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Original Research Article

A Study on the Impact of Suture Anchor Fixation on Functional Outcomes in Patients with Acromioclavicular Joint Disruption

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Abstract:

Background: The Acromioclavicular (AC) joint is a movable joint stabilized by a combination of both active muscular elements and static ligamentous structures. Typically, non-surgical approaches are favoured for Rockwood type 1 and 2 AC joint disruptions, while surgical intervention is recommended for Rockwood types 3, 4, 5, and 6. However, the optimal surgical procedure for managing AC joint disruption remains a topic of ongoing debate, with the continual evolution of newer techniques.

Methods: In our study, we investigated 25 patients who underwent AC joint reconstruction using the suture anchor technique. Patients were assessed before the surgery and during post-operative follow-up using serial radiography. Functional evaluation was performed utilizing the Constant Murley score.

Results: The results showed excellent functional outcomes in 72% of patients, good outcomes in 16% of patients, fair outcomes in 8% of patients, and poor outcomes in 4% of patients. Utilizing the suture anchor technique for AC joint reconstruction proves to be a relatively straightforward approach, resulting in positive functional outcomes and pain relief. These outcomes significantly contribute to an enhanced quality of life for patients.

Conclusion: suture anchors prove to be an effective approach for patients experiencing acute acromioclavicular joint dislocation, offering a successful reconstruction of both coracoclavicular and acromioclavicular joints. This technique stands as a reliable and efficient method for surgically managing acromioclavicular injuries.

Keywords: Acromioclavicular joint disruption, anchor sutures, constant Murley score, acromioclavicular joint reconstruction.

Introduction

Acromioclavicular (AC) joint dislocations, often referred to as AC joint injuries, constitute a significant proportion of shoulder injuries. [1] These injuries account for approximately 9% to 12% of shoulder girdle injuries and are more commonly observed in young adults and athletes. [2] Typically, they occur due to a direct fall onto the superior aspect of the shoulder with the arm in an adducted position. [3] Moreover, AC joint injuries are about five times more prevalent in men compared to women. The acromioclavicular (AC) joint, a diarthrodial joint, is positioned between the lateral end of the clavicle and the medial acromion. The plane of the joint can be vertically or medially inclined at an approximately 50-degree angle. The AC joint is supported by soft tissue, enabling the clavicle to function as a stabilizing structure, which is crucial for maintaining the lateral position of the scapula on the chest wall. The average coracoclavicular distance typically ranges from 1.1 to 1.3 cm. [4] To induce instability in the AC joint, both the horizontally stabilizing capsular ligaments and the more robust vertically stabilizing coracoclavicular (CC) ligaments must be torn. Consequently, the upper trapezius muscle endeavors to retain the clavicle in a horizontal position while the scapula and upper limb deviate, resulting in clinically observable AC joint separations of types III through V. [5, 6] Acromioclavicular (AC) joint injury accounts for approximately 20% of all shoulder injuries. This type of injury is more prevalent in individuals in their second decade of life and is frequently observed in contact sports athletes. [7] The primary mechanism of injury usually involves a fall onto the shoulder with the arm in adduction, often accompanied by lateral end clavicle, acromion, and coracoid fractures. Injuries to the AC joint can lead to persistent pain and

compromise the overall function of the shoulder joint. An anatomically distinguishing feature of such injuries is a downward sag of the shoulder and arm, often accompanied by step-off deformity and tenderness at the AC joint. The initial assessment typically involves standard trauma radiography, including the Zanca view. The Rockwood classification categorizes these injuries and guides treatment decisions. Non-operative approaches are well established for Rockwood types 1 and 2. In contrast, operative intervention is commonly pursued for Rockwood type III injuries if conservative management proves ineffective or if there is a high-grade separation resulting in significant instability due to disruption of dynamic muscular stabilizers. Various surgical techniques, such as K-wires, hook plates, button plates, and ligament reconstruction, have been reported with varying success rates. [8] The use of suture anchors presents a surgical approach with a small incision and limited dissection, primarily focusing on the region above the coracoid. This approach has the potential to reduce the risk of neurovascular injury compared with techniques involving the passage of sutures around the base of the coracoid. Additionally, the procedure eliminates the necessity for hardware removal, and minimal complications concerning implant breakage or migration have been reported. [9] Our goal was to delineate the application of suture anchors secured over the lateral end of the clavicle and to assess its initial outcomes.

