TENSION BAND WIRING ON CHRONIC ACROMIOCLAVICULAR JOINT DISLOCATION ROCKWOOD TYPE III/ISAKOS TYPE IIIB AT DR. ZAINOEL ABIDIN HOSPITAL, INDONESIA: A CASE PRESENTATION

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ABSTRACT

Purpose: To present a case of chronic ACJ dislocation Rockwood Type III/ISAKOS Type IIIB and evaluate the effectiveness of the tension band wiring (TBW) as a treatment option. Benefit: Tension band wiring (TBW) technique with K-wires is an efficient and requires less time surgical technique, faster rehabilitation for active patients and helping them attain a stable and pain free shoulder without any post-operative complications. Implementation: TBW is a cost-effective technique that can be easily implemented in rural areas. Results: After treatment with TBW technique, functional outcomes were assessed using DASH (Disabilities of The Arm, Shoulder and Hand) score and Constant score. Three months and two weeks post-operation, the Constant score improved from 61 to 92 and DASH score decreased from 45 to 5. TBW can be an option of treatment in chronic ACJ dislocation Rockwood type III/ISAKOS type IIIB with excellent clinical results

Keywords: Acromioclavicular Joint Dislocation;Rockwood;tension band wiring, DASH (Disabilities of The Arm, Shoulder and Hand) score; Constant score

Received: Month Year, *Accepted: Month Year,* *Published: Month Year*

INTRODUCTION

Acromioclavicular joint (ACJ) dislocations Rockwood's type III is by far the most common presentation of ACJ dislocations, characterized by the complete disruption of acromioclavicular (AC) ligament and coracoclavicular (CC) ligament, with 25-100% vertical displacement.[1,2] ACJ dislocations are common, representing 10% of all shoulder injuries in an urban population, the incidence of ACJ dilocations is 2.0/10.000 per person/year with male gender and younger age group being risk factors for this injury.[1] A direct force to the superior acromion while the shoulder is in an adducted position is the most common trauma mechanism on ACJ.

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), whereas type IIIB needs surgical treatment due to the instability of the acromioclavicular joint.[2,3] Injuries are acute if they occurred up to 3 weeks after the accident and chronic if they occurred 6 or more weeks after the accident.[4] Chronic ACJ instability is associated with pain in all aspects of the shoulder extending to the back, periscapular muscle fatigue, scapular dyskinesia, dead-arm syndrome and painful horizontal adduction.[1,3]The potential for primary healing of the CC ligaments beyond three weeks is limited. Many studies suggest that mechanical stabilization with biological augmentation is sufficient in chronic cases. However, this technique is expensive and requires specialized skill and expertise in shoulder arthroscopy. Until the present, there is no consensus regarding a gold standard surgical treatment for AC joint injuries and an optimal treatment is still being debated.[5] In our case, we present a case of chronic ACJ dislocation

Rockwood Type III/ISAKOS Type IIIB treated with tension band wiring (TBW) technique have an excellent clinical results.

CASE PRESENTATION

A 30-year-old male presented with pain around his right shoulder following a motorcycle accident 2 months prior to the current presentation. He initially chose to seek an alternative treatment, as a result, the patient felt chronic pain and could not elevate his shoulder. Physical examination revealed that there was a prominence on his dextral distal clavicle and tenderness on palpation. A deform back as a lateral winging of the scapulae, and the range of motion of the right shoulder was limited due to pain and resistance. His functional outcome before the operation as assessed by DASH (Disabilities of The Arm, Shoulder and Hand) score and question score were 61 and 45 respectively. Neurovascular examination was normal as shown in Figure 2. In Figure 3, the patient's radiograph examination (AP view) showed a disruption of the AC joint with 25-100% vertical displacement and we diagnosed him with Acromioclavicular joint dislocation Rockwood Type III /ISAKOS Type IIIB. Tension band wiring (TBW) technique was performed to stabilize the ACJ. Post-operative AP view radiograph of the patient showed a good correction of the ACJ. 3 months after operation, his functional outcome was reassessed by DASH score and we found a significant improvement to 92, with his Constant score significantly decreased to 5. There are no complications and the patient regained a satisfactory functional range of motion.

