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Arthroscopic Bankart Repair with All Suture Anchors as Treatment of Anterior Shoulder Instability

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ABSTRACT

Background: Arthroscopic Bankart repair is the preferred surgical treatment for recurrent anterior shoulder instability. The development of all-suture anchors aims to reduce invasiveness, preserve bone stock, and facilitate revision options.

Aims: To assess short- and mid-term clinical outcomes of arthroscopic Bankart repair using exclusively all-suture anchors, focusing on recurrence of instability, functional recovery, and safety.

Methods: We retrospectively reviewed 53 patients who underwent arthroscopic Bankart repair with all-suture anchors between 2010 and 2024. The primary outcome was recurrent instability (dislocation or subluxation). Secondary outcomes included pain assessed by visual analogue scale, range of motion, functional recovery using the Rowe score, and need for revision surgery. The use of adjunctive procedures (rotator interval closure, remplissage) was documented. Comparative analyses were performed using nonparametric tests, with significance set at $p < 0.05$.

Results: The median follow-up was 8 months (range, 4–94 months). Redislocation occurred in 4 patients (7.5%) and subluxation in 2 (3.8%); 3 patients (5.7%) required revision surgery. The median Rowe score improved from 30 preoperatively to 100 at final follow-up ($p<0.01$), with 88.6% of patients achieving excellent outcomes. Pain scores decreased significantly (median visual analogue scale from 7 to 0; $p<0.01$). Most patients recovered near-full range of motion, and return to sports was achieved at a median of 24 weeks. No anchor-related complications were observed.

Conclusion: Arthroscopic Bankart repair using all-suture anchors provides excellent functional outcomes, significant pain reduction, and low recurrence rates in short- and mid-term follow-up, confirming this technique as a safe and effective option for anterior shoulder instability.

Keywords: Bankart Lesion; Arthroscopy; Shoulder Dislocation; Suture Anchors; Shoulder Instability

Introduction

Anterior shoulder instability is a common and debilitating condition, particularly affecting young, active individuals and athletes. The risk of recurrence after a first-time traumatic anterior shoulder dislocation is strongly influenced by age and activity level, with reported rates as high as 70–90% in adolescents and young adults managed non-operatively [1–3]. Beyond recurrent dislocation, patients often experience persistent pain, apprehension, and functional impairment that can negatively impact sports participation and quality of life [1,2]. If not addressed, repeated instability episodes predispose to cartilage injury, progressive capsulolabral insufficiency, and ultimately glenohumeral osteoarthritis [1,2]. The underlying pathology most frequently involves avulsion of the anteroinferior labrum from the glenoid rim (Bankart lesion), compromising both the labral bumper effect and the capsuloligamentous stabilizers [1,2,4]. Surgical repair of the Bankart lesion remains the mainstay of treatment for patients with recurrent instability and for selected individuals at high risk of recurrence after first-time dislocation [2,3,5,6].

Historically, open Bankart repair was considered the gold standard due to its durability and low recurrence rates; however, with advances in arthroscopy, minimally invasive techniques have become increasingly favored. Arthroscopic Bankart repair (ABR) offers advantages such as smaller incisions, reduced morbidity, faster recovery, and the ability to manage concomitant intra-articular lesions [1,3,7,8]. While early arthroscopic methods were associated with higher recurrence rates compared to open procedures, improvements in surgical technique, patient selection, and fixation devices have resulted in outcomes comparable to open repair [1,6–9]. Consequently, ABR is now widely accepted as a reliable and reproducible method for anterior shoulder stabilization [3,8–11].

Implant technology has been central to these improvements. Traditional metallic and bioabsorbable anchors provide strong fixation but carry risks including implant migration, chondral injury, cyst formation, and imaging artifacts [8,12,13]. All-suture anchors, introduced more recently, were designed to minimize these complications. Their smaller drill holes reduce bone loss, preserve glenoid stock for potential revision surgery, and avoid hardware-related morbidity [8,12–15].

