CASE REPORT

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Tension Band Wiring for Chronic Acromioclavicular Joint Dislocations Rockwood Type III/ISAKOS Type IIIB

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Abstract

Acromioclavicular joint (ACJ) dislocations account for 10% of shoulder injuries, with Rockwood type III being the most common. Despite its prevalence, there is no consensus regarding a gold standard surgical treatment for chronic ACJ dislocations. tients often delay seeking medical attention during the chronic phase, during which soft tissue healing capacity significantly declines. A 30-year-old male presented with persistent shoulder pain and restricted elevation two months after a motorcycle accident. The patient initially sought alternative treatment, later developed chronic pain and an inability to elevate the shoulder. Physical and radiograph examinations revealed a Rockwood type III ACJ dislocation. After treatment with the tension band wiring (TBW) technique, functional outcomes were assessed using the Disabilities of The Arm, Shoulder and Hand (DASH) and Constant scores. The Constant score improved from 61 to 92 and while the DASH score decreased from 45 to 5 in 3 months and 2 weeks post-operation. International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine (ISAKOS) subdivided Rockwood Type III injuries into IIIA (stable) and IIIB (unstable), with type IIIB requiring surgical treatment. Several studies suggested that mechanical stabilization with biological augmentation is sufficient in neglected cases. However, this technique is expensive and required specialized skill and expertise in shoulder arthroscopy. To overcome this challenge, TBW has emerged as a cost-effective and straightforward surgical technique that enables faster rehabilitation and provides a stable, pain-free shoulder without postoperative complications. It may serve as a viable treatment option, particularly in resource-limited or rural settings.

Keywords: Acromioclavicular joint, rockwood, tension band wiring

Introduction

Acromioclavicular joint (ACJ) dislocations represent approximately 10% of all shoulder injuries in the urban population, with an incidence of 2.0 per 10,000 persons per year. Male sex and younger age groups are recognized risk factors.[1] Several studies have shown that Rockwood type III is the most common presentation, and the predominant trauma mechanism comprises a direct force to the superior acromion while the shoulder is in an adducted position. In addition, patients rarely consult medical professionals during the chronic stage of the condition. [2] Based on the time of occurrence, ACJ dislocations are considered acute when occurring within 3 weeks of the accident and chronic when persisting for 6 or more weeks after the accident. Acute ACJ dislocations of less than 3 weeks after trauma are believed to have a potential for spontaneous biological healing due to the early inflammatory phase. Meanwhile, the healing potential in chronic ACJ slowly decreases over time, and coracoclavicular ligament reconstruction (Weaver-Dunn, autograft/allograft, synthetic ligament) is believed to be the main surgical technique option.[3] However, this technique is expensive and requires specialized skill and expertise in shoulder arthroscopy. There is also no consensus regarding a gold-standard surgical treatment for chronic cases.[1]

Long-term outcomes of the tension band wiring (TBW) technique have been reported. Lateur G described favorable results after 12 years and 6 months of follow-up in a patient with acute Rockwood type IV/VI ACJ dislocation, without recurrence.[4] Similarly,Venkatesh V reported satisfactory Constant scores in acute

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Rockwood type II and III dislocations treated with TBW, although implant migration and subsequent hardware removal were noted as potential complications.[5] In this case, a patient with chronic ACJ dislocations Rockwood type III/ ISAKOS type IIIB was presented and successfully treated using the TBW technique. The use of this technique with K-wires is a cost-effective and simple surgical procedure, allowing faster rehabilitation and a stable and pain-free shoulder without any post-operative complications. Several studies have also reported that it is cost-effective and can easily be implemented in rural areas.

Case

A 30-year-old right-handed male, married and employed as a chef (65 kg, 174 cm), presented on February 5, 2024, with pain in the right shoulder following a motorcycle accident sustained 2 months earlier.. The patient had fell onto the right side,striking the shoulder against the roadside. This patient sought an alternative treatment, which led to chronic pain and the inability to elevate the right shoulder. Daily occupational activities involving cooking and recreational sports such as football and basketball were restricted.

Physical examination revealed that there was a prominence on the right distal clavicle and tenderness on palpation. A deformity was found on the right side of the back as a lateral winging of the scapulae, and the range of motion of the right shoulder was limited due to pain and resistance. Abduction was restricted to <90° (Figure 1). Neurovascular examination was normal.

