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Optimizing acromioclavicular joint management: A case series on minimally invasive TightRope with double endobutton fixation

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ABSTRACT

Acromioclavicular (AC) joint dislocation constitutes 40% of shoulder injuries, impacting patients across diverse activities. The Rockwood Staging System guides assessment, prompting exploration of the novel TightRope with double endobutton fixation technique to restore AC joint function. This study aims to evaluate the outcomes of the TightRope with double endobutton fixation technique in 20 cases of AC joint dislocation, emphasizing its potential advantages over conventional methods. A case series involving 20 AC joint dislocation cases underwent comprehensive evaluation, including follow-ups and radiological assessments. Surgical interventions were performed using the TightRope with double endobutton fixation technique. The average age was 44.5 years, with a notable prevalence of severe dislocations (Classes V and VI). Surgical interventions demonstrated efficiency, with a brief hospital stay. The innovative technique yielded excellent outcomes, with 90% achieving high Constant–Murley scores. TightRope with double endobutton fixation emerges as a promising, minimally invasive strategy for AC joint dislocation, exhibiting potential in minimizing post-operative complications and expediting recovery. The study advocates for individualized interventions and emphasizes the need for further exploration of long-term implications.

Key words: Acromioclavicular joint; TightRope; Double endobutton fixation; Rockwood classification; Shoulder injuries

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INTRODUCTION

Acromioclavicular (AC) joint injuries, constituting over 40% of shoulder injuries, span from mild morbidity to severe strength and function loss.[1,2] Their link to diverse activities such as sports, car accidents, and falls highlights their clinical importance. The mechanism often involves direct trauma to the lateral shoulder or acromion during arm adduction.[3] The Rockwood Staging System is vital for radiographic assessment, guiding treatment decisions for AC joint injuries.[4]

Concentrating on AC joint injuries, this study explores their impact from mild to severe, significantly affecting shoulder function. Treatment approaches have evolved from traditional methods to innovative solutions, focusing on stabilizing and restoring AC joint function. This progression is evident in the shift from conventional techniques such as Bosworth screw fixation and tension band wiring (TBW) to contemporary methods such as ligament reconstruction with autografts and hook plates.

In the domain of AC joint injury management, this study introduces a distinctive approach – a novel technique involving TightRope and double endobutton fixation. The method aims to restore normal anatomy, stability, and range of motion in the AC joint. What distinguishes this technique is its potential to reduce the necessity

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for additional surgeries and minimize hardware-related complications, signifying a notable advancement in the field. This study was conducted to assess the functional outcomes of patients with AC joint dislocation undergoing this technique.

METHODOLOGY

This case series focused on 20 cases of AC joint dislocation admitted to a tertiary care center between June 2021 and June 2023. Patients were selected based on specific criteria for inclusion and exclusion. Inclusion criteria comprised dislocations falling within Rockwood types IV to VI, Rockwood type-III cases involving younger active individuals such as high-level athletes and manual laborers, participants aged 20 years or older, and dislocations with a duration of <4 weeks. Exclusion criteria included pre-existing conditions hindering major surgical procedures, Rockwood types I and II diagnoses, poor skin conditions in the immediate surgical area, individuals younger than 20 years, and open injuries. Detailed consent was obtained from the patients.

Case 1

A 24-year-old male presented to the emergency department following a road traffic accident (RTA) falls from a two wheeler. The patient reported immediate pain and swelling in the right shoulder, which worsened with movement. On examination, there was noticeable tenderness and swelling over the left shoulder, accompanied by a restricted range of motion. Standard anteroposterior (AP) X-ray revealed class 3 Rockwood classification AC joint dislocation. The patient underwent minimally invasive TightRope fixation with double endobutton of the right AC joint.

Case 2

A 34-year-old male presented to the outpatient department with complaints of pain and swelling in the right shoulder. He had a trauma fall from two wheeler 2 days ago. Shoulder examination revealed tenderness associated with painful and restricted movements. Standard AP X-ray revealed class 5 Rockwood classification AC joint separation (Figure 1) and underwent minimally invasive TightRope fixation with double endobutton of the right AC joint (Figure 2).