Biomechanical studies demonstrate that all-suture anchors provide fixation strength comparable to metallic and bioabsorbable anchors [3,14,16,17], while clinical series have shown favorable functional outcomes, low complication rates, and satisfactory mid-term recurrence profiles [15,18–21]. An additional advantage is the ability to maximize anchor density along the glenoid rim, which may enhance stability, particularly in patients with capsulolabral laxity [8,13,14].

Nevertheless, the use of all-suture anchors requires technical precision to achieve secure knot tying and appropriate capsulolabral tensioning [14,22]. Furthermore, outcomes are influenced by patient-related variables such as age, activity level, and the presence of associated bone or soft-tissue lesions [10,23,24]. Adjunctive techniques, such as remplissage for engaging Hill-Sachs lesions or rotator interval closure in cases of capsular redundancy, may further augment repair strength in carefully selected patients [25–31]. Despite the growing adoption of all-suture anchors, questions remain regarding their long-term durability, optimal indications, and predictors of failure.

Given these knowledge gaps, robust clinical evidence is needed to inform surgical decision-making. The aim of this study was therefore to evaluate the short- and mid-term outcomes of arthroscopic Bankart repair performed exclusively with all-suture anchors in patients with anterior shoulder instability, with specific emphasis on recurrence, functional recovery, pain relief, and the need for revision surgery.

Methods

PATIENTS

Following approval by our institutional review board (IRB), we conducted a retrospective review of clinical data of consecutive patients who underwent outpatient arthroscopic Bankart repair using exclusively all-suture anchors for anterior shoulder instability between 2010 and 2024 at a medium-complexity specialized private practice. The senior author performed all procedures.

Clinical records of patients of any age and sex were eligible for inclusion if they had undergone arthroscopic repair and completed at least one postoperative follow-up visit a minimum of 4 months after surgery. The diagnosis of primary anterior shoulder instability requiring repair was confirmed preoperatively using computed tomography (CT) or magnetic resonance imaging (MRI). Patients were not eligible for the procedure if they presented with circumferential (pan-labral) tears, had undergone revision procedures for recurrent instability. Incomplete clinical records were not considered for this analysis.

SURGICAL TECHNIQUE AND REHABILITATION PROTOCOL

With the patient in the lateral decubitus position, a standard posterior portal is established to perform diagnostic arthroscopy. Two additional portals are then created, mid-glenoid and anterosuperior, under needle localization. The mid-glenoid portal is positioned along the superior border of the subscapularis tendon with a 15–20° angle of attack, facilitating placement of the initial anchor at the 6 o'clock glenoid position. The anterosuperior portal is created anterior to the long head of the biceps, allowing placement of the cannula along the anterior glenoid margin and parallel to the articular surface.

Subsequently, the arthroscope is switched to the anterosuperior portal, and a cannula is placed posteriorly. When indicated, Hill-Sachs lesions are debrided through this portal, followed by insertion of a knotless Peek anchor (Quattro® Link Knotless Anchors, Zimmer Biomet) and completion of remplissage using a mattress suture tied at the end of the procedure.

The anterior labrum is mobilized to the 6 o'clock position until the subscapularis belly is visualized. A guidewire is introduced through the anterior portal to the 6 o'clock glenoid position for placement of the first all-suture anchor. Capsular plication of the axillary recess is performed approximately 10 mm from the free capsule edge using Sixter forceps (TAG Medical Products Corporation Ltd. and Prof. Ofer Levy). Depending on the pathology, additional anchors are placed at the 7 o'clock (right shoulder) or 5 o'clock (left shoulder) positions, or a double-anchor construct is used at the 6 o'clock position. Anchors are further placed sequentially at the 5 o'clock and 4 o'clock positions with oblique mattress sutures. Additional fixation, when required, is performed with single-suture anchors, ensuring a "south-to-north" tensioning vector to reinforce the anterior band of the inferior glenohumeral ligament.

