.13, p=0.07, **Table 4**), which did not reach statistical significance.

Subgroup analyses based on population activity levels demonstrated the following:

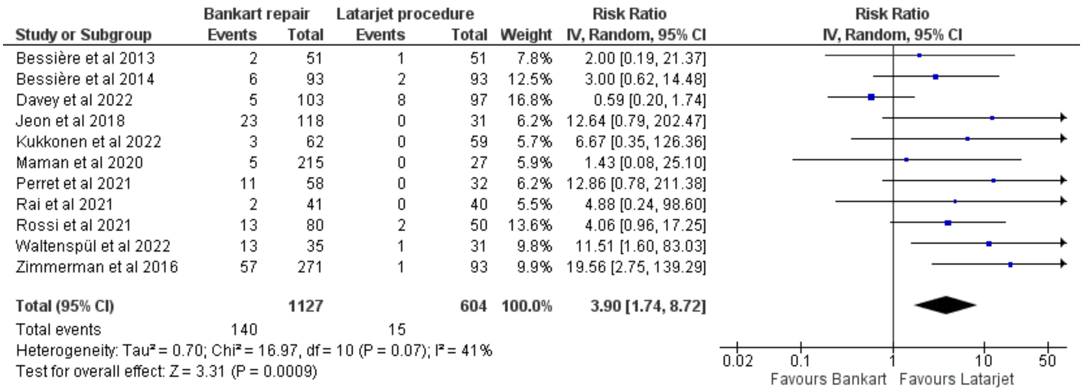

Figure 5. Revision for instability forest plot.

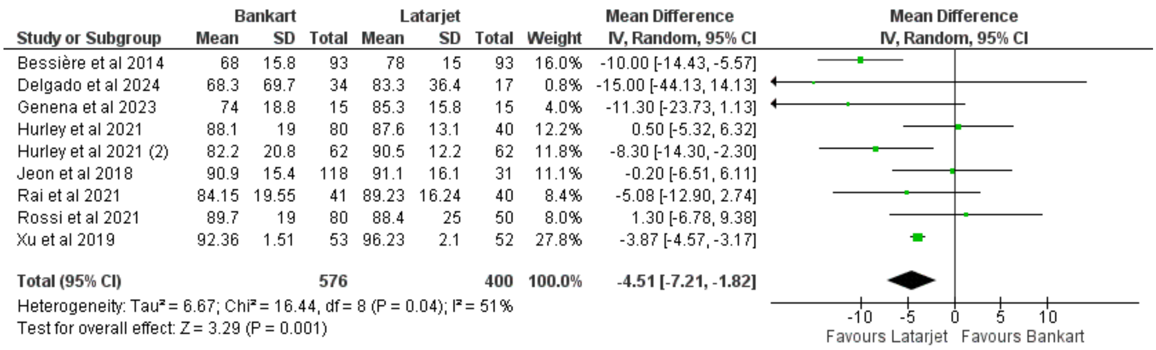

Figure 6. Rowe score forest plot.

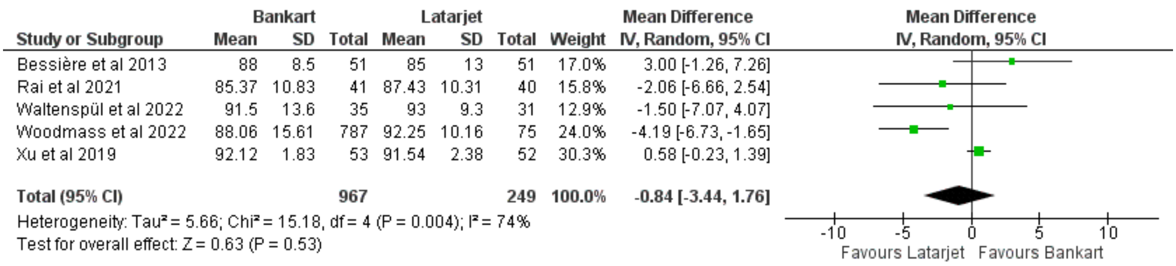

Figure 7. ASES score forest plot.

Non-Athletes: The MD was -5.47 (95% CI: -8.85 to -2.10, p=0.001, **Table 4**), favoring the Latarjet procedure.

Athletes: The MD was -2.41 (95% CI: -8.66 to 3.84, p=0.45, **Table 4**), indicating no statistically significant difference between the two procedures.

