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Original Research Article

Surgical approaches and postoperative outcomes in acromioclavicular joint fractures: a retrospective study of patient demographics, effectiveness and plate removal timing

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ABSTRACT

Background: Acromioclavicular (AC) joint fractures and dislocations are common shoulder injuries, particularly among young active males. Despite the widespread use of various fixation techniques, optimal management and implant removal timing remain topics of ongoing debate. This study retrospectively evaluates patient demographics, surgical approaches, postoperative outcomes, and plate removal timing among individuals treated for AC joint fractures at a major trauma center.
Methods: A retrospective observational study was conducted at Rashid Hospital, Dubai, including 187 patients aged ≥18 years who underwent operative or conservative management for AC joint fractures between 2018 and 2025. Sociodemographic data, treatment modality, surgical technique, complications, functional outcomes, and implant removal times were extracted from electronic medical records. Descriptive statistics were performed using SPSS v29.
Results: The cohort was predominantly male (93%), with most patients aged ≤40 years (69%). Hook plates were the primary fixation method (86.6%). Postoperatively, 47.8% reported pain, while 52.2% remained pain-free. Range-of-motion limitations were noted in 45.2% of patients, with adduction deficits being most common. Reoperation was primarily for implant removal, occurred in 79.7% of cases. Most plate removals occurred between 4–6 months, peaking at 5 months (41 cases). Early removal at 3 months was uncommon, and 37 patients had no removal at the time of review.
Conclusions: Hook plate fixation remains the predominant surgical approach for AC joint fractures at our institution, with generally favorable postoperative outcomes. Functional recovery was preserved in over half of the patients, and implant removal most occurred within 4–6 months. These findings highlight the importance of timely postoperative evaluation and individualized decision-making regarding plate removal to optimize long-term outcomes.

Keywords: Acromioclavicular joint fracture, Hook plate fixation, Postoperative outcomes, Plate removal timing, Shoulder range of motion

INTRODUCTION

One of the most prevalent shoulder injuries is acromioclavicular (AC) joint dislocation, accounting for approximately 9% of all shoulder injuries, particularly among athletes involved in contact sports.[1] The AC joint may sustain direct trauma when a vertically oriented force impacts the lateral aspect of the shoulder, driving the acromion inferiorly.[2] Conversely, indirect trauma occurs when an individual falls on an adducted and outstretched arm, forcing the humeral head superiorly against the acromion and disrupting the joint.[3] In a retrospective study

involving 108 patients, the mean age was 37.5 years. Among them, 2.8% had a clavicular fracture, and 97.2% presented with isolated AC dislocation.[4] Individuals aged 20–39 years represented 50.5% of all cases, with an estimated incidence of 1.8 per 10,000 inhabitants annually and a male-to-female ratio of 8.5:1.[4] A related study reported 3,031 shoulder injuries between May 2013 and April 2014, with 60% of cases occurring in males (median age: 37 years; range: 14 days–102 years). The median age for women was 51 years, compared to 31 years for men ($p < 0.001$).[5] Management of AC joint dislocation is typically guided by Rockwood's classification.[6] Although multiple surgical techniques have been described, no single method has been universally accepted as the gold standard for operative stabilization.[7] For the treatment of acute AC dislocations, both the Minimally Invasive TightRope (MITR) and Hook Plate (HP) techniques have demonstrated comparable radiological and clinical outcomes.[8,9] However, the MITR method offers greater surgical convenience and a slightly lower incidence of postoperative pain.[8]

In a retrospective analysis, the union rate was 95%, with a mean time to union of 3 months (IQR: 2–4).[9] Ninety-two percent of the plates were removed at a median of 4.5 months (IQR: 3-8.75), and no complications were reported.[9] Similarly, a Chinese study observed a median time to union of 3.4 months (range: 2–6) and hook-plate removal after 3.8 months (range: 3–12) following fracture healing.[10] A German study reported a 63.2% overall complication rate, with 5.2% of patients requiring revision surgery for peri-implant fracture. Other complications included post-traumatic AC joint arthrosis, acromial osteolysis, delayed union, and non-union.[10]

Despite high success rates and favourable outcomes, AO-type hook-plate fixation is associated with complications such as subacromial impingement and acromial osteolysis.[11] To minimize these risks, early removal of the plate following bone union has been widely recommended.[11] Therefore, the present study aims to retrospectively analyse patient characteristics, fixation methods, functional outcomes, complication rates, and implant removal duration in individuals undergoing surgical fixation for AC joint fractures and dislocations. The goal is to identify trends that can help refine surgical decision-making and optimize postoperative management.