DISCUSSION

ACJ dislocations are classified using radiographs and clinical examination into 6 different types according to Rockwood. Type I presents with AC ligament sprain, type II presents with complete AC tear with the CC intact, type III presents with AC and CC ligament tears and ≤100% of superior displacement, type IV is grade III with posterior displacement, type IV is grade III with ≤300% of superior displacement, in type V there is a 100-300% vertical displacement and type VI is grade III with inferior displacement.[2]

Figure 2. Clinical picture before operation, the patient could not elevate his right shoulder above 90°

The complication of ACJ injury is an unstable distal clavicle which can lead to scapular dyskinesis (malposition and abnormal movement of scapula) and if left untreated it can cause a scapular malposition, inferior medial border prominence, coracoid pain and malposition, and dyskinesis of scapular movement, also referred to as SICK scapula syndrome.[7] In higher-grade ACJ injuries like Rockwood type III-VI, there is a possibility of complications such as a plexus brachialis injury and intra-articular SLAP lesion.[8]

Diagnosis of ACJ injury can be obtained from a comprehensive anamnesis, physical examination and radiograph. On anamnesis, the patient will normally describe an anterosuperior shoulder pain located over the ACJ, which may be worse with elevation of the affected limb above 90° or upon laying on the affected shoulder.[2] In a chronic case, the patient will feel the pain extend into the cervical spine and all sides of the shoulder. Objective examination may reveal bruising, swelling, or deformity of the ACJ, depending on the severity of the injury. Patients may present holding their upper extremity in an adducted position with the acromion depressed, which can cause apparent elevation of the clavicle. Patients will show tenderness over the ACJ on palpation and may have a reduced active and passive range of movements due to pain. Special tests can be used to aid in the diagnosis of an ACJ injury and help reduce the need for costly investigations and imaging procedures, including Cross-body test (with 77% sensitivity), active compression test (with 95% specificity), horizontal translation test to asses 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 requires anteroposterior (AP), lateral and axial views. A Zanca

view and an anteroposterior view are a specialized projection of the ACJ, which may be opted to see if there is a vertical displacement of the ACJ.[2]

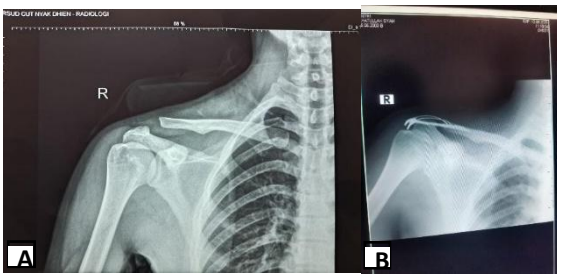

Figure 3. (A) AP X-ray before surgical treatment, ACJ Rockwood type III; (B) AP X-ray after surgical treatment with TBW technique

ACJ injury Rockwood types I and II are generally treated conservatively with a shoulder sling for two weeks, an anti-inflammation drug followed by rehabilitation.[9] ACJ injury Rockwood type III treatment is 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, where type IIIA can be treated with conservative measures meanwhile type IIIB needs surgical treatment. However nowadays, the treatment of grade III dislocation is based on the surgeon's preference as well as the patient's age and activity level.[9] Surgery can also be an option for patients whose AC joint is still painful 7 days after the injury (VAS>7) and whose clinical function has not improved.[10] ACJ injury Rockwood type IV-VI requires surgical treatment in general as an accurate anatomical reduction is a prerequisite to a good functional outcome and it minimizes the risk of scapular dyskinesis.[11] Acute ACJ injury less than 3 weeks after trauma is believed to have a potential of spontaneous biological healing due to the early inflammatory phase whereas the healing potential in chronic ACJ slowly decreases over time therefore coracoclavicular ligament reconstruction (Weaver-Dunn, autograft/allograft, synthetic ligament) is believed to be the main surgical technique option on chronic cases.[12]