In patients with open rotator interval or signs of laxity, interval closure is performed percutaneously near the glenoid using the technique described by Stokes et al.[26]. All portals are closed conventionally with single sutures.
Postoperative rehabilitation consists of sling immobilization for 4–5 weeks. At 8 days, sutures are removed and passive range of motion (ROM) initiated (flexion up to 90° and external rotation to neutral). At 4–5 weeks, the sling is discontinued, and active ROM is allowed with progressive stretching in flexion, external rotation, and internal rotation at 90° of abduction. At 12 weeks, supervised physiotherapy begins, focusing on strengthening and proprioception, while sport-specific training is permitted, excluding activities that involve throwing or contact. By 6 months, full return to sports is allowed if scapular mobility, strength, and stability are adequate and apprehension is absent.

OUTCOMES
Postoperatively, patients were followed according to the institutional protocol, and data were retrospectively extracted from clinical records using the last available follow-up for analysis. The primary outcome was recurrent instability, defined as any postoperative episode of dislocation or symptomatic subluxation, together with functional stability assessed using the Rowe Score [32]. Secondary outcomes included recovery of shoulder range of motion, pain intensity measured with a visual analogue scale (VAS), clinical signs of instability, and the need for revision surgery.

STATISTICAL ANALYSIS
All analyses were performed using SPSS version 25.0 (IBM Corp., Chicago, IL, USA). Data distribution was assessed with the Kolmogorov–Smirnov test. Quantitative data are presented as medians with ranges (minimum–maximum), and categorical data as absolute frequencies and percentages. Pre- and postoperative comparisons at final follow-up were conducted using the Wilcoxon signed-rank test for continuous variables and chi-square test for categorical variables. The impact of adjunctive procedures (rotator interval closure and/or remplissage) on postoperative outcomes was analyzed using the Kruskal–Wallis test for continuous variables and Fisher's exact test for categorical variables. A p-value <0.05 was considered statistically significant.

Results

This study included 53 patients with a mean age of 27 years (range, 15–63 years) at the time of surgery. In 51.9% of cases, the dominant shoulder was affected. Regarding occupational activity, 74.5% of patients worked in office-based jobs, whereas 20.7% reported manual or operative labor. Before surgery, 69.8% of patients experienced up to five dislocation episodes of the same shoulder, and 81.1% reported a traumatic mechanism of injury.

At baseline physical examination, the median anterior flexion was 170°, and external rotation in abduction was 70°. Posterior internal rotation reached the T12 spinal level in 90.5% of patients. Instability tests were frequently positive: apprehension in 94.3%, relocation in 75.5%, release in 67.9%, and sulcus in 20.8%. Shoulder pain of 7 or greater on the VAS was reported by 79.3% of patients. The median baseline Rowe score was 30, with 98.1% of patients classified in the poor category.

Imaging studies demonstrated a high prevalence of structural injuries, with Bankart lesions identified in 92.5% and Hill-Sachs lesions in 86.8% of patients. The median interval from first dislocation to surgery was 25 months. Intraoperatively, rotator interval closure was performed in 79.2% of patients and remplissage in 34%. The median number of all-suture anchors used was 4. No intraoperative complications were reported. Baseline clinical, imaging, and intraoperative variables are summarized in Table 1.

The median follow-up duration was 8 months (range, 4–94 months); 37.7% of patients had a last follow-up between 6 and 12 months (Table 1).