Case 3

A 35-year-old male presented to the outpatient department following a fall from height a week ago, after which he experienced pain and swelling in the right shoulder. On examination, there was tenderness and swelling over the right shoulder with a restricted range of motion. Standard AP X-ray revealed class 5 Rockwood classification AC joint dislocation. The patient underwent minimally invasive TightRope fixation with double endobutton of the right AC joint.

Figure 1: Image of a study subject showing restricted range of movement at presentation and a pre-operative radiographic image of study subjects showing right acromioclavicular joint dislocation

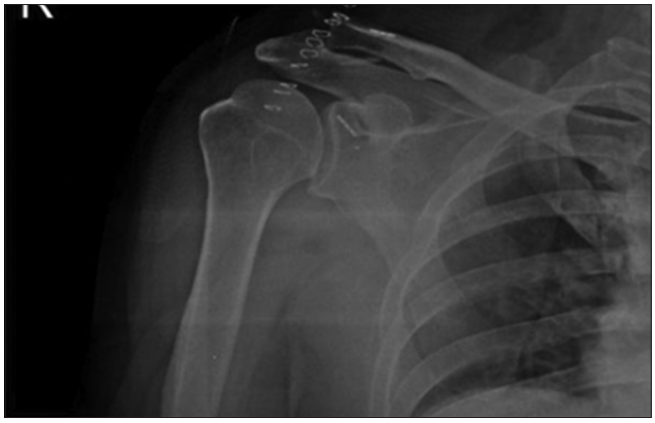

Figure 2: Post-operative X-ray image: Acromioclavicular joint after TightRope with double endobutton fixation

Case 4

A 50-year-old male presented to the emergency department following a slip and fall from stairs. The patient had pain and swelling in the right shoulder with tenderness over the right shoulder and painful range of motion. Standard AP X-ray revealed class 6 Rockwood classification AC joint separation. The patient underwent minimally invasive TightRope fixation with double endobutton of the right AC joint.

Case 5

A 55-year-old female presented to the emergency department following a fall from a two wheeler. On examination, there was noticeable tenderness and swelling over the left shoulder, accompanied by a restricted range of motion. Standard AP X-ray revealed class 4 Rockwood classification AC joint separation. The patient underwent minimally invasive TightRope fixation with double endobutton of the left AC joint.

Case 6

A 46-year-old male presented to the emergency department following a fall from height with pain and swelling in the

right shoulder, which worsened with movement. Standard AP X-ray revealed class 6 Rockwood classification AC joint dislocation. The patient underwent minimally invasive TightRope fixation with double endobutton of the right AC joint.

Case 7

A 49-year-old female presented to the outpatient department following a fall from height at the workplace. The patient reported pain and swelling in the left shoulder with painful movements. Standard AP X-ray revealed class 5 Rockwood classification AC joint dislocation. The patient underwent minimally invasive TightRope fixation with double endobutton of the left AC joint.

Case 8

A 38-year-old male presented to the outpatient department following a fall from height at workplace 3 days ago. The patient reported pain and swelling in the right shoulder with painful movement. On examination, there was tenderness and deformity over the right shoulder, accompanied by a restricted range of motion. Standard AP X-ray revealed class 6 Rockwood classification AC joint separation. The patient underwent minimally invasive TightRope fixation with double endobutton of the right AC joint.

Case 9

A 44-year-old male presented to the emergency department following a RTA. On examination, there was tenderness over the right shoulder with restricted range of motion. Standard AP X-ray revealed class 6 Rockwood classification AC joint separation and underwent minimally invasive TightRope fixation with double endobutton of the right AC joint.

Case 10

A 31-year-old male presented to the emergency department following a RTA with pain and swelling in the right shoulder, which worsened with movement. Standard AP X-ray revealed class 4 Rockwood classification AC joint separation. The patient underwent minimally invasive TightRope fixation with double endobutton of the right AC joint.

Case 11

A 59-year-old male presented to the emergency department following a fall from two wheeler with pain and swelling in the left shoulder, which worsened with movement. The patient denied any associated symptoms such as loss of consciousness, vomiting, or seizures. Standard AP X-ray revealed class 5 Rockwood classification AC joint dislocation and underwent minimally invasive TightRope fixation with double endobutton of the left AC joint.

Case 12

A 54-year-old female presented to the outpatient department following a fall from stairs a week ago. On examination, there was noticeable tenderness and swelling over the left shoulder, accompanied by a restricted range of motion. Standard AP X-ray revealed class 5 Rockwood classification AC joint dislocation. The patient underwent minimally invasive TightRope fixation with double endobutton of the left AC joint.

