

Mid-term Functional Outcomes of Open Congruent Arc Latarjet for Recurrent Anterior Shoulder Instability: A Retrospective Cohort Study

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Learning Point of the Article:

The congruent arc modification enhances glenoid arc restoration and graft contact area, enabling improved stability and predictable outcomes in patients with significant glenoid bone loss undergoing the Latarjet procedure.

Abstract

Introduction: Recurrent anterior shoulder instability with significant glenoid bone loss is associated with high failure after isolated soft-tissue repair. The open Latarjet procedure with congruent arc modification improves graft coverage and glenoid arc restoration, but mid-term clinical data are limited.

Materials and Methods: This retrospective cohort included patients who underwent open Latarjet with congruent arc modification between January 2015 and December 2020. Eligibility criteria were ≥ 3 anterior dislocations, $\geq 15\%$ glenoid bone loss, and ≥ 24 months of follow-up. Functional outcomes (Western Ontario Shoulder Instability Index [WOSI], Rowe), range of motion, complications, and graft union on computed tomography (CT) were assessed. Kaplan–Meier survival analysis estimated recurrence-free survival.

Results: A total of 80 patients (62 males, 18 females; mean age 28.5 ± 6.4 years) were analyzed with a mean follow-up of 4.5 ± 1.2 years. WOSI improved from 46.7 ± 12.3 to 79.4 ± 15.8 ($P < 0.001$), and Rowe from 32.5 ± 9.6 to 85.6 ± 10.7 ($P < 0.001$), both exceeding minimal clinically important difference thresholds. Forward flexion ($+15^\circ$) and abduction ($+20^\circ$) improved significantly, whereas external rotation showed a mild, non-significant reduction (-10° , $P = 0.079$). Complications occurred in 12.5%, mainly graft non-union (5%). CT confirmed graft union in 95%. Kaplan–Meier analysis showed 97.5% recurrence-free survival at 5 years.

Conclusion: Open Latarjet with congruent arc modification provides clinically meaningful functional improvement, reliable graft union, and durable mid-term stability in recurrent anterior instability with glenoid bone loss.

Keywords: Latarjet, congruent arc, shoulder instability, glenoid bone loss, functional outcomes.

Introduction

Recurrent anterior shoulder instability in young, active patients is frequently associated with glenoid bone loss, particularly when it exceeds 15% of the inferior glenoid diameter. In such cases, isolated soft-tissue repair carries a high risk of failure [1, 2]. The Latarjet procedure addresses this by transferring the coracoid to

the glenoid rim, offering both bony augmentation and dynamic stability through the conjoint tendon [3].

The congruent arc modification rotates the coracoid by 90° to increase articular arc coverage and surface contact, potentially enhancing stability and reducing graft-related complications [4,5,6]. Although biomechanical advantages have been

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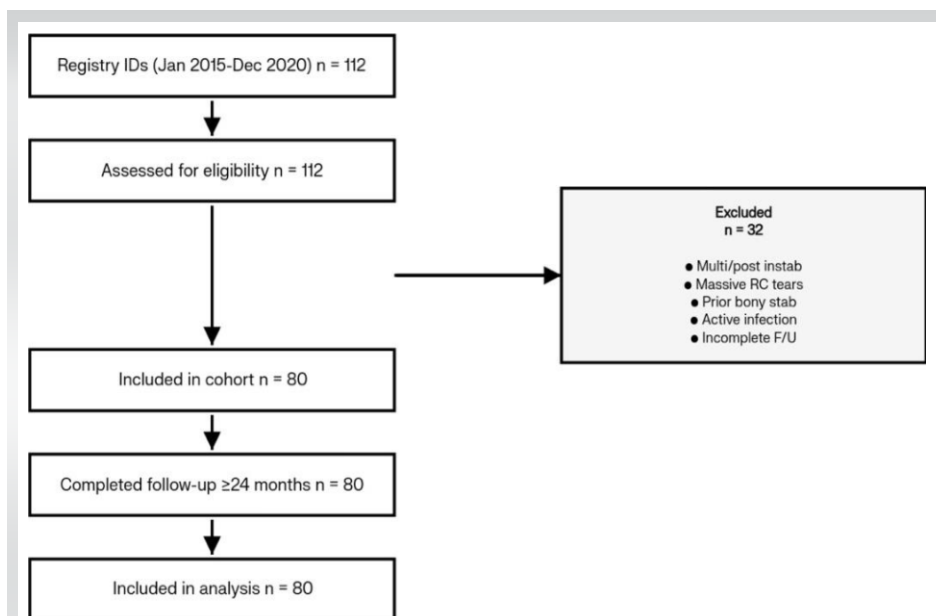


