

# Six-Month Outcomes of Suture-Anchor Versus Hook-Plate Fixation for Rockwood Type III and V Acromioclavicular Joint Dislocation

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## Research Article

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# Abstract

## Background

Operative management of high-grade acromioclavicular joint (ACJ) dislocation remains heterogeneous, and no single fixation construct has demonstrated unequivocal clinical superiority. Hook-plate fixation provides rigid reduction but is associated with implant-related morbidity and frequently requires subsequent implant removal. Coracoclavicular fixation using suture anchors avoids subacromial hardware and may facilitate biological ligament healing, although concerns remain regarding loss of reduction and construct failure.

## Purpose

To compare 6-month clinical and functional outcomes after suture-anchor versus hook-plate fixation for Rockwood type III and V ACJ dislocations.

## Methods

In this single-center observational cohort study, 44 patients who underwent operative fixation at Poursina Hospital, Rasht, Iran, were followed for 6 months; 22 received suture-anchor fixation and 22 received hook-plate fixation. Outcomes included fixation failure, neurologic complications, categorical Constant-Murley outcome, time to return to daily activity, and number of physiotherapy sessions.

## Results

Mean age was  $37.1 \pm 11.9$  years, 40 patients (90.9%) were male, and 41 injuries (93.2%) were acute. Thirteen patients (29.5%) had Rockwood type III and 31 (70.5%) had type V injuries. Baseline characteristics were similar between treatment groups. Fixation failure occurred in 2 of 22 patients (9.1%) in the suture-anchor group and none in the hook-plate group ( $P = .488$ ). The distribution of Constant-Murley categories did not differ significantly between groups ( $P = .474$ ); 13 of 22 patients (59.1%) in the suture-anchor group and 15 of 22 (68.2%) in the hook-plate group had good or excellent outcomes. Median time to return to daily activity was 37.5 days in the suture-anchor group and 60 days in the hook-plate group ( $P = .348$ ). Median numbers of physiotherapy sessions were 12.5 and 10, respectively ( $P = .084$ ). No postoperative neurologic complications were recorded.

## Conclusion

No statistically significant between-group differences were detected at 6 months. Suture-anchor fixation was associated with a numerically shorter return to daily activity but two fixation failures, whereas the

hook-plate group underwent fewer physiotherapy sessions. Because the cohort was small, nonrandomized, and lacked continuous functional scores and standardized radiographic outcomes, these findings do not establish equivalence or superiority.

## Introduction

Acromioclavicular joint injuries are common traumatic shoulder injuries and occur particularly frequently in young, physically active patients. The Rockwood classification remains the most widely used system for describing injury severity and incorporates the degree and direction of displacement together with disruption of the acromioclavicular and coracoclavicular ligament complexes. Although type I and II injuries are generally managed nonoperatively, controversy persists regarding selected type III injuries, whereas higher-grade injuries are more commonly considered for surgical stabilization (1–4). The distinction is clinically relevant because restoration of both vertical and horizontal stability may influence pain, shoulder mechanics, and long-term function.

Despite extensive investigation, there is no universally accepted operative technique for unstable ACJ dislocation. Contemporary options include hook plates, cortical button constructs, suture-based coracoclavicular fixation, ligament reconstruction, tendon grafts, and combined procedures (3–5). Hook-plate fixation provides immediate mechanical stabilization by engaging the inferior surface of the acromion while securing the plate to the clavicle. However, subacromial osteolysis, implant irritation, pain, restriction of motion, peri-implant fracture, and the potential requirement for a second operation for plate removal remain important disadvantages (1, 5, 6). Studies evaluating hook plates have nevertheless consistently demonstrated satisfactory restoration of alignment and acceptable functional outcomes.

Suture-based coracoclavicular stabilization seeks to restore the relationship between the clavicle and coracoid without a subacromial implant. Suture-anchor constructs may therefore reduce hardware-related morbidity and avoid routine plate removal. Previous clinical and biomechanical studies have demonstrated that anchor-based constructs can provide effective stabilization, although the mechanical characteristics of suture fixation differ from rigid plate fixation and loss of reduction remains a concern (7, 8). Direct comparative evidence remains heterogeneous. In one comparative study, suture-anchor fixation combined with coracoclavicular ligament reconstruction produced favorable long-term functional results relative to hook-plate fixation, whereas other comparative investigations have demonstrated similar functional outcomes between rigid and ligament-reconstruction constructs (9, 10).