Table 1. Clinical and intraoperative characteristics

	Patients (n=53)
***Age (years)**	27 (15 – 63)
£Sex	
Males	47 (79,2%)
Females	11 (20,8%)
£Affected side	
Right	29 (54,7%)
Left	24 (45,3%)
£Sports activity	43 (81,1%)
Contact sports	11 (20,8%)
£Mechanism of injury	
Traumatic	43 (81,1%)
Atraumatic	10 (18,9%)

	Patients (n=53)
***£Number of previous dislocations**	4 (2 – 22)
2	5 (9,4%)
3	11 (20,8%)
4	14 (26,4%)
5	7 (13,2%)
6 -10	10 (18,9%)
>10	6 (11,3%)
£Imaging findings	
Classic Bankart-type labral lesion	49 (92,5%)
Bony Bankart-type labral lesion	13 (24,5%)
Labroligamentous periosteal avulsion	7 (13,2%)
Glenoid bone defect/bone loss	9 (17%)
Hill-Sachs lesion	46 (86,8%)
SLAP II lesion	3 (5,7%)
SLAP III lesion	0
Rotator cuff injury	6 (11,3%)
£Additional procedures	
Rotator interval closure	42 (79,2%)
Remplissage	18 (34%)
***£Number of suture anchors**	
2	1 (1,9%)
3	7 (13,2%)
4	27 (50,9%)
5	9 (17%)
6	6 (11,3%)
7	3 (5,7%)
***£Follow-up time (months)**	8 (4 – 94)
< 6	12 (22,6%)
6 – 12	20 (37,7%)
12 – 24	11 (20,8%)
24 – 48	6 (11,3%)
> 48	4 (7,5%)
***Time to return to sports activities (weeks)**	24 (24 – 28)

*Quantitative values expressed as median and range
£Values expressed in absolute and relative frequencies (%)

During follow-up, recurrent anterior dislocation occurred in four patients (7.5%), including two atraumatic and two traumatic redislocations, while subluxation occurred in two patients (3.8%). Patients with redislocation had a median age of 28.5 years (range, 15–38), and those with subluxation had a median age of 19 years. Revision surgery was required in three cases (5.7%): one underwent open Bankart repair, and two underwent Latarjet procedures (Table 2).

Table 2. Outcomes and postoperative evolution

	Preoperative (n=53)	Last follow-up in months (n=53)									
		< 6 (n=12)	**p-value**	**6 – 12 (n=20)**	**p-value**	**12 – 24 (n=11)**	**p-value**	**24 - 48 (n=6)**	**p-value**	**> 48 (n=4)**	**p-value**
***Anterior flexion (°)**	170 (70 – 190)	165 (160 – 180)	*0,660*	170 (130 – 180)	*0,253*	160 (140 – 180)	*0,518*	170 (160 – 170)	*0,317*	170 (120 – 180)	*0,655*
***External rotation in aduction (°)**	70 (50 – 80)	60 (30 – 70)	***0,027&***	65 (50 – 80)	*0,883*	70 (50 – 80)	*0,257*	60 (20 – 70)	*0,276*	70 (30 – 70)	*1,000*
£Posterior Internal rotation			*0,130*		*0,263*		*0,210*		*0,219*		*0,625*
(vertebral level)	1 (1,9%)										
T5	1 (1,9%)	1 (8,3%)									
T6	2 (3,8%)	4 (33,3%)		7 (35%)		4 (36,4%)		1 (16,7%)		1 (25%)	
T10						1 (9,1%)					
T11	48 (90,5%)	6 (50%)		13 (65%)		6 (54,5%)		5 (83,3%)		3 (75%)	
T12		1 (8,3%)									
L1	1 (1,9%)										
S1											
***Pain level (VAS)**	7 (4 – 10)	0 (0 – 6)	***0,002&***	0 (0 – 3)	***0,000&***	0 (0 – 8)	***0,004&***	0 (0 – 7)	***0,027&***	0 (0 – 4)	*0,066*
***Rowe Score**	30 (20 – 65)	100 (80 – 100)	***0,002&***	100 (50 – 100)	***0,000&***	100 (30 – 100)	***0,004&***	100	***0,024&***	100	***0,046&***