Figure 1: Patient flow diagram (STROBE).

demonstrated, clinical outcome evidence at mid-term follow-up remains scarce. Furthermore, most available studies are limited by small sample sizes or heterogeneous populations, and data from Asian centers are particularly sparse. The present study aimed to evaluate functional outcomes, range of motion, complications, and graft survival following open Latarjet with congruent arc modification in patients with recurrent anterior shoulder instability and significant glenoid bone loss. We hypothesized that this technique would yield clinically meaningful improvements in validated outcome scores, high graft union rates, and low recurrence.

Materials and Methods

This retrospective cohort study was conducted at a tertiary orthopedic center. Ethical approval for this study was obtained from the Institutional Ethical Committee (No - KIIT/KIMS/IEC/1038/2022 on February 22, 2022). The study complied with the Declaration of Helsinki principles.

Patient selection

Patients who underwent open Latarjet with congruent arc modification between January 2015 and December 2020 were identified from the institutional surgical registry. Inclusion criteria were:

- ≥3 documented anterior shoulder dislocations,
- Pre-operative CT or MRI confirming ≥15% glenoid bone loss using the best-fit circle method,
- Open Latarjet procedure performed with a congruent arc modification, and
- Minimum clinical follow-up of 24 months.

Exclusion criteria included multidirectional or posterior instability, massive irreparable rotator cuff tears, prior bony stabilization procedures, active infection, or incomplete follow-up. Of 112 screened patients, 80 met all eligibility criteria.

Surgical technique

All procedures were performed by three fellowship-trained shoulder surgeons using a standardized deltopectoral approach. The coracoid process was osteotomized, rotated 90° (congruent arc orientation), and fixed flush with the glenoid rim using two 4.0-mm partially threaded screws.

Post-operative rehabilitation

A four-phase standardized rehabilitation protocol was followed:

- Phase I (0–6 weeks): Immobilization in a sling with passive range-of-motion exercises
- Phase II (6–12 weeks): Active-assisted motion and progressive strengthening
- Phase III (3–6 months): Advanced strengthening and sport-specific drills

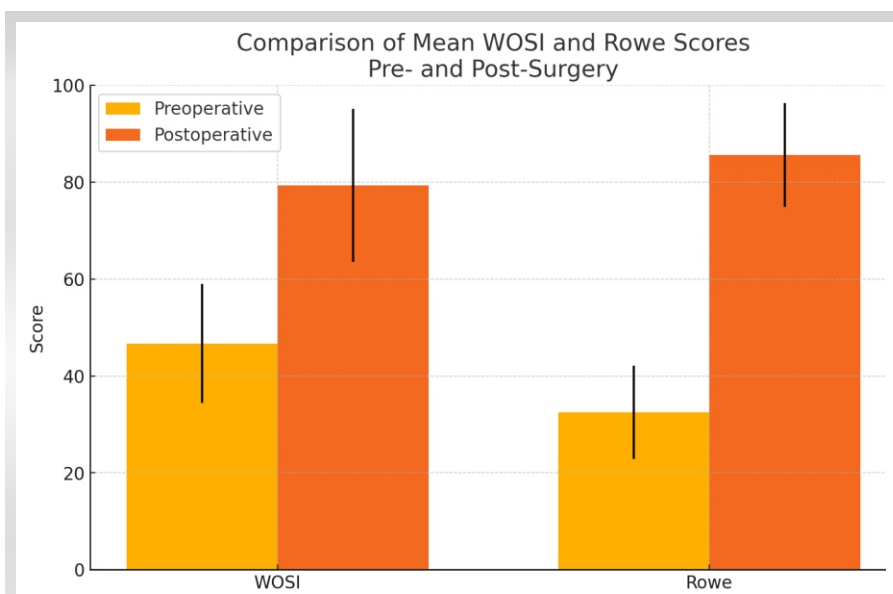


Figure 2: Bar graph comparing pre- and post-operative Western Ontario Shoulder Instability Index and Rowe scores.