Systematic reviews comparing suture-button techniques with hook plates suggest either modest functional advantages for suspensory fixation or no clinically clear superiority, emphasizing the heterogeneity of operative constructs and available evidence (11, 12). Because suture-anchor fixation is biomechanically and technically distinct from cortical suture-button constructs, direct clinical comparisons of suture anchors and hook plates remain relevant. A retrospective comparison of suture-button and hook-plate fixation performed specifically for acromioclavicular joint injuries found no

significant between-group difference in Constant-Murley outcome, although hook-plate fixation was associated with better postoperative pain scores and suture-button fixation more reliably restored coracoclavicular reduction (13). In a related population with distal clavicle fractures treated with either construct, suture-anchor coracoclavicular reconstruction produced lower early pain scores and Constant-Murley scores comparable to hook-plate fixation at longer-term follow-up, although hook-plate patients required a second procedure for implant removal (14).

The purpose of this study was therefore to compare short-term clinical outcomes following suture-anchor and hook-plate fixation for high-grade ACJ dislocation. We evaluated fixation failure, Constant-Murley functional outcome, time to return to daily activities, physiotherapy requirements, and postoperative complications.

## Methods

### Study Design and Setting

This single-center observational cohort study included patients undergoing surgical stabilization of ACJ dislocation at Poursina Hospital, Rasht, Iran, a tertiary trauma referral center affiliated with Guilan University of Medical Sciences. Eligible patients were enrolled by convenience sampling from daily orthopedic admissions and assessed after surgery, including at a prespecified 6-month visit. This manuscript was prepared in accordance with the STROBE reporting framework (15).

This study was approved by the Research Ethics Committee of Guilan University of Medical Sciences, Rasht, Iran (IR.GUMS.REC.1402.171). The study was conducted in accordance with the Declaration of Helsinki(16) and institutional ethical guidelines. Written informed consent was obtained from all participants or, when acute injury precluded direct consent, from their legal guardians or next of kin. All patient data were anonymized and kept confidential.

### Participants

Patients undergoing surgical fixation for ACJ dislocation were screened for eligibility. The inclusion criteria were age of 25–65 years, complete operative records, and regular postoperative follow-up. Exclusion criteria were Rockwood type I or II injury, concomitant fracture, previous fracture or surgery of the affected shoulder, rheumatoid arthritis, incomplete medical records, or incomplete follow-up. The analyzed cohort contained only Rockwood type III and V injuries.

The required sample size was estimated a priori from the mean and standard deviation of 6-month Constant-Murley scores reported after suture-anchor ( $92.3 \pm 7.3$ ) and hook-plate ( $96.0 \pm 2.6$ ) fixation in a comparable prior series (14), assuming a two-sided  $\alpha$  of .05 and 90% power ( $Z\beta = 1.28$ ); this calculation indicated a minimum requirement of 17 patients per group (34 total), a target the analyzed cohort of 44 patients exceeded.

## Treatment Allocation

Patients underwent either coracoclavicular stabilization using a suture-anchor construct or open reduction and internal fixation using a clavicular hook plate. Treatment allocation was nonrandomized. Patients were analyzed according to the fixation technique they received during routine clinical care. All procedures were performed using an open approach with the objective of restoring acromioclavicular alignment and coracoclavicular stability.

In the suture-anchor group, the acromioclavicular joint was reduced under direct visualization, and coracoclavicular stabilization was achieved using a suture-anchor construct. The sutures were used to maintain reduction between the clavicle and coracoid, after which the stability and alignment of the acromioclavicular joint were assessed.

In the hook-plate group, the acromioclavicular joint was openly reduced and stabilized using a clavicular hook plate. The hook component was positioned beneath the acromion, and the plate was secured to the distal clavicle to maintain reduction. Joint alignment and implant position were assessed intraoperatively.