METHODS

Study design and setting

This retrospective observational study was conducted at Rashid Hospital, a tertiary trauma center in Dubai, United Arab Emirates. The study aimed to evaluate patient characteristics, management approaches, outcomes, satisfaction, and timing of plate removal among individuals treated for acromioclavicular (AC) joint fractures. Data were collected from hospital electronic medical records (EMR) and orthopedic surgery archives over a six-year period (e.g., January 2018 to January 2024).

Participants and sampling

The study included all patients aged 18 years and above who underwent operative or non-operative treatment for AC joint fractures at Rashid Hospital during the study period. Inclusion criteria were confirmed diagnosis of AC joint fracture or dislocation, documented treatment details, and available follow-up data. Patients with incomplete records, prior ipsilateral shoulder surgery, or pathological fractures were excluded. A consecutive sampling approach was used to include all eligible cases presenting to the Orthopedics and Trauma departments.

Data collection and variables

Data extraction was conducted using a structured, predesigned data collection sheet that captured key demographic information such as age, gender, occupation, and mechanism of injury. Treatment-related variables were also recorded, including whether management was operative or conservative, the type of implant used (such as hook plate or locking plate), relevant surgical details, and any postoperative complications. Follow-up outcomes were documented, particularly the duration until plate removal and functional recovery indicators such as range of motion and pain scores.

All collected data were numerically coded for analysis, with continuous variables (e.g., age and time to plate removal) maintained in their original units, while categorical variables (e.g., gender, implant type, and presence or absence of complications) were coded using appropriate numerical classifications.

Bias control and analysis

To minimize selection and information bias, only patients with complete records and follow-up data were included. Data extraction was performed independently by two investigators, and discrepancies were resolved through consensus. All data were anonymized prior to analysis. Statistical analysis was performed using SPSS version 29. Descriptive statistics (means, medians, frequencies) summarized patient characteristics and outcomes.

Ethical considerations

Ethical approval for the study was obtained from the Dubai Health (DH) Research Ethics Committee. The study followed institutional and international ethical standards for retrospective research. As this study involved review of existing medical records, informed consent was waived by the ethics committee. All patient data were de-identified to maintain confidentiality, and files are stored securely within the Orthopedics Department research registry.

RESULTS

A total of 186 participants were included in the study. The majority were male (n=173, 93%), while females constituted a smaller proportion (n=13, 7%). Most participants were aged 40 years or younger (n=128, 69%), whereas 59 participants (31%) were above 40 years of age. These sociodemographic characteristics provide important context for interpreting the subsequent findings of the study.

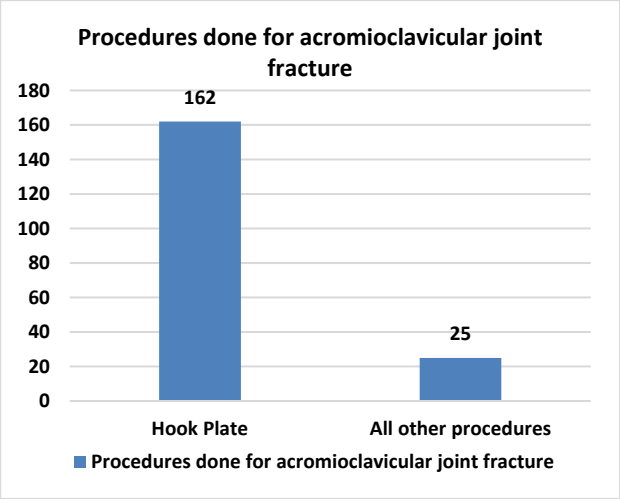

Figure 1: Distribution of procedures performed for acromioclavicular joint fractures.