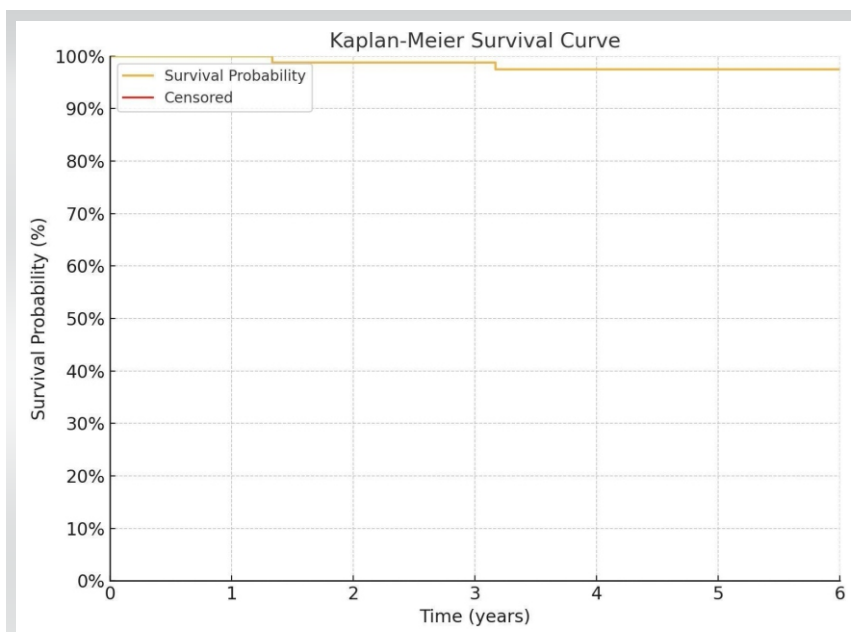


Figure 3: Kaplan-Meier survival curve illustrating time to instability recurrence.

- Phase IV (≥ 6 months): Return to contact sports, provided pain-free symmetric motion was restored.

Outcome measures

The primary outcomes were functional scores:

- Western Ontario Shoulder Instability Index (WOSI; normalized 0–100, higher = better),
- Rowe score (0–100, higher = better).

Secondary outcomes included range of motion (forward flexion, abduction, and external rotation), complications (graft non-union, malposition, recurrence, neurologic symptoms, reoperation, infection, and hardware issues), and graft union assessed on post-operative CT scans.

Statistical analysis

Continuous variables were expressed as mean \pm standard deviation (SD). Pre- and post-operative comparisons were performed using paired t-tests. Mean differences were reported with 95% confidence intervals (CI) and effect sizes (Cohen's d). Statistical significance was set at $P < 0.05$. Minimal clinically important difference (MCID) thresholds were applied for interpretation (14 for WOSI, 9.7 for Rowe). Kaplan–Meier survival analysis was performed to estimate recurrence-free survival.

Results

Patient demographics

A total of 80 patients (62 males and 18 females) with a mean age

of 28.5 ± 6.4 years were included (Fig. 1).

The mean follow-up was 4.5 ± 1.2 years (range, 2.1–7.0 years). Of these, 51 patients (63.7%) were competitive or recreational contact-sport athletes, and 16 (20.0%) had failed prior arthroscopic stabilization. Functional outcomes, both primary outcome measures, improved significantly (Table 1 and Fig. 2).

- WOSI score improved from 46.7 ± 12.3 to 79.4 ± 15.8 , with a mean difference of $+32.7$ (95% CI, 28.9–36.5; $P < 0.001$; $d = 1.89$).
- Rowe's score improved from 32.5 ± 9.6 to 85.6 ± 10.7 , with a mean difference of $+53.1$ (95% CI, 49.8–56.3; $P < 0.001$; $d = 3.58$).
- Both exceeded the established MCID thresholds.

Range of motion

Post-operative forward flexion and abduction improved significantly, whereas external rotation showed a mild, non-significant reduction (Table 1).

- Forward flexion: $155^\circ \pm 10.6$ to $170^\circ \pm 8.4$; mean difference $+15^\circ$ (95% CI, 11.3–18.7; $P < 0.001$).
- Abduction: $140^\circ \pm 15.2$ to $160^\circ \pm 12.1$; mean difference $+20^\circ$ (95% CI, 15.1–24.2; $P < 0.001$).
- External rotation: $60^\circ \pm 7.3$ to $50^\circ \pm 6.9$; mean difference -10° (95% CI, -21.2 to $+1.2$; $P = 0.079$).