## Postoperative Rehabilitation

Postoperative rehabilitation was directed by the treating surgical team according to clinical recovery and the stability of fixation. Rehabilitation generally included an initial period of shoulder protection followed by progressive restoration of passive, active-assisted, and active range of motion and subsequent strengthening. Return to unrestricted daily activity was permitted according to clinical progress, shoulder function, and the treating surgeon's assessment.

## Data Collection and Outcomes

Baseline variables included age, sex, smoking status, hypertension, diabetes mellitus, thyroid disease, mechanism of injury, acute versus chronic presentation, Rockwood classification, and time from injury to surgery. The analyzed cohort included 44 patients, 22 in each group.

The principal clinical assessment was performed 6 months after surgery. Functional outcome was evaluated with the Constant-Murley score, a 100-point composite measure of pain, activities of daily living, range of motion, and strength (6). This manuscript reports categorical outcomes only. Secondary outcomes were fixation failure assessed clinically and radiographically, postoperative neurologic involvement, days to return to daily activity, and number of physiotherapy sessions.

## Statistical Analysis

Continuous variables were summarized as mean  $\pm$  standard deviation and, for skewed variables, as median with interquartile range. Categorical variables were summarized as number and percentage. Between-group comparisons used the independent-samples t test for approximately normally distributed continuous variables, the Mann-Whitney U test for skewed continuous variables, and the chi-square or Fisher exact test for categorical variables, as appropriate. All tests were two-sided, and  $P < .05$  was considered statistically significant. Because of the small sample and sparse outcome events, multivariable models were restricted to a small number of predictor variables selected a priori, and adjusted effect estimates are reported as exploratory rather than confirmatory.

Exploratory multivariable analyses were performed using binary logistic regression with backward likelihood-ratio selection. Constant-Murley categories were defined in the source thesis as excellent (score  $< 11$ ), good (11–20), acceptable (20–30), and poor (score  $> 30$ ); because lower scores corresponded to better categories, this appears to reflect a deficit-based or locally modified scoring convention rather than the standard 0-100 Constant-Murley scale, and the discrepancy could not be further resolved from the available source materials. Return to daily activity as more than 1 month versus 1 month or less, and number of physiotherapy sessions as more than 10 versus 10 or fewer. Candidate variables in the initial models were fixation technique, age, smoking, hypertension, injury mechanism, Rockwood type, and time from injury to surgery. Odds ratios (ORs), 95% confidence intervals (CIs), and two-sided P values were reported.

## Results

### Patient Characteristics

Forty-four patients were analyzed, including 22 treated using suture-anchor fixation and 22 using hook-plate fixation. Mean age was  $37.09 \pm 11.89$  years (range, 20–62 years), and 40 participants (90.9%) were male. Thirteen patients (29.5%) were smokers. Age, sex, and smoking status did not differ significantly between treatment groups.

Seven patients (15.9%) had hypertension, two (4.5%) had diabetes mellitus, and two (4.5%) had thyroid disease. These baseline comorbidities did not differ significantly between groups. The median interval from injury to surgery was 5.0 days (IQR, 3.5–10.0); the corresponding medians were 5.5 days (IQR, 3.0–7.0) in the suture-anchor group and 4.5 days (IQR, 4.0–14.0) in the hook-plate group ( $P = .628$ ). Traffic-related trauma accounted for 21 injuries (47.7%), falls for 18 (40.9%), and sports-related trauma for five (11.4%). Forty-one injuries (93.2%) were acute. Thirteen patients (29.5%) had Rockwood type III dislocation and 31 (70.5%) had type V dislocation. The distribution of injury characteristics was similar between treatment groups (Table 1).