2) ASES Score

The pooled analysis of the ASES (American Shoulder and Elbow Surgeons) score among five studies revealed an overall MD of -0.84 (95% CI: -3.44 to 1.76, p=0.53, Figure 7), indicating no statistically significant difference between the Bankart and Latarjet procedures. However, Considerable heterogeneity was observed among the included studies (heterogeneity: p=0.004, I^2=74%, **Figure 7**), suggesting variability among studies.

Subgroup analysis based on age groups yielded the following results:

Adults: The MD was -0.74 (95% CI: -3.72 to 2.24, p=0.63, **Table 4**), which was not statistically significant.

Adolescents: Similarly, the analysis revealed a MD of -1.50 (95% CI: -7.07 to 4.07, p=0.60, **Table 4**), also indicating no significant difference between the procedures.

3) SSV Score

The pooled analysis of the SSV (Subjective Shoulder Value) score showed an overall MD of -1.01 (95% CI: -4.40 to 2.37, p=0.56, **Figure 8**), demonstrating no significant difference between the two procedures. High heterogeneity was observed among the studies (heterogeneity: p<0.00001, I^2=81%, **Figure 8**).

Subgroup analyses were conducted to explore potential sources of heterogeneity:

Age-Based Analysis:

Adults: The MD was -0.82 (95% CI: -4.43 to 2.79, p=0.66, **Table 4**), indicating no significant difference.

Adolescents: The analysis revealed a MD of -3.54 (95% CI: -16.29 to 9.21, p=0.59, **Table 4**), also showing no significant difference.

Study Design:

Cohort Studies: The MD was -2.07 (95% CI: -4.32 to 0.19, p=0.07, **Table 4**), which approached but did not reach statistical significance.

RCTs: In contrast, RCTs demonstrated a significant MD of 5.00 (95% CI: 3.45 to 6.55, p<0.00001, **Table 4**), favouring Bankart over Latarjet repair. However, the subgroup included only one study.

Population Activity Levels:

Non-Athletes: The MD was -1.07 (95% CI: -5.62 to 3.49, p=0.65, Table **4**), showing no significant difference.

Athletes: Similarly, the MD was -0.81 (95% CI: -3.88 to 2.27, p=0.61, **Table 4**), indicating no significant difference.

4) VAS Score Analysis

The pooled analysis of six studies reported the VAS (Visual Analog Scale) score revealed a MD of 0.10 (95% CI: -0.26 to 0.45, p=0.59, Figure 9), indicating no statistically significant difference in pain outcomes between the two procedures. Moderate heterogeneity was observed among the studies (heterogeneity: p=0.002, I^2=73%, **Figure 9**).

Subgroup analyses based on population activity levels yielded the following results:

Non-Athletes: The MD was 0.27 (95% CI: -0.18 to 0.73, p=0.24, Table 4), which was not statistically significant.

Athletes: The analysis revealed a MD of -0.15 (95% CI: -0.68 to 0.39, p=0.59, Table 4), also indicating no significant difference.

Return to sports outcomes

- **Return to sports (RTS) rate**

The pooled analysis of RTS rates revealed an overall RR of 0.94 (95% CI: 0.88 to 1.00, p=0.06, **Figure 10**), indicating that the difference between the Bankart and Latarjet procedures approached but did not reach statistical significance. The analysis demonstrated no heterogeneity among the included studies (heterogeneity: p=0.72, I^2=0%, **Figure 10**).

Subgroup analyses explored variations based on activity level and surgical comparisons:

Activity Level Subgroups:

Non-Athletes: The RR was 0.91 (95% CI: 0.78 to 1.05, p=0.20, Table 4), showing no statistically significant difference in RTS rates between the procedures.

Athletes: The RR was 0.95 (95% CI: 0.88 to 1.02, p=0.15, Table 4), similarly indicating no significant difference.

Surgical Comparisons:

ABR vs. OL: The RR was 0.94 (95% CI: 0.88 to 1.01, p=0.11**Table 4**), suggesting no significant difference.

ABR vs. AL: The RR was 0.91 (95% CI: 0.75 to 1.09, p=0.29, **Table 4**), also indicating no significant difference.

2) RTS time (Months)

The pooled analysis of RTS time observed in four studies showed a statistically significant MD of 0.60 months (95% CI: 0.08 to 1.12, p=0.02, Figure 11), with patients undergoing the Bankart repair requiring a slightly longer time to return to sports compared to those receiving the Latarjet procedure. Low heterogeneity was observed in this analysis (heterogeneity: p=0.33, I^2=12%, **Figure 11**).