Our patient was diagnosed with chronic ACJ Rockwood type III/ISAKOS type IIIB, based on the epidemiology in which type III is the most common presentation and male gender of a younger age group is a risk factor for an ACJ injury.[1,13] The patient presented with pain in all aspects of his right shoulder extending to the cervical spine which matches the symptom of a chronic ACJ injury.[2] As a result of inflammation and distal clavicle instability, on physical examination, we found tenderness on palpation and prominence located at the ACJ area. Right shoulder abduction was below 90° due to pain and resistance, which makes an abnormal SHR.[7] There is no plexus brachialis injury in this patient. Abnormal SHR and asymmetric are signs of a conoid ligament injury.[14]

Figure 4. Clinical picture after hardware (TBW) removal

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 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 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.[15]

3 months after the primary operation and 2 weeks after hardware removal, the patient's functional outcome was reassessed by DASH score which showed a significant improvement to 92 while his Constant score significantly decreased to 5. There are no complications and the patient regained a functional range of motion. TBW gave an excellent clinical result on this patient. TBW is a simple, less time-consuming surgical technique that allows faster rehabilitation in active patients to achieve a stable and pain-free shoulder. Muthukumar K did a study in which an ACJ injury was treated with TBW and the functional outcome was subsequently assessed with Constant score and DASH score showed good functional clinical results.[16] In another study done by Venkatesh V, an acute ACJ injury type II and type III showed a good constant score although there is a risk of implant migration and a secondary operation for hardware removal was needed.[17]

Functional assessment with DASH score and Constant score uses questionnaires to assess functional limitations and are made sensitive to the patient's upper extremity symptoms. An excellent DASH score is in the range of 0-5 and a very good Constant score is in the range of 86-100.[18,19]

TBW operative procedure was performed under general anesthesia, and a 6 cm superior longitudinal incision was made perpendicularly to the ACJ. The delto-trapezial fascia and muscle were then split longitudinally. The ACJ, including the articular surfaces, disk, and ligaments were examined. The joint was cleansed, and the was left in place if considered intact or removed otherwise. After reducing the ACJ, a tension band wiring with two 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 so it can reach the farthest side and improve 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.[16] Immobilization was accomplished with a sling for two weeks, and an elevation of more than 90° was prohibited until after hardware removal on the secondary operation. The second operation was done in 3 months after the first one and the patient was able to go back to work 2 weeks after the hardware removal. This technique was chosen because it allows faster rehabilitation and the patient can go back to work early. After surgical reconstruction, the AC joint dislocation recurrence rate ranges 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 injury Rockwood type IV/VI, showed a satisfying clinical outcome without any recurrence.[20] Our patient showed the same result, where at the final evaluation he was able to do daily activities without any pain in his shoulder.

The treatment of an ACJ injury should not be delayed, as a study done by Barth J et al reported that a good horizontal reduction was influenced by less than 3 months' time to surgery. Time from injury to surgery markedly influenced the anatomical and functional outcomes in some studies, indicating that treatment should be provided within 3 weeks. Surgery should undoubtedly be performed at the early inflammatory phase (<10 days) before the cell repair mechanism becomes active to increase the likelihood of spontaneous ligament healing. In this patient, the time to surgery was under 2 months thus a good horizontal reduction could still be achieved.