£Excellent (100-90)		11 (91,7%)	18 (90%)	8 (72,7%)	6 (100%)	4 (100%)
£Good (89-75)	1 (1,9%)		1 (5%)			
£Fair (74-51)	52 (98,1%)	1 (8,3%)		2 (18,2%)		
£Poor (≤50)			1 (5%)	1 (9,1%)		
£Aprehension sign	50 (94,3%)	1 (8,3%)	0	2 (18,2%)	1 (16,7%)	1 (25%)
£Instability sensation		1 (8,3%)	0	2 (18,2%)	1 (16,7%)	0
£Recurrence		1 (8,3%)	0	0	0	3 (75%)
£Subluxation		0	0	1 (9,1%)	0	1 (25%)
£Revision surgery		1 (8,3%)	0	0	0	2 (50%)

*Quantitative values expressed as median and range
£Values expressed as absolute and relative frequencies (%)
&Statistical significance between pre- and post-surgical values from the last follow-up performed in each time range

VAS: Visual Analog Scale

At the last follow-up, median anterior flexion was maintained at 170° (range, 120°–180°), and median abduction external rotation was 70° (range, 20°–80°). Posterior internal rotation improved, reaching T10 in 32.1% and T12 in 62.3% of patients. The apprehension sign was positive in only 9.4% of patients. Shoulder pain improved substantially: 92.5% reported VAS ≤3 at final follow-up (Figure 1).

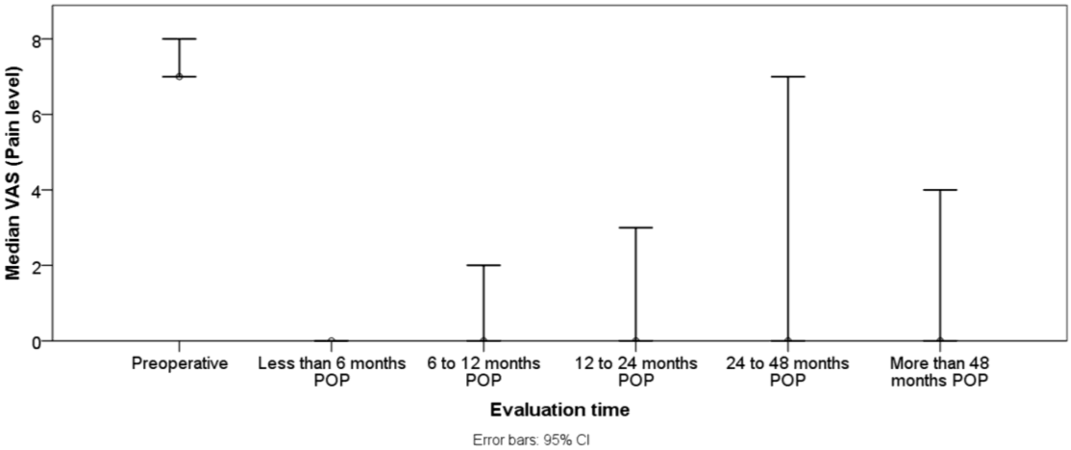

Figure 1. Postoperative pain reduction following arthroscopic Bankart repair. The graph shows the distribution of visual analogue scale (VAS) pain scores preoperatively and at final follow-up. A significant decrease in pain was observed across the cohort ($p<0.001$).

Median Rowe scores improved significantly to 100 (range, 30–100), with 88.6% of patients achieving excellent results (**Table 2**).