Total Complications Outcome

The pooled analysis of total complications across 11 studies demonstrated an overall RR of 0.54 (95% CI: 0.32 to 0.93, p=0.03, Figure 12), favoring the Bankart

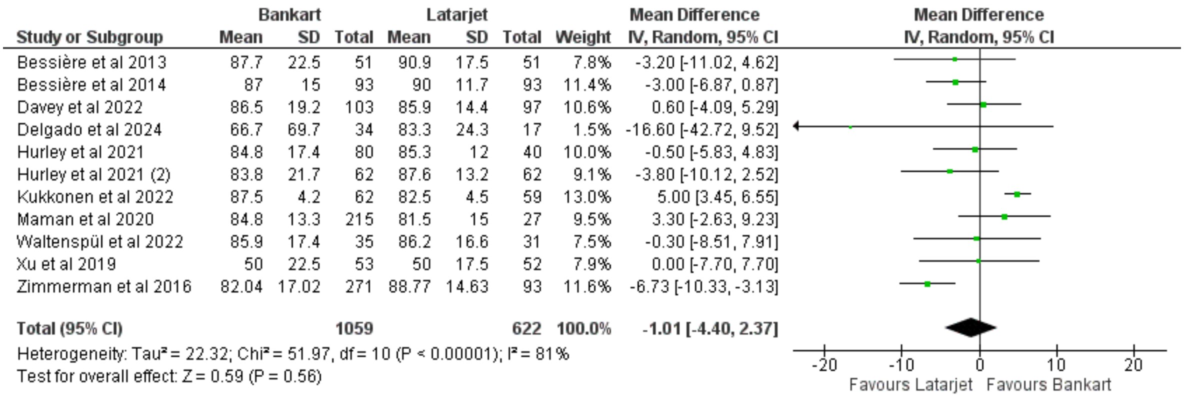

Figure 8. SSV score forest plot.

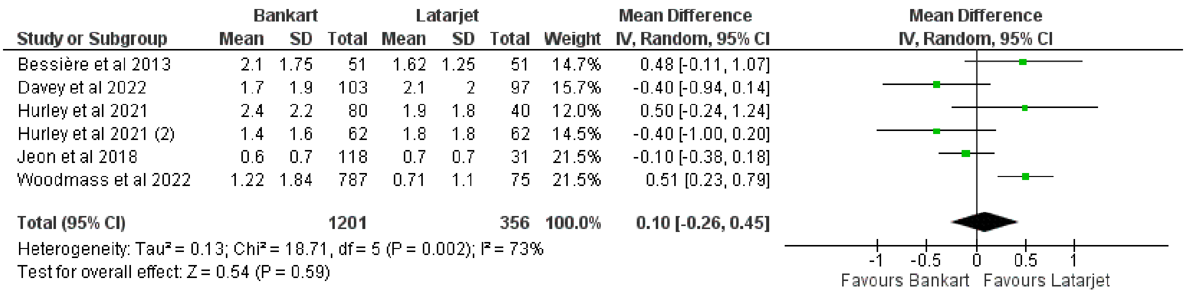

Figure 9. VAS score forest plot.

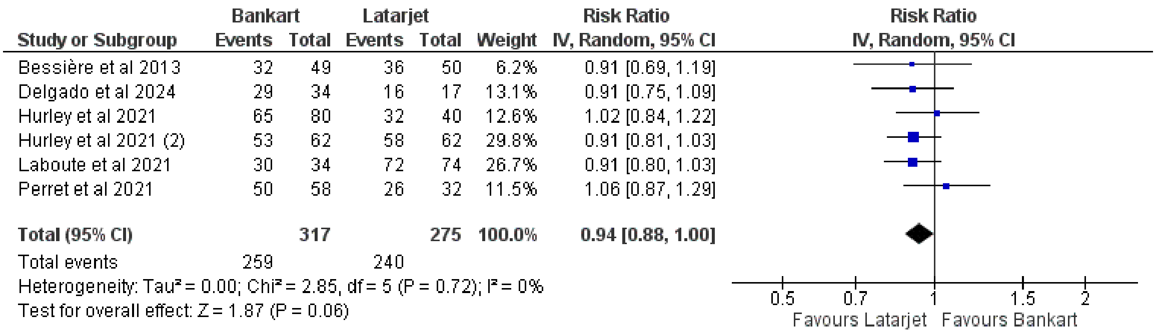

Figure 10. RTS rate forest plot.