Figure 1 illustrates the distribution of procedures performed for acromioclavicular joint fractures. Most cases were managed using a hook plate, accounting for 162 procedures (86.6%). In contrast, all other surgical techniques collectively comprised only 25 cases (13.4%).

Table 1: Socio-demographic factors of patients with acromioclavicular joint fracture.

Sociodemographic factors		Frequency
Gender	Male	173
	Female	14
Age	Less than or equal to 40 years old	128
	More than 40 years old	59

Among the postoperative outcomes assessed in Table 2, 89 participants (47.8%) reported experiencing pain after the procedure, while 98 participants (52.2%) reported no postoperative pain. Regarding functional outcomes, 84 participants (45.2%) demonstrated limitations in range of motion, whereas 103 participants (54.8%) had no range of motion impairment following the procedure. These findings indicate that just over half of the patients achieved pain-free recovery and preserved shoulder mobility postoperatively. Figure 2 demonstrates the distribution of range of motion deficits among patients following acromioclavicular joint fracture procedures. Most participants (n=106, 57%) exhibited no loss of range of motion. Among those with deficits, adduction limitation was the most common (n=43, 23%), followed by isolated flexion limitation (n=23, 12%). A smaller proportion (n=15,8%) experienced combined deficits in both adduction and flexion.

Table 2: Postoperative pain and range of motion outcomes among patients undergoing AC joint fracture procedures.

Variables		Frequency
Pain after procedure	Yes	89
	No	98
Range of motion	Yes	84
	No	103

Figure 3 presents the proportion of patients who required reoperation following acromioclavicular joint fracture management.

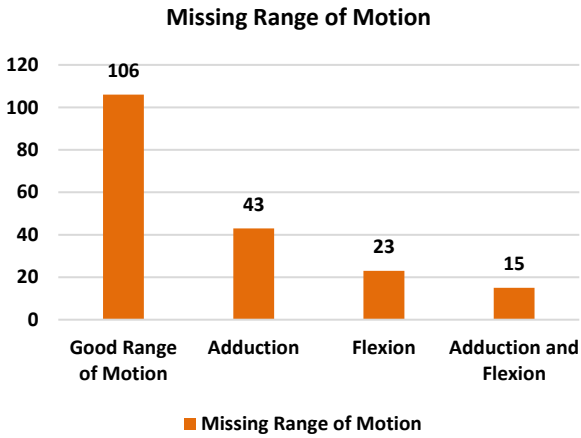

Figure 2: Distribution of missing range of motion types among patients following acromioclavicular joint fracture procedures.

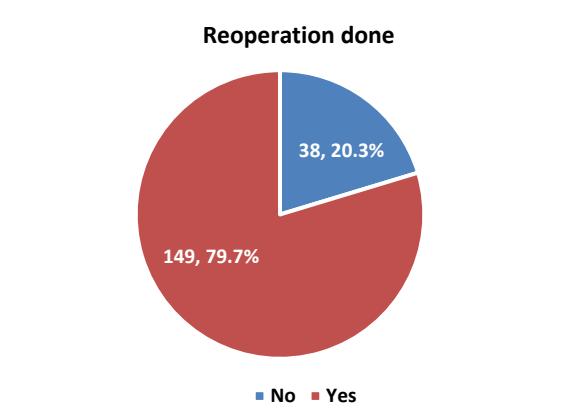

Figure 3: Proportion of patients who required reoperation following acromioclavicular joint fracture procedures.

A total of 149 patients (79.7%) underwent a reoperation, while the majority, 38 patients (20.3%), did not undergo surgical intervention. From Figure 4, the distribution of implant removal times showed that most removals occurred between 4 and 6 months. The highest proportion was at 5 months (41 cases), followed closely by 4 months (37 cases) and 6 months (35 cases).