Diagnosis of ACJ dislocation was based on clinical history, physical examination, and radiographic findings. The patient was diagnosed with chronic ACJ Rockwood type III/ISAKOS type IIIB, based on the epidemiology in which type III was the most common presentation and male gender of a younger age group was a risk factor.[1,6] In this case report, the patient complained of pain in all areas of the right shoulder extending to the cervical spine with VAS 3 , which matched the symptoms of chronic cases.[6,7] Due to inflammation and distal clavicle dislocation, physical examination revealed tenderness on palpation and prominence at the ACJ area, there is minimal AC joint movement on palpation. Right shoulder abduction was below 90° due to pain and resistance, which led to abnormal SHR (Scapulo Humeral Rhytm). The SHR refers to the coordinated movement of the humerus, scapula, and clavicle to achieve full abduction or elevation. The rhythm can be divided into three different phases during abduction. The first phase is a setting phase of the scapula, wherein the first 30° of abduction, the scapula shows minimal movement, while the clavicle elevates between 0-5° at the SC and AC joint. After the first 30° of

Figure 1 Clinical Image Before Surgery Showing Inability to Elevate the Right Shoulder Above 90°

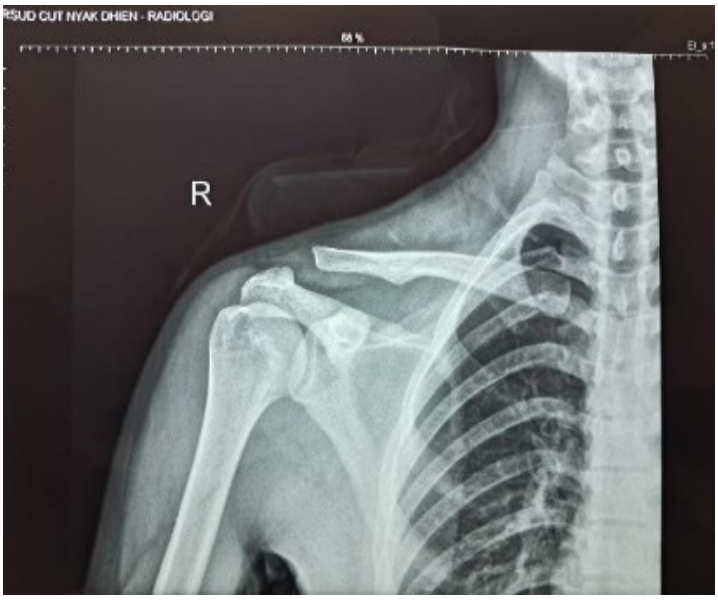

Figure 2 AP X-ray of Right Shoulder Before Surgical Treatment, ACJ Rockwood Type III

abduction, the humerus and the scapula move in a ratio of 2:1. For the second phase, the humerus abducts 40°, while the scapula laterally rotates 20° with minimal protraction or elevation. The clavicle elevates 15° because of scapular rotation and begins to rotate posteriorly. In the third phase, the humerus abducts 60° and laterally rotates 90° to avoid impingement between the greater tuberosity of the humerus and the acromion process, while the scapula laterally rotates another 40° and begins to elevate. The clavicle rotates 30–50° posteriorly and elevates another 15°. In reality, this is only a 5–8° rotation relative to the acromion because of a scapular rotation. The total amount of 60° lateral rotation of the scapula during phases two and three is made possible by 20° of motion at the AC joint and 40° of movement at the SC joint. It is important to observe the scapulohumeral rhythm through the ascending as well as the

Figure 3 AP Radiograph of the Left Shoulder Showing Normal ACJ Alignment

Figure 4 Intraoperative Image Showing Anatomical Reduction of the AC Joint With Tension Band Wiring

Figure 5 AP X-ray After Surgical Treatment with TBW Technique

descending phase because weakness of muscles that control the scapula is more evident in the descending phase and a jump of the scapula may occur if control is lost.[7] According to previous studies, abnormal SHR and asymmetry were signs of conoid ligament injuries.[8] The functional outcome of the patient before the operation was assessed by the DASH (Disabilities of The Arm, Shoulder, and Hand) score and Constant score, each was 61 and 45, respectively. Neurovascular examination was normal, as shown in Figure 1. In Figure 2, the patient's radiograph examination (AP view) revealed a disruption of the ACJ with 25 to 100% vertical displacement. Figure 3, shown AP view of normal left shoulder . Consequently, the patient was diagnosed with ACJ dislocations Rockwood Type III /ISAKOS Type IIIB.