Case 13

A 37-year-old male presented to the emergency department following an assault. On examination, there was noticeable tenderness and swelling over the right shoulder, accompanied by a restricted range of motion. Standard AP X-ray revealed class 4 Rockwood classification AC joint separation. The patient underwent minimally invasive TightRope fixation with double endobutton of the right AC joint.

Case 14

A 65-year-old male presented to the emergency department following a RTA with pain and swelling in the right shoulder. On examination, there was noticeable tenderness and swelling over the right shoulder, accompanied by a restricted range of motion. Standard AP X-ray revealed class 6 Rockwood classification AC joint dislocation. He underwent minimally invasive TightRope fixation with double endobutton of the right AC joint.

Case 15

A 53-year-old male presented to the outpatient department following a fall from height a day ago. The patient reported pain and swelling in the left shoulder. On examination, there was noticeable tenderness and swelling over the left shoulder, accompanied by a restricted range of motion. Standard AP X-ray revealed class 6 Rockwood classification AC joint separation and underwent minimally invasive TightRope fixation with double endobutton of the left AC joint.

Case 16

A 47-year-old male presented to the outpatient department following a RTA with pain and swelling in the right shoulder with restricted range of motion. Standard AP X-ray revealed class 5 Rockwood classification AC joint dislocation. The patient underwent minimally invasive TightRope fixation with double endobutton of the right AC joint.

Case 17

A 37-year-old female presented to the emergency department following an assault. The patient reported pain and swelling in the right shoulder, which worsened

with movement. Standard AP X-ray revealed class 4 Rockwood classification AC joint dislocation. The patient underwent minimally invasive TightRope fixation with double endobutton of the right AC joint.

Case 18

A 25-year-old female presented to the emergency department following a fall from a two wheeler. On examination, there was tenderness and swelling over the right shoulder, accompanied by a restricted range of motion. Standard AP X-ray revealed class 3 Rockwood classification AC joint separation and underwent minimally invasive TightRope fixation with double endobutton of the right AC joint.

Case 19

A 63-year-old male presented to the outpatient department following a fall from height 2 days ago. The patient reported pain and swelling in the left shoulder, which worsened with movement. Standard AP X-ray revealed class 6 Rockwood classification AC joint dislocation. The patient underwent minimally invasive TightRope fixation with double endobutton of the left AC joint.

Case 20

A 54-year-old female presented to the emergency department following a fall from a two wheeler. On examination, there was tenderness and swelling over the right shoulder, with restricted range of motion. Standard AP X-ray revealed class 5 Rockwood classification AC joint separation. The patient underwent minimally invasive TightRope fixation with double endobutton of the right AC joint.

Surgical intervention

The surgical procedure involved placing patients in the Beach Chair position. A 5 cm incision was made from the lateral end of the clavicle to the tip of the coracoid process, followed by incisions into the skin and subcutaneous tissue. Skeletonization of the clavicle was performed by removing the trapezius and deltoid muscles from their attachment points. Clavicular tunnels, including the conoid and trapezoid tunnels, were created. The coracoid process was exposed through a longitudinal split, and a TightRope was threaded through the clavicular tunnels and around the coracoid process. Reduction was successful with the double endobutton, followed by securing the rope with the AC joint and stitching the wound with a sterile dressing.

Post-operative care

Post-operative care included 3 days of parenteral antibiotics, followed by a switch to oral antibiotics. Shoulder immobilizers were prescribed for stabilizing the joint. X-rays were taken on the same day as surgery, and dressing changes occurred on post-operative day 2. Sutures were removed on post-operative day 12. Patients were instructed to perform pendulum exercises daily for the first 4 weeks, followed by the initiation of active supported abduction exercises after 4 weeks. Resistance training for muscles commenced after 8 weeks.

Follow-up

Patients underwent follow-up evaluations at 4 weeks, 2 months, and 1-year post-surgery. Radiological evaluations included X-rays of the shoulder with clavicle AP view. Follow-up assessments were conducted according to CONSTANT and MURLEY SCORING systems.[5] Subjective evaluations covered pain levels and range of movements, while objective assessments included activities of daily living, functional external rotation, level of work capabilities, active abduction without pain, functional internal rotation, and strength of abduction. Scores were assigned based on a scale with a maximum score of 100 points, categorized as Excellent (91–100), Good (81–90), Satisfactory (71–80), and Adequate (61–70).