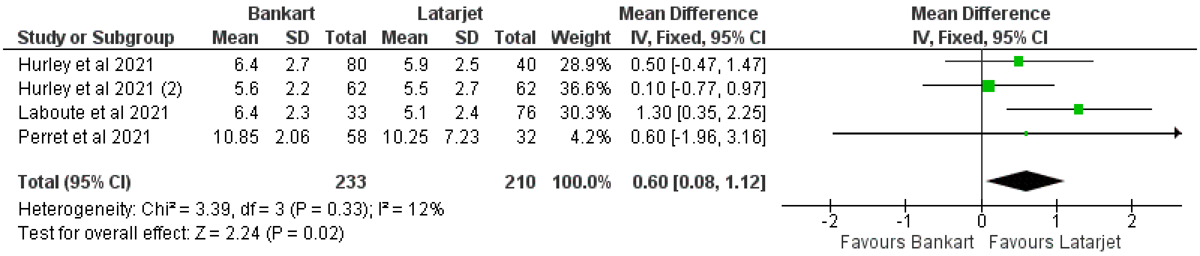

Figure 11. RTS time forest plot.

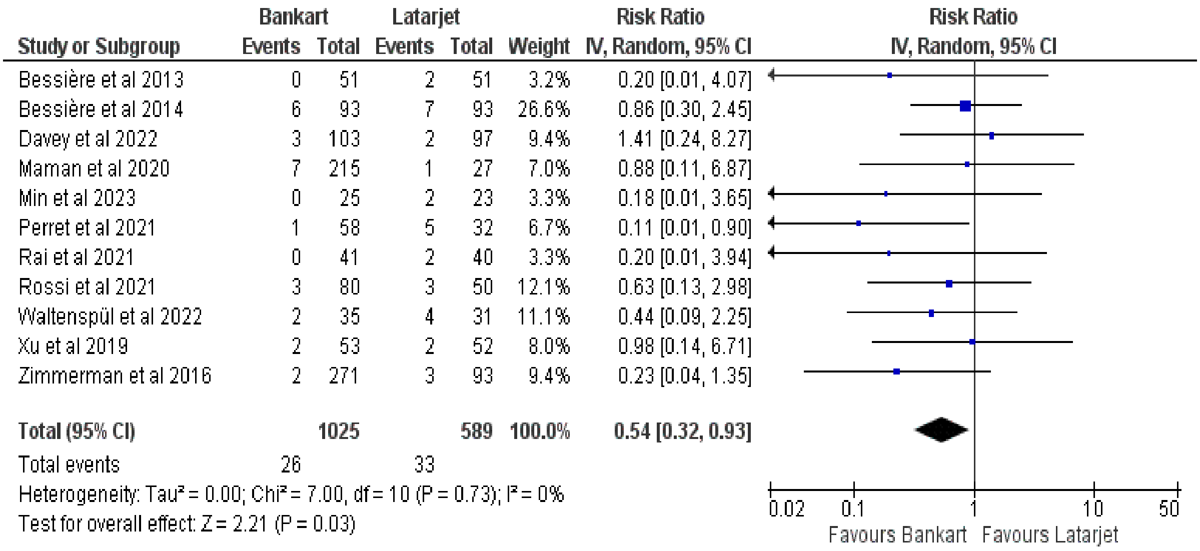

Figure 12. Total complications forest plot.

repair over Latarjet procedure, with a significantly lower risk of complications. No heterogeneity was observed in this analysis (heterogeneity: p=0.73, I²=0%, **Figure 12**).

Subgroup analyses provided additional insights:

Activity Level Subgroups:

Non-Athletes: The RR was 0.54 (95% CI: 0.29 to 1.03, p=0.06, **Table 4**), showing a trend toward fewer complications with the Latarjet procedure, though not reaching statistical significance.

Athletes: The RR was 0.51 (95% CI: 0.13 to 1.97, p=0.33, **Table 4**), indicating no statistically significant difference in complication rates between the procedures.

Discussion

In this study, we comprehensively assessed the implementation of ABR vs. OL and AL across different populations. Recurrence rate and revision for instability favoured the Latarjet procedure, while mean time to recurrence did not favour either of the interventions, except in one study of adolescents, which favoured the Bankart repair. Additionally, ASES, SSV, and VAS scores were not in favour of both of the comparators, whereas Rowe score favoured the Latarjet. We also noticed the shorter time required in RTS with Latarjet. In addition to that, Bankart repair had a lower RTS rate despite the insignificant statistics. The study also revealed more complications in the Latarjet, favouring the ABR.