Table 1  
Baseline and injury characteristics according to fixation technique

| Characteristic                                                                                                                                                                                                          | Overall (n = 44)  | Suture anchor (n = 22) | Hook plate (n = 22) | P value |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|------------------------|---------------------|---------|
| Age, years, mean $\pm$ SD                                                                                                                                                                                               | 37.09 $\pm$ 11.89 | 38.95 $\pm$ 12.58      | 35.23 $\pm$ 11.13   | .304    |
| Male sex                                                                                                                                                                                                                | 40 (90.9)         | 20 (90.9)              | 20 (90.9)           | .999    |
| Current smoking                                                                                                                                                                                                         | 13 (29.5)         | 6 (27.3)               | 7 (31.8)            | .741    |
| Hypertension                                                                                                                                                                                                            | 7 (15.9)          | 5 (22.7)               | 2 (9.1)             | .412    |
| Diabetes mellitus                                                                                                                                                                                                       | 2 (4.5)           | 2 (9.1)                | 0                   | .488    |
| Thyroid disease                                                                                                                                                                                                         | 2 (4.5)           | 2 (9.1)                | 0                   | .488    |
| Injury-to-surgery interval, days, median (IQR)                                                                                                                                                                          | 5.0 (3.5–10.0)    | 5.5 (3.0–7.0)          | 4.5 (4.0–14.0)      | .628    |
| Fall                                                                                                                                                                                                                    | 18 (40.9)         | 9 (40.9)               | 9 (40.9)            | .999*   |
| Traffic accident                                                                                                                                                                                                        | 21 (47.7)         | 10 (45.5)              | 11 (50.0)           |         |
| Sports injury                                                                                                                                                                                                           | 5 (11.4)          | 3 (13.6)               | 2 (9.1)             |         |
| Acute injury                                                                                                                                                                                                            | 41 (93.2)         | 21 (95.5)              | 20 (90.9)           | .999    |
| Chronic injury                                                                                                                                                                                                          | 3 (6.8)           | 1 (4.5)                | 2 (9.1)             |         |
| Rockwood type III                                                                                                                                                                                                       | 13 (29.5)         | 7 (31.8)               | 6 (27.3)            | .741    |
| Rockwood type V                                                                                                                                                                                                         | 31 (70.5)         | 15 (68.2)              | 16 (72.7)           |         |
| Values are n (%) unless otherwise indicated. *P value for the overall distribution of injury mechanism. The source report did not define the acute/chronic threshold. IQR, interquartile range; SD, standard deviation. |                   |                        |                     |         |

## Six-Month Clinical and Rehabilitation Outcomes

No postoperative neurologic involvement was observed in either group. Two fixation failures occurred, both in the suture-anchor group (2/22, 9.1%), compared with none in the hook-plate group; this difference was not statistically significant ( $P = .488$ ). Given the very small number of events, this result should not be interpreted as evidence that the techniques have equivalent failure rates.

The overall Constant-Murley categorical distribution consisted of six excellent outcomes (13.6%), 22 good outcomes (50.0%), 12 acceptable/fair outcomes (27.3%), and four poor outcomes (9.1%). In the suture-anchor group, four patients had excellent, nine good, six acceptable, and three poor outcomes. Corresponding numbers in the hook-plate group were two, 13, six, and one, respectively. The overall distribution did not differ significantly between techniques ( $P = .474$ ). Thus, 13 of 22 patients (59.1%) treated with suture anchors and 15 of 22 (68.2%) treated with hook plates achieved a good or excellent categorical result.

Return to daily activity occurred numerically earlier after suture-anchor fixation. Median time was 37.5 days versus 60 days after hook-plate fixation, but the difference was not statistically significant ( $P = .348$ ). Mean times were  $45.55 \pm 21.98$  and  $50.18 \pm 20.64$  days, respectively. Patients in the suture-anchor group underwent a median of 12.5 physiotherapy sessions compared with 10 after hook-plate fixation. Mean numbers were  $15.18 \pm 9.38$  and  $10.09 \pm 8.29$  sessions, respectively ( $P = .084$ ) (Table 2).