Tension band wiring (TBW) was performed to stabilize the acromioclavicular joint (ACJ). Figure 4 demonstrates anatomical reduction of the ACJ, and the postoperative AP view radiograph (Figure 5) shows satisfactory correction

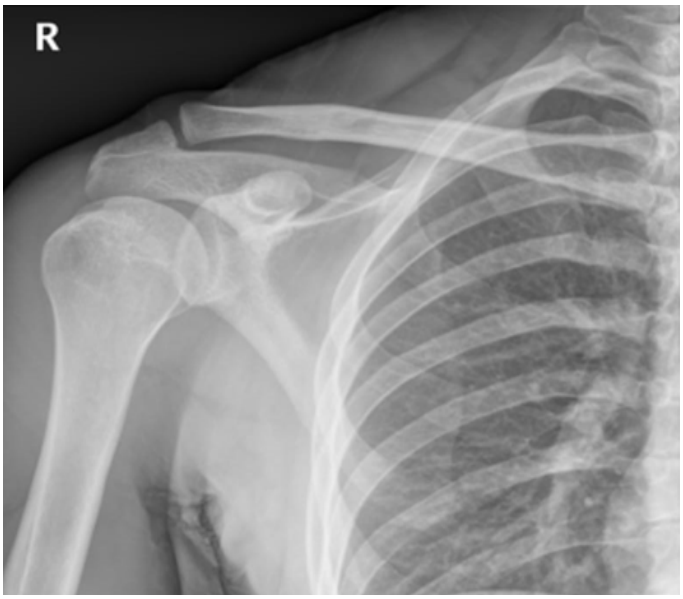

Figure 6 AP X-Ray and Clinical Picture After Hardware (TBW) Removal

following fixation. The patient was discharged on postoperative day 3, and sutures were removed on day 12. During the first 12 days, the upper limb was immobilized with an arm pouch, permitting only active and passive movements of the elbow. The patient was instructed to refrain from elevating the upper limb above the horizontal until the tension band was removed at 12 weeks after operation. No rehabilitation therapy was provided after surgery. Passive movements were started simultaneously as patient tolerated. Active movements were begun at 21 days and full range of movement were started after 3 weeks.

Follow-up evaluation was performed after hardware removal at 12 weeks. The AP radiograph at that time (Figure 6) demonstrated restoration of the coracoclavicular distance to normal., Scar tissue covered the postoperative wound, and functional outcomes were markedly improved, with the DASH score decreasing from 45 to 5 and the Constant score increasing from 61 to 92. No complications were observed, and the patient achieved a satisfactory range of motion.. Written informed consent was obtained from the patient for both the surgical treatment and the publication of this case report, including the accompanying images. No personal identifying information is disclosed in this article.

Discussion

A case of chronic acromioclavicular joint (ACJ) dislocation Rockwood type III/ISAKOS type IIIB was diagnosed at Dr. Zainoel Abidin Hospital, Aceh, Indonesia. In this case, starting from the results of the anamnesis, physical examination, and supporting examinations carried out, so that the diagnosis of chronic ACJ dislocations Rockwood type III/ISAKOS type IIIB could be established. This diagnosis was made based on the history of the symptoms that he felt chronic pain and could not elevate his shoulder since 2 month after being on motorcycle accident. The delay in seeking medical care, due to prior use of alternative treatment, contributed to the rarity of this case.

ACJ dislocations are classified using radiographic and clinical examination into six types according to Rockwood. Type I was presented with AC ligament sprain, type II with complete AC tear with the CC intact, type III with AC and CC ligament tears and ≤100% superior displacement, type IV was grade III with posterior displacement and ≤300% superior displacement, in type V there was a 100 to 300% vertical displacement and type VI was grade III with inferior displacement.[6]