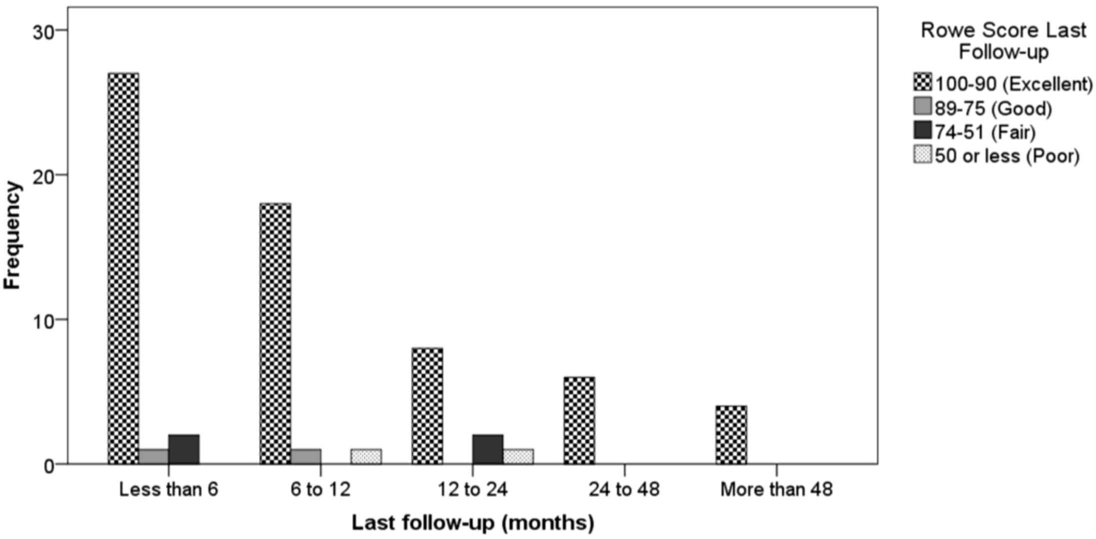

Figure 2. Improvement in functional outcomes measured by the Rowe score. The graph shows the comparison of preoperative and postoperative Rowe scores. Most patients achieved excellent functional results at the last follow-up, with statistically significant improvements from baseline ($p < 0.001$).

Comparative bivariate analysis confirmed significant improvement in median pain levels and Rowe scores across all follow-up intervals compared to preoperative values (Table 2).

External rotation in abduction only showed a significant difference in the subgroup with 4–6 months of follow-up ($p = 0.027$). For other parameters, changes in range of motion were not statistically different from baseline at later follow-up points. No significant relation was found between adjunctive procedures (rotator interval closure and/or remplissage) and the risk of recurrence ($p=0.603$), postoperative pain ($p=0.383$), Rowe score ($p=0.920$), or shoulder range of motion ($p=0.761$).

Discussion

This retrospective series demonstrated that arthroscopic Bankart repair using all-suture anchors achieves low recurrence rates (7.5%), significant pain reduction, and excellent functional outcomes (median Rowe 100) at short- to mid-term follow-up, with no anchor-related complications. These results highlight the reliability of all-suture anchors in managing anterior shoulder instability and align with contemporary evidence showing that advances in arthroscopic stabilization techniques provide results comparable to those of traditional open procedures.

Our recurrence rate (7.5%) is within the range reported in recent systematic reviews of ABR [7,10,11,33]. Sugawara et al. [34] confirmed the long-term durability of ABR, with recurrence rates of 10% after 10 years of follow-up. Deshpande et al.[27] recently compared ABR with the Latarjet procedure, showing that while Latarjet may reduce recurrence in high-risk patients, ABR provides similar functional outcomes and lower complication rates in the general population. In our study, nearly 90% of patients reached excellent Rowe scores, which is consistent with other reports of high postoperative satisfaction and functional recovery following ABR [8,11,18,21,34].

One of the central findings of our study was the absence of anchor-related complications. This corroborates reports from Ideler et al.[35] and Wallace et al.[36], who found that all-suture anchors are safe and radiologically stable at mid-term follow-up. These devices preserve glenoid bone stock, minimize cyst formation, and avoid migration risks associated with rigid anchors [2,37]. Lee et al.[14,22] further showed that anchor position and deployment angle significantly influence fixation strength, underscoring the importance of meticulous technique. These findings reinforce that all-suture anchors provide biomechanical stability equivalent to traditional anchors while avoiding revision procedures [3,15].