Table 2  
Six-month clinical and rehabilitation outcomes

| Outcome                                                                                        | Overall (n = 44)  | Suture anchor (n = 22) | Hook plate (n = 22) | P value |
|------------------------------------------------------------------------------------------------|-------------------|------------------------|---------------------|---------|
| Fixation failure                                                                               | 2 (4.5)           | 2 (9.1)                | 0                   | .488    |
| Neurologic complication                                                                        | 0                 | 0                      | 0                   | —       |
| Constant-Murley: excellent                                                                     | 6 (13.6)          | 4 (18.2)               | 2 (9.1)             | .474    |
| Constant-Murley: good                                                                          | 22 (50.0)         | 9 (40.9)               | 13 (59.1)           |         |
| Constant-Murley: acceptable/fair                                                               | 12 (27.3)         | 6 (27.3)               | 6 (27.3)            |         |
| Constant-Murley: poor                                                                          | 4 (9.1)           | 3 (13.6)               | 1 (4.5)             |         |
| Good/excellent Constant-Murley outcome                                                         | 28 (63.6)         | 13 (59.1)              | 15 (68.2)           | —       |
| Return to daily activity, days, mean $\pm$ SD                                                  | $47.86 \pm 21.20$ | $45.55 \pm 21.98$      | $50.18 \pm 20.64$   | .348    |
| Return to daily activity, median (IQR)                                                         | 46 (30–60)        | 37.5 (30–60)           | 60 (30–60)          |         |
| Physiotherapy sessions, mean $\pm$ SD                                                          | $12.64 \pm 9.12$  | $15.18 \pm 9.38$       | $10.09 \pm 8.29$    | .084    |
| Physiotherapy sessions, median (IQR)                                                           | 10 (8–20)         | 12.5 (10–20)           | 10 (0–15)           |         |
| Values are n (%) unless otherwise indicated. IQR, interquartile range; SD, standard deviation. |                   |                        |                     |         |

## Exploratory Multivariable Analyses

For good/excellent Constant-Murley outcome, hook-plate fixation was not significantly associated with higher odds than suture-anchor fixation in the initial model (OR, 1.47; 95% CI, 0.34–6.42;  $P = .607$ ). In the final backward-selected model, Rockwood type III injury was associated with higher odds of a good/excellent outcome than type V injury (OR, 10.62; 95% CI, 1.16–97.16;  $P = .037$ ), while hypertension remained nonsignificant (OR, 0.19; 95% CI, 0.03–1.31;  $P = .091$ ). (Table 3)

Table 3  
logistic regression analyses

| Outcome and model                                                                                                                                                                                                                                                                         | Predictor and comparison            | OR (95% CI)        | P value |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|--------------------|---------|
| Good/excellent Constant-Murley, initial                                                                                                                                                                                                                                                   | Hook plate vs suture anchor         | 1.47 (0.34–6.42)   | .607    |
| Good/excellent Constant-Murley, final                                                                                                                                                                                                                                                     | Rockwood III vs V                   | 10.62 (1.16–97.16) | .037    |
| Good/excellent Constant-Murley, final                                                                                                                                                                                                                                                     | Hypertension, yes vs no             | 0.19 (0.03–1.31)   | .091    |
| Return to activity > 1 month, initial                                                                                                                                                                                                                                                     | Hook plate vs suture anchor         | 2.32 (0.54–9.93)   | .256    |
| Return to activity > 1 month, final                                                                                                                                                                                                                                                       | Traffic injury vs fall              | 5.00 (1.28–19.53)  | .021    |
| Return to activity > 1 month, final                                                                                                                                                                                                                                                       | Sports injury vs fall               | 8.00 (0.73–88.23)  | .090    |
| Physiotherapy > 10 sessions, initial                                                                                                                                                                                                                                                      | Suture anchor vs hook plate         | 2.73 (0.62–12.07)  | .186    |
| Physiotherapy > 10 sessions, final                                                                                                                                                                                                                                                        | Rockwood V vs III                   | 3.98 (0.88–18.03)  | .074    |
| Physiotherapy > 10 sessions, final                                                                                                                                                                                                                                                        | Injury-to-surgery interval, per day | 0.91 (0.81–1.03)   | .146    |
| CI, confidence interval; OR, odds ratio. Initial models included fixation technique, age, smoking, hypertension, injury mechanism, Rockwood type, and time from injury to surgery. Final models were selected using backward likelihood-ratio procedures. These analyses are exploratory. |                                     |                    |         |

For return to daily activity after more than 1 month, hook-plate fixation was not significantly associated with delayed return compared with suture-anchor fixation in the initial model (OR, 2.32; 95% CI, 0.54–9.93;  $P = .256$ ). Injury mechanism remained significant overall in the final model ( $P = .039$ ): traffic-related injury was associated with greater odds of delayed return than falling (OR, 5.00; 95% CI, 1.28–19.53;  $P = .021$ ), whereas the estimate for sports injury versus falling was imprecise and nonsignificant (OR, 8.00; 95% CI, 0.73–88.23;  $P = .090$ ). (Table 3)