The ACJ is a diarthrodial joint formed by the lateral end of the clavicle articulating with the acromion process of the scapula.. This plane synovial joint allows only gliding movement, achieved through a combination of translation, elevation, and rotation. Biomechanically, an articular movement was restrained, guided, and supported by static ligamentous stabilizers along with dynamic muscular stabilizers. Static stabilizers are supported by acromioclavicular (AC) ligament as horizontal

stabilizers, coracoacromial (CA) ligament and coracoclavicular ligament as vertical stabilizers. CC ligament had a primary function in vertical stabilizers and consisted of conoid ligament and trapezoid ligament. Dynamic stability was supported by the muscle that was attached to the clavicle, such as *m. pectoralis* major, *m. sternocleidomastoideus, m. trapezius* and *m. deltoideus*. The primary functions of the ACJ included allowing an additional range of motion to the scapula on the thorax, assisting in shoulder flexion and abduction, and transmission of forces from the upper extremity to the axial skeleton.[6] A direct force to the superior acromion, when the shoulder was in an adducted position, was the most common trauma mechanism on ACJ. In addition, ACJ dislocations were classified using radiographs and clinical examination into 6 different types according to Rockwood.[1] Recommendations for the management of these injuries were typically non-surgical for types 1 and 2, surgical for types 4 to 6, and controversial for type 3.[2] Experts noted that based on the time of occurrence, ACJ dislocations were acute when it occurred up to 3 weeks after the accident and chronic when it occurred 6 or more weeks after the accident.[8] Chronic instability is often associated with pain throughout the shoulder, extending posteriorly, and results from compensatory abnormal scapular movement and overuse of the periscapular muscles.[1,2]

According to previous studies, there were more than 160 ACJ reconstruction techniques. Generally, these techniques differentiate into 4 groups, namely ACJ stabilization technique (K-wiring, hook plate, tension band wiring), Coracoclavicular stabilization (CC ligament reparation, Bosworth screw, suture button, loop with button), excision on the lateral end of the clavicle with or without ligament reconstruction, and the last technique was weaver-dunn. The last 2 techniques were often used in chronic ACJ.[9] All of these surgical techniques aimed to restore anatomy and biomechanics, minimize deformity of the ACJ, and decrease the pain symptom in patients.[6] Until the present, there was no consensus regarding a gold standard surgical treatment due to the lack of studies and each surgical technique had its risks and benefits.[2]

Diagnosis of ACJ dislocations was obtained from a comprehensive anamnesis, physical examination, and radiograph. On anamnesis, the patient could normally describe an anterosuperior shoulder pain located over the ACJ, which was worse with elevation of the affected limb above 90° or upon laying on the affected shoulder.[6] In a chronic case, the patient felt the pain extend into the cervical spine and all sides of the shoulder. Objective examination revealed bruising, swelling, or deformity of the ACJ, depending on the severity of the injuries. Patients was diagnosed holding their upper extremity in an adducted position with the acromion depressed, which could cause apparent elevation of the clavicle. In addition, the patients also showed tenderness over the ACJ on palpation and could have a reduced active and passive range of movements due to the pain. Special tests were used to aid in the diagnosis of ACJ dislocations and reduce the need for costly investigations and imaging procedures, including the Cross-body test (with 77% sensitivity), active compression test (with 95% specificity), horizontal translation test to assess an anteroposterior translation, O'brien test (with 16% sensitivity and 90% specificity) and Scapulohumeral Rhythm (SHR) observation to assess horizontal and rotational stability. Radiograph evaluation of the ACJ can be assed with anteroposterior (AP), lateral, and axial views. A Zanca view and an anteroposterior view were a specialized projection of the ACJ, which could be opted to observe when there was a vertical displacement of the ACJ.[6,10] Anteropsterior view was applied in this case to obtained patient diagnosis.

The complication of ACJ dislocations was an unstable distal clavicle which could lead to scapular dyskinesis (malposition and abnormal movement of scapula) and when left untreated it could cause a scapular malposition, inferior medial border prominence, coracoid pain, and malposition, as well as dyskinesis of scapular movement, also referred to as SICK scapula syndrome. In higher-grade ACJ dislocations, such as Rockwood type III-VI, there was a possibility of complications such as plexus brachialis injuries and intra-articular SLAP lesions.[11] ACJ dislocations Rockwood types I and II were generally treated conservatively with a shoulder sling for 2 weeks, an anti-inflammation drug followed by rehabilitation.[12] The type III treatment was still being debated, the International Society of Arthroscopy, Knee Surgery, and Orthopaedic Sports Medicine (ISAKOS) Upper Extremity Committee, in 2014, further subdivided Rockwood type III injuries into IIIA (stable) and IIIB (unstable) depending on the residual stability of the ACJ. Type IIIA could be treated with conservative measures, while type IIIB needed surgical treatment. However, recently, the treatment of grade III dislocation