Material and Methods

This perspective study was conducted in the Department of Orthopedics, Prathima Institute of Medical Sciences, Naganoor, Karimnagar. Institutional Ethical approval was obtained for the study. Written consent was obtained from all the participants of the study after explaining the nature of the study in the vernacular language. The patients underwent preoperative and postoperative evaluations, including serial radiography and functional assessment was conducted using the Constant Murley score.

Surgical Procedure: Under an interscalene block, the patient assumed the beach chair position. Standard prepping and draping techniques were employed for the shoulder and upper extremities. An examination under anesthesia was conducted to assess shoulder range of motion, stability, and ease of reducing the acromioclavicular joint. A 7 cm incision, resembling a strap, was carefully made along Langer's line, commencing 2.5 cm posterior to the clavicle. The incision traversed the clavicle, positioned 2.5 cm medial to the AC joint, and extended distally to a point medial to the coracoid process. Subsequently, the deltoid and trapezius muscles were gently elevated in a subperiosteal manner from the distal clavicle and anterior acromion. Retraction of the deltoid muscle followed, directed anteriorly and distally, revealing the base of the coracoid. A towel clip was employed to grasp the distal inch of the clavicle, lifting it upwards for a comprehensive debridement of the AC joint from the intra-articular disc. Any loose frays of the acromioclavicular ligaments were carefully removed from the clavicle or acromion. The base of the coracoid was then identified and prepared for the anchor insertion. Using a 2 mm drill bit, two tunnels were created through the superior cortex of the clavicle, aligning with the original ligament positions, approximately 1 cm apart and situated 2 to 5 cm proximal to the distal clavicle end. A needle was threaded through these tunnels to retrieve two strands of suture through each hole. The four free suture ends were guided through openings made over the lateral end of the clavicle and a small button plate. With the assistance of holding the reduction, the acromioclavicular joint was meticulously reduced to its anatomical position. The four suture ends were securely tied and tightened over the plate. Following this, the deltoid and trapezius muscles, along with the fascia, were reattached to the clavicle, and the skin was closed. After the surgery, the shoulder was carefully immobilized in a sling for 4-6 weeks. Pendulum exercises were initiated 3 weeks after the surgical procedure. By the sixth week, patients commenced a gradual transition to a wider range of motion exercises and began strengthening exercises. However, any activities involving heavy lifting or resistance were strictly prohibited for the initial 3 months following the surgery.

Statistical analysis: All the available data was verified and uploaded on an MS Excel spreadsheet and analyzed by SPSS version 21 in Windows format. The continuous variables were measured as mean, standard deviation, and percentages. The categorical variables were measured with p values using the chi-square test. P values of (<0.05) were considered significant.

Results

A total of 25 cases were included in the study during the study period. Out of the 25 cases, 15(60%) were males and 10(40%) were females. The male-to-female ratio was 1.5: 1.

Table 1: Showing the age-wise distribution of cases of Acromioclavicular disruption in the study

Age group	Frequency	Percentage
21 – 25	4	16.00
26 – 30	3	12.00
31 – 35	6	24.00
36 – 40	7	28.00
41 – 45	2	08.00
46 – 50	3	12.00
Total	25	100.00

Table 1 shows the age-wise distribution of cases of acromioclavicular disruption in the study. The highest frequency of cases (28%) was in the 36-40 age group, followed by the 31-35 age group (24%). The lowest frequency of cases (8%) was in the 41-45 age group. This suggests that acromioclavicular disruption is most common in people in their 30s and 40s, but it can occur at any age.

Table 2: Distribution of cases of acromioclavicular disruption in the study according to the side of injury, mode of injury, and Rockwood classification.

	Frequency	Percentage
Side of acromioclavicular disruption		
Right	16	64
Left	9	36
Mode of injury for acromioclavicular disruption		
Road Traffic Accidents	18	72
Sports injuries	5	20
Interpersonal fights	2	8
Distribution of cases according to Rockwood classification		
T3	10	40
T4	4	16
T5	11	44

Table 2 shows that acromioclavicular disruption is more common on the right side than on the left side. This is likely because the right side is the dominant side for most people, and therefore more likely to be involved in activities that can lead to acromioclavicular disruption, such as sports and road traffic accidents. The most common mode of injury is road traffic accidents, followed by sports injuries and interpersonal fights. This is not surprising, as these are all activities that can involve high-energy impacts. The most common Rockwood classification type is Type 5, followed by Type 3 and Type 4. Rockwood type 5 acromioclavicular disruptions are the most severe, as they involve complete disruption of the acromioclavicular ligaments and coracoclavicular ligaments.