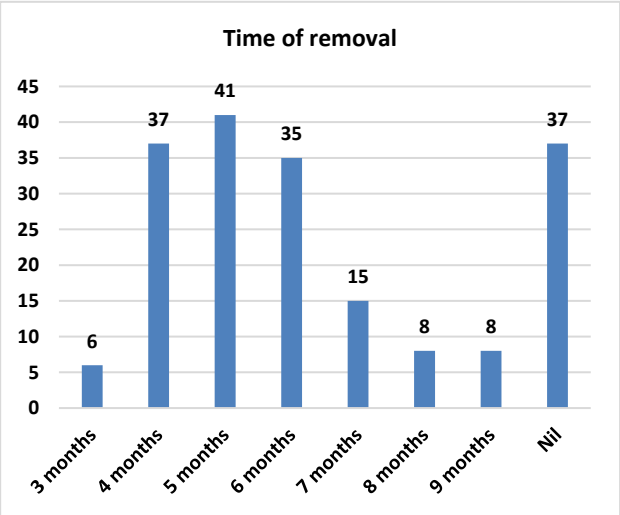

Figure 4: Distribution of implant removal times among participants, showing the frequency of removals across different months and those who had not yet undergone removal.

A smaller number of removals were reported at 7 months (15 cases), while only 8 cases each were removed at 8 and 9 months. Early removals at 3 months were uncommon (6 cases). Notably, 37 participants had no removal at the time of assessment, indicating a considerable proportion that continued use beyond the observed timeframe.

DISCUSSION

This retrospective study provides important insights into the demographic characteristics, surgical practices, postoperative outcomes, and implant removal patterns among patients treated for acromioclavicular (AC) joint fractures at a major trauma centre in the United Arab Emirates.

The demographic profile of our study population aligns closely with previously published literature on AC joint injuries. In our cohort, 93% of patients were male and most were 40 years or younger, reflecting the high-energy mechanisms and activity levels typically associated with these injuries. Similar trends have been observed in large epidemiological datasets. For example, an analysis of 4,163 AC joint separations from the U.S. National Electronic Injury Surveillance System reported that 83.9% of cases occurred in males, with the highest incidence in individuals aged 10–30 years (47.6%).[12] Likewise, a Swedish prospective study involving 158 patients found a strong male predominance (139 males) and a mean age of 39 years, consistent with the relatively young adult population affected in our study.[13] Comparable demographic characteristics were also reported in a Pakistani cohort, where the mean age was 35.7 years and 70% of patients were male.[14] Collectively, these findings support the global pattern that AC joint fractures and dislocations predominantly affect younger, active males across diverse geographic regions. The alignment of our results with international data strengthens the external validity of our study and provides a reliable epidemiological context for interpreting the clinical outcomes observed in our population.

The predominance of hook plate fixation in our cohort used in 162 cases (86.6%) highlights its continued preference as the primary surgical approach for acromioclavicular joint fractures in our institution. This finding is consistent with patterns reported in international studies. In a retrospective Chinese study, 39 of 71 patients underwent hook plate fixation, while 32 were treated with a TightRope system, demonstrating a similarly high utilization of hook plates in clinical practice.[15]

Another retrospective analysis of 61 patients with acute AC joint dislocations reported comparable trends, with 36 patients treated using hook plates and 25 treated with TightRope stabilization.[16] From a clinical standpoint, the preference for hook plates may reflect surgeon familiarity, predictable biomechanical stability, and the ease of achieving and maintaining anatomical reduction factors that are particularly important in high-energy injuries. In our experience, hook plate fixation provides reliable stabilization during the early healing period, which may contribute to the lower rates of redislocation observed in many studies. However, it is also important to recognize that the reliance on hook plates has implications for postoperative management, including the need for a second surgery for implant removal. This underscores the importance of evaluating patient-specific factors, such as activity level, comorbidities, and tolerance for reoperation when selecting the optimal fixation method.