Complications

Complications were observed in 10 patients (12.5%):

- Graft non-union: 4 patients (5.0%)
- Transient axillary nerve symptoms: 3 patients (3.8%),
- Recurrent instability: 2 patients (2.5%),
- Graft malposition: 1 patient (1.3%).

No infections, hardware failures, or reoperations were recorded during follow-up.

Graft union and survival

CT evaluation confirmed graft union in 76 patients (95.0%). Kaplan–Meier survival analysis demonstrated a 97.5% recurrence-free survival at 5 years (95% CI, 91.2–99.4%) (Fig. 3).

Discussion

This study demonstrates that the open Latarjet procedure with

Table 1: Range of motion (degrees)

Motion	Pre-operative (°)	Post-operative (°)	Mean difference (°)	95% CI	P-value
Forward flexion	155±10.6	170±8.4	15	11.3 to 18.7	<0.001
Abduction	140±15.2	160±12.1	20	15.1 to 24.2	<0.001
External rotation	60±7.3	50±6.9	-10	-21.2 to +1.2	0.079

CI: Confidence interval

congruent arc modification results in substantial functional gains and reliable stability at mid-term follow-up. Both WOSI and Rowe scores improved well beyond established MCID thresholds, confirming the clinical significance of these outcomes.

Our findings support earlier reports of the congruent arc modification. De Beer and Roberts first described the technique, highlighting improved graft coverage [4], while subsequent biomechanical studies confirmed its superiority in restoring glenoid arc width compared with the traditional orientation [5,6,7,8,9,10]. In our series, Rowe improved by +53 points and WOSI by +33 points, comparable to or exceeding earlier clinical cohorts [11,12]. The complication rate of 12.5% aligns with systematic reviews, which report pooled rates between 10 and 15% [13,14].

Recent studies further validate these outcomes in the Indian context. A prospective cohort reported Rowe improving from 42.16 ± 7.26 to 97.0 ± 8.45 with high patient satisfaction [19], while a multicenter evaluation of open congruent arc Latarjet in low-resource hospitals (n = 40) demonstrated Rowe improving from 23.05 to 91.10 and ASES from 22.95 to 75.65, with no redislocations at 24 months [20]. These results are consistent with our low redislocation rate (2.5%) and excellent 5-year recurrence-free survival (97.5%). Meta-analyses comparing open and arthroscopic Latarjet procedures also show broadly similar WOSI and Rowe outcomes [13, 17], suggesting that the favorable results in our cohort reflect the construct itself rather than the surgical approach.

Loss of external rotation, though mild and not statistically significant in our series, remains a recognized concern. Some reports describe measurable deficits [15], while others suggest minimal functional impact [16]. In our cohort, the reduction was small and outweighed by the stability benefits. Graft-related complications, mainly non-union, accounted for most adverse events. Our non-union rate (5%) was lower than some

previous reports [14, 17], possibly due to standardized surgical technique and structured rehabilitation. Transient neurologic symptoms were in line with published data [18], and no hardware failures or reoperations occurred.

The strengths of this study include a relatively large cohort, standardized surgical technique performed by fellowship-trained surgeons, and the use of validated scoring systems.

Limitations

This retrospective, single-center, non-randomized study with a modest sample size may introduce selection bias and limit generalizability. The absence of a control group and heterogeneity in surgeon experience may have influenced outcomes. Mid-term follow-up restricts long-term assessment, and radiological evaluation was non-uniform with limited dynamic imaging. Patient-reported scores, incomplete return-to-sport data, and potential loss to follow-up may affect interpretation. Cost-effectiveness and subclinical complications were not assessed, external validity is limited by the young active cohort, and learning-curve effects were not evaluated.

In summary, the open congruent arc Latarjet provides reliable mid-term stability, high graft union, and excellent functional recovery in recurrent anterior instability with glenoid bone loss. While mild external rotation loss may occur, recurrence rates remain low. Future prospective and comparative studies with long-term follow-up are warranted to further define its role relative to classic and arthroscopic techniques.

Conclusion

The open Latarjet procedure with congruent arc modification provides excellent functional outcomes, durable stability, and low recurrence at mid-term follow-up in recurrent anterior shoulder instability with glenoid bone loss.



Clinical Message

The congruent arc Latarjet provides reliable stability and clinically meaningful functional improvement for recurrent anterior shoulder instability with glenoid bone loss, with high graft-union rates and acceptable complication rates at mid-term follow-up.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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