Table 3: Constant Murley scores at 6-month post-operative period

Grades of constant scores	Score Interval	Postoperative	
		Frequency	Percentage
Excellent	90 – 100	18	72
Good	80 – 89	4	16
Fair	70 – 79	2	8
Poor	< 70	1	4
Total		25	100
Mean ± SD		89.52 ± 5.54	
Percentage of constant score		89.5%	

Table 3 shows the Constant Murley scores of 25 patients at 6 months after surgery for acromioclavicular joint disruption. The Constant Murley score is a measure of shoulder function that takes into account pain, range of motion, strength, and activities of daily living.

Excellent: Patients with an excellent Constant Murley score have no or minimal pain, full range of motion, and full strength in their shoulders. They can perform all activities of daily living without difficulty.

Good: Patients with a good Constant Murley score have mild pain, some limitations in range of motion and strength, and some difficulty performing certain activities of daily living.

Fair: Patients with a fair Constant Murley score have moderate pain, significant limitations in range

of motion and strength, and difficulty performing many activities of daily living.

Poor: Patients with a poor Constant Murley score have severe pain, severe limitations in range of motion and strength, and are unable to perform most activities of daily living.

The results of the table show that 72% of patients had an excellent Constant Murley score at 6 months after surgery, 16% had a good score, 8% had a fair score, and 4% had a poor score. The mean Constant Murley score was 89.52 ± 5.54, which is considered to be an excellent score. Overall, the results of the table suggest that surgery for acromioclavicular joint disruption is a very effective treatment, with most patients achieving excellent or good functional outcomes at 6 months after surgery.

Discussion

Acromioclavicular (AC) joint dislocations are often referred to as AC joint injuries. The occurrence of high-grade AC joint injuries that necessitate surgery is relatively low, there is ongoing debate regarding the choice between conservative and surgical treatments for type III and V injuries. This controversy has led to the development of various surgical techniques, suggesting a certain level of dissatisfaction with available treatment options and outcomes. [10-14] Many surgical repair and reconstruction techniques have been documented. There are over 150 techniques described for surgically addressing AC injuries. [10] These treatments are based on three types of fixations: acromioclavicular, coracoclavicular, and dynamic muscle transfer. Our study was done on 25 patients who had Acromioclavicular joint disruption and underwent reconstruction using suture anchors.

Breslow et al. [15] discovered that comparable stability can be attained through coracoclavicular fixation using either suture anchors or sutures encircling the base of the coracoid in the management of acromioclavicular joint separations. Employing suture anchors may streamline surgical procedures and minimize the risk of neurovascular injury linked with passing sutures beneath the coracoid. Jerosch et al. [16] examined eight distinct AC reconstruction approaches using ten cadaveric shoulders. They observed that employing a bone anchor system for distal clavicle fixation at the base of the coracoid process and creating a medialized hole in the clavicle resulted in the most accurate restoration of anatomy. Based on this, they advocated for this technique in achieving anatomic AC reconstruction. Su et al. [17] presented findings from their study involving 11 consecutive patients with complete AC separations. They were treated using two suture anchors anchored at the base of the coracoid. No instances of fixation failure or deformity recurrence were reported. Arthroscopic reconstruction for AC joint dislocation using suture anchors is a more intricate and technically demanding procedure. Open surgical repair remains the established and most effective treatment for high-grade AC joint disruption. It offers adequate exposure, allowing thorough debridement of the AC joint and excellent visualization of the base of the coracoid. Additionally, it tends to require relatively less surgical time.

Several biomechanical studies have shown that suture anchors offer comparable effectiveness to reconstructive methods involving the coracoacromial ligament, screw fixation, or the passage of sutures or synthetic augmentations beneath the base of the coracoid. [18, 19] Our approach carries several advantages. Firstly, the suture configuration closely mimics the anatomic alignment of the coracoclavicular ligaments, providing comparable strength and functionality to the intact ligaments. Secondly, the bone tunnel diameter is 2.0 mm, potentially reducing the risk of fractures. Thirdly, our technique eliminates the possibility of impingement, a concern associated with hook plate fixation, and obviates the need for hardware removal.

Conclusion

In conclusion, the suture anchors prove to be an effective approach for patients experiencing acute acromioclavicular joint dislocation, offering a successful reconstruction of both coracoclavicular and acromioclavicular joints. This technique stands as a reliable and efficient method for surgically managing acromioclavicular injuries. Notably, it boasts advantages such as ease of operation, reduced risk of complications, and eliminates the necessity for fixation removal. Adherence to a well-structured rehabilitation regimen is of paramount importance and should be rigorously followed.

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