There is a recent increase in publications on the reconstruction of the ACJ after injury, with new techniques focusing on the anatomic reconstruction of the CC ligament aiming to restore both vertical and horizontal planes stability of the ACJ using synthetic/biological grafts. Chronic AC and CC injuries have poorer results in healing because the biological capabilities are compromised. Therefore, mechanical stabilization alone without biological augmentation may be insufficient.[22] Paul RW et al. concluded that insignificantly there were no differences in functional outcome, complication, and revision rate between allograft and graft-less patients.[23] As reported by Chang Gung et al., patients with ACJ injury treated with the TBW technique have the same satisfaction with the CA ligament transfer technique.[24]

Hook plate, screw and tension band wiring are the three most commonly performed techniques because they are simple and easy to apply, but require a secondary operation for hardware removal which could increase the risk of infection.[25] In his study, Jambukeswaran compared TBW and Screw fixation on ACJ injury, both techniques showed good results, however, TBW had a superior functional outcome than screw fixation. Screw fixation is a more simple

and reliable technique than TBW but it has a greater risk for a screw pull-out and impingement pain.[6]

Fosser M et al. did a study where he compared tight rope, TBW and hook plate techniques on acute ACJ injuries Rockwood type III-IV. After the operation, the affected shoulder was immobilized with a Velpeau-type brace for 3 weeks followed by physiotherapy starting in the third week. TBW technique and hook plate have the same clinical score whereas most complications result from a TBW technique such as a loss of reduction due to K-wire migration or an implant breakage.[25] TBW stabilization is consistently imperfect as it works by opposing the forces exerted on the AC joint in a transverse movement. The largest component is the forces related to gravity acting on the upper limb. This partly explains why the TBW causes secondary displacement.[26] In order to prevent such complications, for the last 10 years, several surgeons have been placing a knob at each end of the wire, and a 1.5 mm K-wire is believed to prevent an implant migration and give good stabilization.[12,20] The hook plate technique is good for stabilization without any loss of reduction but this could limit the patient's movement and cause stiffness due to the plate, moreover, the cost is more expensive than TBW and most complications that result from this technique are acromion fracture, osteolysis, AC osteoarthritis, and rotator cuff tear.[27] The tight rope technique has a much better functional clinical result, doesn't need a second operation procedure for hardware removal and the patient can go back to work as early as 12 weeks after the operation whereas 14 weeks after the operation with TBW. However, this technique is expensive and requires skill and expertise in shoulder arthroscopy.[25]

Renaud M et al. compared TBW and double endobutton (DB) on acute ACJ Rockwood type IV in their study. TBW and DB showed the same functional clinical result at one year after the operation. DB technique has fewer complications, stable reduction, early rehabilitation, early return to exercise and doesn't need hardware removal. However, this technique is expensive and requires arthroscopic experience . A study done by Ozan F reported midterm results of the TBW technique for acute ACJ Rockwood type III, where functionally satisfactory results can be obtained even if complications develop due to implant and they believed retaining the implants for a shorter duration will reduce the incidence of complication. The tension band wiring treatment method is effective in the repair of delto-trapezial muscles and fascia and acromioclavicular ligaments, as these structures are very important in providing effective control of the horizontal and vertical stability of the clavicle.

CONCLUSION

Tension band wiring can be the treatment of choice in chronic acromioclavicular joint dislocation Rockwood type III/ISAKOS IIIB over biological augmentation with excellent clinical results. TBW technique is a simple, less time-consuming surgical technique, allowing faster rehabilitation in young and active patients to achieve a stable and pain-free shoulder without any post-operative. This technique can be used in rural areas because the cost is inexpensive. TBW method is effective in the repair of delto-trapezial muscles and fascia and acromioclavicular ligaments, as these structures are very important in providing effective control of the horizontal and vertical stability of the clavicle.

Funding source

No funding sources.

Data and material availability

Every data will be provided as per request.

Conflict of interest

Every author claims there is no conflict of interest in this research.

Ethics approval

No ethics approval.

Informed consent

Informed consent was written and obtained from the patient for publication of this case report and the following images.

Author contribution

All authors wrote this case report and discussed the results in the preparation of the manuscript. All authors have read and approved the final manuscript.

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