Postoperative pain and functional limitation were relatively common in our cohort, with 47.8% of patients reporting pain and 45.2% experiencing some degree of range-of-motion (ROM) restriction. While slightly more than half of the participants achieved pain-free recovery and preserved mobility, these findings highlight the clinical variability following AC joint fixation. The pattern of ROM deficits showed that adduction limitation was most prevalent, followed by isolated flexion impairment and combined deficits, suggesting that superior–inferior stabilization by hook plates may contribute to localized shoulder stiffness.

Our observations align with existing literature reporting persistent shoulder discomfort after hook plate fixation. A meta-analysis comparing TightRope and hook plate techniques demonstrated that TightRope fixation was associated with significantly lower postoperative pain scores (VAS difference −0.69; p=0.001), indicating that

hook plates may inherently predispose patients to increased pain during recovery.[7] Functional outcomes also vary across studies. Another study examined ROM following hook plate fixation with ligament repair and found mean postoperative forward flexion of 160.4°, abduction of 160.4°, and relatively preserved internal and external rotation, reflecting a generally favourable mobility profile despite some limitations.[17] Similarly, a German study involving 225 patients treated with AC hook plates reported postoperative pain across different procedure groups, further supporting that discomfort is not uncommon following this fixation method.[18]

Taken together, these findings underscore the importance of considering postoperative pain and potential ROM deficits when selecting surgical techniques. In our clinical experience, hook plates provide excellent initial stability, but surgeons must weigh the benefits against the risk of postoperative stiffness and the requirement for later implant removal. Personalised rehabilitation programs and timely removal may play key roles in optimizing long-term functional recovery.

The reoperation rate in our cohort was notably high, with 79.7% of patients requiring a secondary procedure, largely due to routine implant removal following hook plate fixation. This rate is substantially higher than what has been reported in the literature. A recent meta-analysis comparing TightRope and hook plate techniques documented a reoperation rate of only 18.3% in the hook plate group, corresponding to 44 out of 240 patients undergoing removal.[19] This discrepancy likely reflects institutional protocols and surgeon preference, as hook plates inherently necessitate removal once union is achieved, while some centres delay removal or reserve it only for symptomatic patients. Our findings emphasize the operational burden associated with hook plate fixation, including the need for additional anaesthesia exposure and recovery time.

The timing of implant removal in our study also demonstrated clear trends. Most removals occurred between 4 and 6 months, consistent with recommendations to avoid prolonged subacromial irritation. Comparable removal windows have been documented in previous studies. A study reported routine hook plate removal between 8 and 12 months postoperatively, with no postoperative redislocations observed at follow-up.[20] In contrast, another study described substantially earlier removal, with a median interval of 11.9 weeks (10–13 weeks), reflecting a more aggressive strategy to prevent impingement-related symptoms.[21] A study reported mean reoperation times of 5.31 months for AC dislocations and 9.65 months for distal clavicle fractures, intervals that closely mirror the predominant removal period seen in our cohort.[22] The variability in removal timing across studies highlights the ongoing debate regarding optimal hardware retention duration. In our clinical setting, removal clustered around 4–6 months appears to strike a balance between achieving stable union and minimizing complications such as subacromial impingement or acromial osteolysis. However, the 37 patients who had not undergone removal at the time of assessment illustrate the challenges of individualized care, patient adherence, and surgical scheduling. These observations underscore the importance of tailored postoperative planning and further research to refine evidence-based guidelines for hook plate removal.

CONCLUSION

This unique, region-specific study provides valuable insights into the demographics, surgical management, and outcomes of AC joint fractures in a major UAE trauma center. AC injuries predominantly affected young, active males, with hook plate fixation used in the majority (86.6%) of cases. Although this method provides reliable early stability, it is associated with postoperative pain, limited shoulder mobility, and a high rate of reoperations due to routine implant removal, typically between 4–6 months.

By filling a critical gap in Middle Eastern data, these findings highlight the need for optimized surgical planning, careful timing of implant removal, and standardized rehabilitation protocols. Further prospective studies are warranted to compare fixation techniques and refine postoperative management for improved patient outcomes.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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