For requiring more than 10 physiotherapy sessions, suture-anchor fixation was not significantly associated with higher odds than hook-plate fixation in the initial model (OR, 2.73; 95% CI, 0.62–12.07;  $P = .186$ ). In the final model, neither Rockwood type V versus type III injury (OR, 3.98; 95% CI, 0.88–18.03;  $P = .074$ ) nor time from injury to surgery per day (OR, 0.91; 95% CI, 0.81–1.03;  $P = .146$ ) reached statistical significance. The wide confidence intervals and stepwise selection indicate substantial model instability; these results should not be interpreted as confirmatory adjusted effects. (Table 3)

## Discussion

In this observational cohort, no statistically significant between-group difference was detected in the measured 6-month outcomes. Most patients in both groups had good or excellent categorical Constant-Murley outcomes. Suture-anchor patients returned to daily activity sooner numerically, whereas hook-plate patients underwent fewer physiotherapy sessions and had no recorded fixation failures. These findings are imprecise and exploratory; absence of statistical significance in a cohort of 44 patients is not evidence of equivalence.

The absence of a statistically significant difference in functional outcome is consistent with a substantial portion of the comparative ACJ literature. Metzclaff et al. reported similar Constant-Murley outcomes between hook-plate fixation and minimally invasive reconstruction in patients with acute ACJ separation, despite differences in implant characteristics and the need for subsequent hook-plate removal (17). Yoon et al. likewise reported comparable final pain and Constant-Murley scores after hook-plate fixation or coracoclavicular ligament reconstruction, although hook plates maintained radiographic reduction more reliably and were associated with subacromial erosion (10).

At the same time, the present findings differ from studies favoring ligament or suture-based reconstruction. An et al. compared coracoclavicular ligament reconstruction combined with either hook-plate or suture-anchor fixation and reported more favorable functional outcomes with the suture-anchor strategy (9). Differences in reconstruction technique, follow-up duration, and patient selection limit direct comparison with the present cohort.

The present pattern of statistically similar categorical Constant-Murley outcomes, with a numerical trend favoring hook-plate fixation, resembles a retrospective series comparing suture-button and hook-plate fixation for acromioclavicular joint injuries, which likewise found no significant between-group difference in Constant-Murley score but a modestly better pain outcome after hook-plate fixation (13). Findings have differed in other injury patterns: in a cohort of distal clavicle fractures, suture-anchor coracoclavicular reconstruction produced lower pain scores than hook-plate fixation with comparable Constant-Murley outcomes at longer follow-up, suggesting that injury type and fracture pattern may modify the relative performance of these constructs (14). In patients with more severe (Rockwood type IV) acromioclavicular injury, augmenting hook-plate fixation with a coracoclavicular suture anchor improved shoulder-specific functional scores without increasing complications, raising the possibility that combining rather than choosing between these constructs may benefit selected patients (18).

Contemporary meta-analytic evidence also illustrates this heterogeneity. Wang et al. reported higher pooled Constant scores and lower pain scores with suture-button fixation compared with hook plates, while finding no clear difference in complications or loss of reduction (11). A later systematic review similarly suggested improved function and pain with suture-button fixation, although differences across constructs, study design, and outcome timing limit direct extrapolation to anchor-based fixation (12).

A clinically relevant observation in our cohort was the occurrence of two fixation failures in the suture-anchor group and none following hook-plate fixation. Rigid hook-plate constructs provide immediate mechanical stabilization, and biomechanical investigations indicate that their stiffness differs

substantially from anchor- or suspensory-based techniques (8). Conversely, anchors avoid the subacromial component of a hook plate and the associated implant-related morbidity. Friedman et al. reported favorable outcomes with coracoclavicular suture-anchor stabilization, while also emphasizing the potential for early construct failure (7).

The two failures observed in the present study should therefore be clinically reported but not overinterpreted. With only two total events, the study has little ability to discriminate between a true difference in failure risk and random variation. Detailed review of those cases—including Rockwood type, chronicity, number and location of anchors, postoperative compliance, mechanism of failure, and whether revision surgery was required—would materially strengthen the manuscript.