RESULTS

The study consists of 20 patients with AC joint dislocation, with a mean age of 44.5 years and a moderate degree of variability (SD=31.72) in age distribution. The average duration between admission and surgery was approximately 2.33 days, showcasing a swift intervention process. It comprised of 16 males (80%) and 4 females (20%), with RTA being the primary mode of injury in 80% of cases, predominantly affecting the right side in 70% of instances.

The Rockwood classification, reflecting dislocation severity, revealed a distribution of 10% Class III, 15% Class IV, 35% Class V, and 35% Class VI. Notably, Classes V and VI were more prevalent, signifying a higher frequency of severe dislocations. The average amount of blood loss during the operation was between 130 and 150 mL, and the average amount of time it took was between 100 and 120 min. The average hospital stay was 4.55 days (SD=0.87), and most patients returned to work within 10–17-day post-surgery, offering insights into typical durations and variability. One case reported infection, successfully managed with antibiotics.

Constant score distribution highlighted excellent outcomes (90 and above) in 90% of cases (Figure 3). These scores cut across all Rockwood classifications, indicating positive functional outcomes. In summary, the study demonstrated favorable surgical results, affirming the efficacy of TightRope with double endobutton fixation in AC joint dislocation cases.

Figure 3: Follow-up image of a study subject showing improved range of movement

DISCUSSION

In our investigation, Rockwood classification served as a fundamental tool for patient stratification and treatment planning, aligning with the literature emphasizing on operative management for severe AC joint disruptions.[6,7] The ZANCA view radiography, coupled with Rockwood classification, ensured a standardized assessment of AC joint injuries, enabling precise diagnosis and appropriate patient stratification for optimal management in this study.

Our study on TightRope with double endobutton fixation demonstrated favorable outcomes, with 90% achieving excellent Constant–Murley scores. The hook plate technique, indicated for Rockwood type III and V injuries, achieves an excellent reduction of the AC joint. However, the necessity for subsequent removal surgery to prevent complications such as subacromial irritation and rotator cuff damage is a notable consideration.[8] Kienast et al.,[9] report 84% good and excellent results, showcasing effectiveness, but variations in outcomes may stem from differences in patient populations and the severity of AC joint dislocation.

Comparing TBW with the endobutton technique, TBW offers comparable clinicoradiological results, while the endobutton technique, like the hook plate, may allow for an earlier range of motion and potentially present a reduced complication rate.[10,11] Notably, TBW requires removal after 8 weeks to prevent wire-related issues, whereas the endobutton technique, with its different fixation method, may offer advantages such as potential stability without the need for subsequent removal. The choice between these techniques depends on specific patient factors and treatment goals.[12]

Our study observed one infection following TightRope with double endobutton fixation, contrasting with literature discussing potential complications with hook plate use.[13] Variations could be attributed to patient populations, surgeon techniques, and post-operative care differences, emphasizing the need for tailored interventions to minimize adverse events. The long-term implications of our technique warrant further investigation.

TightRope with double endobutton fixation, with its advantages, highlights the importance of tailored interventions to patient characteristics. Further research is essential to establish the sustained efficacy and long-term implications of this minimally invasive technique.

Factors such as a limited sample size or specific patient demographics may influence the generalizability of our findings. Looking ahead, future research should explore the sustained efficacy and long-term implications of our minimally invasive technique.

CONCLUSION

The TightRope with double endobutton fixation emerges as a promising and minimally invasive technique for AC joint dislocation. Our study underscores its practical implications, demonstrating excellent outcomes and potential benefits, including reduced post-operative complications and shorter recovery times. As clinicians navigate the landscape of AC joint management, the adoption of this technique holds promise for optimizing patient care, emphasizing the importance of tailored interventions based on individual characteristics for enhanced surgical outcomes.

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PKK- Concept and design of the study, clinical protocol, data collection, analysis and contribution, manuscript preparation, final drafting and submission of article; **BVK-** Concept, statistical analysis and interpretation, reviewed the literature; **VM-** Preparation and drafting of manuscript, review manuscript, coordination and revision of the manuscript.

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