These findings can be attributed to the established bony block of the coracoid process transfer and the sling action of its tendon, providing stability upon performing the Latarjet procedure and resulting in less recurrence, shorter RTS time, and higher Rowe scores. Additionally, the invasive nature of the OL in the majority of studies justified the noticed higher total complications, underscoring the need for postoperative monitoring to mitigate that risk. These findings also showed that non-athletes can benefit more from ABR, potentially because of less shoulder function demand they need. This underscores the importance of tailoring the intervention according to the patient's situation.

The subgroup analysis revealed some notable trends in specific populations. Adolescents showed a significantly higher recurrence rate and revision for instability compared to adults. This is back to the higher physical activity they exert, suggesting the vulnerability of younger patients to poorer outcomes. These findings call for additional support and consideration of age and activity level when tailoring surgical interventions. Additionally, the higher recurrence rates observed in athletes underscore the importance of postoperative rehabilitation for better long-term optimization of outcomes. Nevertheless, the Latarjet procedure came in favor of the athlete group in terms of all the patient-reported outcomes, even with the complications outcome.

In comparison with the previous literature, Vinh Gia An et al (33). conducted the first comparison between Bankart repair (both arthroscopic and open) vs. OL through six studies. They found less recurrence and a higher Rowe score in favour of OL, agreeing with our results. They also reported consistent findings regarding the higher complications rate in Bankart repair. In the same line, Imam et al (34). revealed over the long term the low rate of recurrence and radiolocation in the Latarjet group. However, Rowe score, hematoma, and revision for instability were not statistically significant. These differences can be justified by several reasons, including the low sample size resulting from low included studies and the various versions of available Rowe scores, with no study reporting which one was used. They also reported a higher infection in the Latarjet group, revealing a consistent finding with the known screw-related infections and complications. At a broader scope, comparing AL to arthroscopic bony Bankart repair, which is a modified version of ABR, revealed over 29 studies the superiority of AL in terms of instability recurrence and union rates in spite of the indifference reported in other outcomes (35). Additionally, the Bankart lesion (injury to the anterior labrum), along with a Hill-Sachs lesion (posterior humeral head bone defect), was the point of investigation of Schrouff et al. in which Bankart repair with remplissage was compared against the Latarjet procedure (36). They found equal instability recurrence between the two groups if the Hill-Sachs lesion depth was <10 mm. This suggests that patient-specific factors, such as the extent of bone loss and lesion characteristics, should guide the choice of surgical technique. Overall, these findings pointed to the association of demographic, anatomical, and activity-related factors with the resulting outcome, calling for an individualized approach when dealing with each case.

This study approached the literature in detail, providing a thrilling investigation of the debated comparison between Bankart repair and the Latarjet procedure. It also processed their reported outcomes in different scenarios and populations, providing evidence-based recommendations for healthcare workers. However, we acknowledged several limitations. First, significant heterogeneity is noted among the included studies concerning patient demographics, surgical techniques, and follow-up durations that could lessen the generalizability and significance of the findings. Furthermore, a limited number of studies were included regarding some subgroups, such as adolescents and athletes, which could lead to lower analysis power. Additionally, the lack of standardized outcome measures, such as differences in functional scoring systems (e.g., Rowe, ASES, and VAS) and definitions of recurrence, adds variability to the reported outcomes, complicating direct comparisons. Short follow-up durations in several studies limit the ability to assess long-term outcomes, such as the durability of the repairs and the incidence of late complications. Moreover, the evidence base relies heavily on observational studies, with few high-quality RCTs, introducing a risk of bias. Lastly, while this analysis focused on the Bankart repair and Latarjet procedure, it did not extensively explore other surgical techniques, such as arthroscopic methods combined with remplissage, which may offer alternative solutions for specific patient groups.

Conclusion

This meta-analysis provides valuable insights into the comparative outcomes of the Bankart repair and Latarjet procedure for managing anterior shoulder instability. The findings highlight the strengths and limitations of each approach, underscoring the importance of patient-specific factors, such as age, activity level, and the presence of glenoid bone loss, in guiding surgical decision-making. While the Latarjet procedure demonstrated superior results in reducing recurrence rates and providing structural stability, the Bankart repair offered advantages in terms of preserving anatomy and minimizing complications, making it a favorable choice for patients without significant bony defects. However, the limitations of the current evidence, including study heterogeneity, short follow-up durations, and the lack of standardized outcome measures, warrant caution in generalizing these findings. Future research should prioritize high-quality randomized controlled trials with longer follow-up periods and standardized outcomes reporting. Additionally, exploring alternative techniques and optimizing patient selection criteria could further refine treatment strategies for anterior shoulder instability. Ultimately, this study underscores the need for a personalized approach to surgical management, balancing the risks and benefits of each procedure to achieve optimal patient outcomes.

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