Despite favorable outcomes overall, recurrence remains a concern in specific populations [3]. Young age, contact sports participation, and the presence of bipolar bone loss consistently emerge as risk factors [1,2,15,23]. Recent meta-analyses by Bulleit et al.[24] and Zhang et al.[23] found that younger age (particularly <20 years), the presence of glenoid bone loss, Hill–Sachs lesions, and shoulder hyperlaxity are the most consistent predictors of recurrent instability following arthroscopic Bankart repair. Additional factors, such as participation in contact or competitive sports and male sex, have also been associated with higher recurrence risk [23,24]. Likewise, our cases of redislocation and subluxation occurred predominantly in younger patients, consistent with these reports.

Bone loss assessment has shifted from absolute critical thresholds to a spectrum that includes subcritical loss and dynamic concepts such as the glenoid track [2,20]. Lau et al.[20] emphasized that defects as low as >7 % can compromise outcomes, while Asghar et al.[38] questioned whether 13.5% should remain the defining cutoff. Recent reviews recommend that subcritical bone loss (10–15%) be carefully weighed when considering augmentation procedures [1,39]. The glenoid track model, revisited by Itoi et al. [40] and Yamamoto et al.[41], refines risk stratification by incorporating both glenoid and humeral head defects. In line with this, Moroder et al. [42]have recently proposed the global track concept, which integrates 3D evaluation of bipolar bone loss for a more precise prediction of engagement. While our study did not stratify by bone loss percentage, most failures occurred in patients with associated Hill-Sachs lesions, supporting the clinical importance of bipolar assessment.

Adjunctive remplissage has gained increasing attention [27,28,30]. A recent meta-analysis by Davis et al.[43] demonstrated that Bankart plus remplissage reduces recurrence and facilitates higher return-to-sport rates compared with Bankart repair alone, with outcomes similar or superior to Latarjet in selected patients [27,43]. Our cohort included remplissage in 34% of cases, without anchor-related morbidity, supporting its role in treating engaging Hill-Sachs lesions [28,30,31,44]. Similarly, rotator interval closure was performed in nearly 80% of cases. Although its benefit remains debated, closure has been advocated in cases of capsular laxity [29,45]. Our analysis did not find a significant association between interval closure and recurrence, echoing recent reviews suggesting its effect may be patient-specific rather than universally beneficial [45].

The median time to sports resumption in our series aligns with the literature [1,27,46]. Valk et al.[47] reported that most athletes return between 5 and 7 months postoperatively, though psychological readiness may delay physical recovery [46,48]. Utami et al.[49] emphasized individualized, criteria-based progression to sport rather than rigid timelines. Our findings support this approach, as patients demonstrated a near-complete ROM and minimal pain before clearance.

The main limitations of our study are its retrospective design, variable follow-up, and lack of standardized imaging quantification of bone loss. These constraints may have limited our ability to fully stratify recurrence risk. Additionally, our sample was derived from a single surgeon's practice, which enhances technique consistency but may limit generalizability. Longer prospective studies incorporating glenoid track measurements and patient-reported outcomes are warranted.

Overall, our findings add to the growing evidence that all-suture anchors are a safe, bone-preserving, and effective option for arthroscopic Bankart repair. Recurrence rates are low when the procedure is applied to appropriately selected patients, and functional outcomes are excellent. For high-risk populations, such as young athletes with bipolar bone loss, adjunctive procedures or alternative stabilizations like the Latarjet procedure should be considered.

Conclusion

Arthroscopic Bankart repair using all-suture anchors is a reliable option for treating anterior shoulder instability, providing low recurrence rates and excellent functional outcomes while preserving glenoid bone and minimizing implant-related complications.

Conflicts of Interest Statement:

The authors have no conflicts of interest to declare.

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