Hook-plate fixation has its own characteristic disadvantages. The hook occupies the subacromial space and may be associated with pain, osteolysis, erosion, restriction of motion, and peri-implant fracture. Implant removal is commonly undertaken after ligament healing (1, 10, 19–21). The current study did not report implant-related osteolysis, impingement, plate removal, or quantitative radiographic outcomes. Inclusion of coracoclavicular distance, loss of reduction, ACJ alignment, subacromial osteolysis, and implant removal would therefore strengthen the comparison substantially if these data can be recovered from the radiographic and operative records.

Another potentially meaningful observation was the numerically shorter return to daily activities following suture-anchor fixation: median 37.5 compared with 60 days. This difference did not reach statistical significance and the distributions were wide, but an early functional advantage from avoiding a rigid subacromial implant is biologically plausible. Similar early functional benefits have been reported with less rigid or suspensory constructs, although long-term differences often diminish (11, 12, 17). Consequently, the present result should be interpreted as hypothesis-generating rather than evidence of faster recovery.

Conversely, patients treated with suture anchors underwent more physiotherapy sessions on average. This could reflect treatment-protocol differences, surgeon preference, postoperative apprehension, differences in rehabilitation access, or more intensive rehabilitation in patients treated without rigid fixation. Because the source study did not document a standardized stopping criterion for physiotherapy, the number of sessions should not be interpreted simply as treatment burden.

The majority of patients in this cohort had Rockwood type V injuries. Contemporary consensus documents support consideration of injury grade, horizontal instability, scapular dysfunction, chronicity, patient demand, and associated pathology rather than reliance exclusively on vertical displacement (3–5). The exploratory association between Rockwood type III injury and better functional outcome in the original regression should therefore be interpreted cautiously. Type V injury represents more extensive soft-tissue disruption and a worse outcome is biologically plausible, but only 13 type III patients were available and the reported confidence interval was extremely wide.

## Strengths and Limitations

This study directly compares two clinically distinct fixation strategies at one tertiary trauma center, includes equally sized treatment groups, and focuses on Rockwood type III and V injuries. The measured baseline variables were broadly similar, although the small sample means clinically important imbalance and unmeasured confounding remain possible.

Several limitations are substantial. First, the cohort contained only 44 patients, yielding low precision for uncommon complications and limited power to detect clinically important differences. Second, treatment was not documented as randomized and the allocation mechanism was not reported, leaving a risk of confounding by indication. Third, recruitment dates, operative details, rehabilitation protocols, and the hook-plate removal policy were absent from the source report. Fourth, follow-up was limited to 6 months and cannot characterize late recurrent displacement, ACJ degeneration, persistent pain, or outcomes after plate removal. Fifth, the report provided only categorical Constant-Murley results and no standardized radiographic measurements, ASES or DASH scores, or pain scores. Sixth, fixation failure was not operationally defined, and arthritis was planned but not reported. Finally, the protocol age criterion conflicts with the analyzed age range, and the original stepwise regression models were overparameterized and unstable.

## Conclusion

Among 44 patients with Rockwood type III or V ACJ dislocation, no statistically significant between-group differences were detected in categorical Constant-Murley outcome, return to daily activity, fixation failure, or physiotherapy use at 6 months. Suture-anchor fixation was associated with a numerically earlier return to daily activity but two fixation failures, whereas hook-plate fixation was associated with fewer physiotherapy sessions. The study does not establish superiority or equivalence. Larger prospective comparative studies should use continuous validated outcomes, standardized radiographic measures, longer follow-up, and detailed reporting of technique-specific complications.

## Declarations

### **Ethics approval and consent to participate**

This study was approved by the Research Ethics Committee of Guilan University of Medical Sciences, Rasht, Iran (IR.GUMS.REC.1402.171). The study was conducted in accordance with the Declaration of Helsinki and institutional ethical guidelines. Written informed consent was obtained from all participants or, when acute injury precluded direct consent, from their legal guardians or next of kin. All patient data were anonymized and kept confidential.