was based on the surgeon's preference as well as the patient's age and activity level.[12] Surgery was also an option for patients whose ACJ was still painful 7 days after the injuries (VAS>7) and whose clinical function had not improved.[16] ACJ dislocations Rockwood type IV to VI required surgical treatment in general as an accurate anatomical reduction was a prerequisite to a good functional outcome, and it minimized the risk of scapular dyskinesis.[17] Acute ACJ dislocations less than 3 weeks after trauma were believed to exhibit the potential of spontaneous biological healing due to the early inflammatory phase, while the healing potential in chronic ACJ slowly decreased over time. Therefore, coracoclavicular ligament reconstruction (Weaver-Dunn, autograft/allograft, synthetic ligament) was believed to be the main surgical technique option in chronic cases.[3]

Tension band wiring technique was applied on this patient and 3 months after the primary operation and 2 weeks after hardware removal, the patient's functional outcome was reassessed by DASH score which revealed a significant improvement to 92 while the Constant score significantly decreased to 5. In addition, there were no complications and the patient regained a functional range of motion. TBW gave an excellent clinical result on this patient. TBW was a simple, less time-consuming surgical technique that allowed faster rehabilitation in active patients to achieve a stable and pain-free shoulder. According to a study by Muthukumar K, ACJ dislocations were treated with TBW, and the functional outcome was subsequently assessed with the Constant and DASH scores, which showed good functional clinical results.[18] In another study by Venkatesh V, acute ACJ dislocations type II and type III revealed a good constant score although there was a risk of implant migration and a secondary operation for hardware removal was needed.[5]

Functional assessment with DASH score and Constant score used questionnaires to assess functional limitations and were made sensitive to the patient's upper extremity symptoms. An excellent DASH score was in the range of 0 to 5 and a very good Constant score was in the range of 86 to 100.[16,17]

The TBW procedure was performed under general anesthesia through a 6 cm superior longitudinal incision placed perpendicular to the ACJ. The delto-trapezial fascia and muscle were split longitudinally. The Acromioclavicular joint and Coracoclavicular joint was left in place and go forward to reduce the ACJ, a tension band wiring with 2 different 2.5 mm cross K-wires from the lateral acromion edge into the clavicle and a 1.5 mm steel wire in a figure of eight configuration was performed, to ensure that it reached the farthest side and improved pull-out strength to maintain reduction. To prevent a proximal K-wire migration, the lateral pin ends were bent. The correct K-wire and ACJ positions were confirmed by an intraoperative radiographic examination.[17] Immobilization was accomplished with a sling for 2 weeks, and an elevation of more than 90° was prohibited until after hardware removal on the secondary operation. The implant removal was performed three months after the initial procedure, TBW technique allowing the acromioclavicular joint (ACJ) to return to its anatomical position. This facilitated the biological soft tissues healing of the acromioclavicular and coracoclavicular ligaments and restoring their integrity. The patient was able to return to work two weeks after the hardware removal and didn't feel any pain with full range of movement on his right shoulder. This technique was selected because it allowed faster rehabilitation and the patient could resume work early. After surgical reconstruction, the ACJ dislocation recurrence rate ranged between 20% and 30% or even higher.[1] Lateur G who evaluated long-term outcomes of TBW for 12 years and 6 months on a patient with acute ACJ dislocations Rockwood type IV/VI, revealed a satisfying clinical outcome without any recurrence.[4] This patient showed the same result, where at the final evaluation, was able to perform daily activities without any pain in the shoulder.

Tension band wiring (TBW) was the treatment of choice for chronic ACJ dislocation Rockwood type III/ISAKOS type IIIB, providing excellent clinical results. This technique is simple, less time-consuming, and allows faster rehabilitation in young and active patients, leading to a stable and pain-free shoulder without postoperative complications. TBW is also cost-effective, making it suitable for use in rural areas. Moreover, it is effective in repairing the delto-trapezial muscles, fascia, and acromioclavicular ligaments, which play a crucial role in maintaining both horizontal and vertical stability of the clavicle. Overall, TBW demonstrated favorable clinical outcomes in this case..

This study has several limitations. First, being a single case, it may not represent other types of acromioclavicular dislocation (Types I, II, IV, V, and VI). Second, the short follow-up period constrains the ability to generalize the findings.

Further research with a larger cohort and longer follow-up is needed to validate these results.

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