### **Clinical trial number**

Not applicable

### **Consent for publication**

Not applicable

## **Funding**

Not applicable

## **Conflict of interest**

Not applicable

## **Data availability**

The data that support the findings of this study are available from the corresponding author upon reasonable request, subject to institutional and ethical restrictions.

## **Author contributions**

Sina Kamrani Moghadam: Conceptualization, surgical procedures, data collection, writing – original draft; Mojtaba Abbasalizadeh: Data collection, investigation, writing – original draft; Mohammad Amouzadeh-Lichahi: Data collection, investigation, writing – review and editing; Ehsan Kazemnezhad Leyli: Formal analysis, statistical analysis, interpretation of data; Samman Mohammadi: Data collection, investigation, writing – review and editing; Kamran Asadi: Conceptualization, supervision, surgical procedures, project administration, writing – review and editing, final approval of the manuscript. All authors read and approved the final manuscript.

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Figures

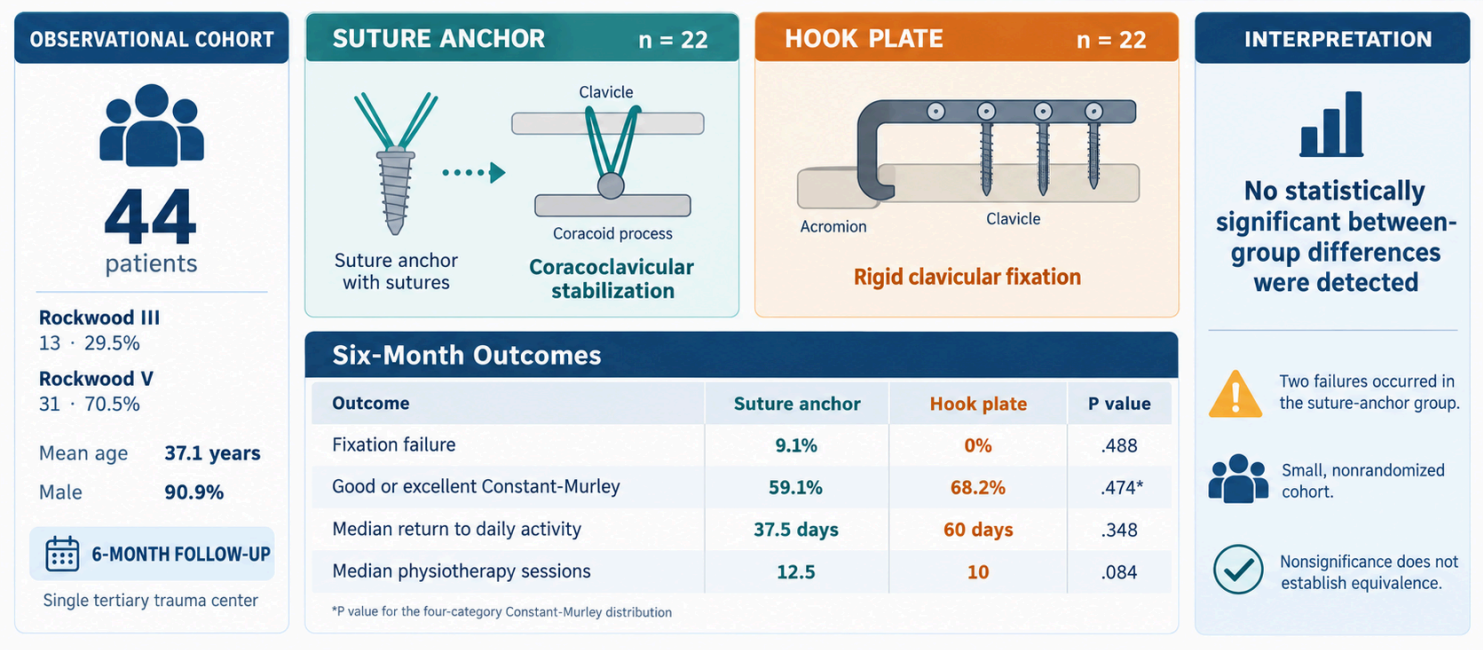


Figure 1

Graphical abstract represents a summary of the study findings