Evaluation of the Surgical Treatment of Acromioclavicular Joint Dislocation With a New Option for Temporary Fixation of the Acromioclavicular Joint

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Abstract: The purpose of this paper is to evaluate the results of surgical treatment of acute acromioclavicular joint (ACJ) dislocation using coracoclavicular cerclage, coracoacromial ligament transfer to the distal third of the clavicle, and a new option *for strengthening the* temporary stabilization of the ACJ *using a Kirschner wire* between the clavicle and scapula. We evaluated 21 patients who underwent surgical treatment for ACJ dislocation. The average follow-up period was 18 months and varied from 13 to 23 months. Postoperative results, graded by the UCLA scoring system, were satisfactory in 20 patients. Using radiographic evaluation, 18 patients did not show loss of reduction. Among 21 patients who underwent surgical treatment, only 2 complications related to a new method of temporary ACJ stabilization were reported, neither of which appeared to influence the final outcome. The authors concluded that the surgical treatment of acute ACJ dislocation provides good functional and radiographic outcomes and that a new method of temporary ACJ stabilization described herein is an easy-to-perform and low-cost procedure with a low complication rate.

Key Words: acromioclavicular joint dislocation, shoulder dislocation, surgical treatment of acromioclavicular joint dislocation, ACJ, dislocation, AC joint lesion

(*Tech Should Surg* 2013;14: 99–103)

Acromioclavicular joint (ACJ) dislocations encompass 9% to 12% of traumatic shoulder lesions and are more prevalent among young and active individuals, particularly athletes involved in contact sports.[1,2] These dislocations are more common among patients in their third and fourth decades and in males.[3]

ACJ is one of the elements of the superior shoulder suspensory complex.[4] The superior shoulder suspensory complex is responsible for maintenance of a normal and stable relationship between the upper extremity and the axial skeleton, providing harmonic motion of the scapular girdle.[5] Disruption of the acromioclavicular and coracoclavicular ligaments leads to the loss of this harmonious relationship, resulting in the induction of muscular fatigue, subacromial impingement, and neurological symptoms due to traction on the brachial plexus[6,7] in addition to any symptoms related to the trauma itself.

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The authors declare no conflict of interest.

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Rockwood classified ACJ dislocations into 6 grades according to the direction of the dislocation and the integrity of the acromioclavicular and coracoclavicular ligaments.[8]

The treatment of choice for grades 1 and 2 ACJ dislocations is nonsurgical, whereas surgical treatment is well established for grades IV, V, and VI lesions. However, the best treatment option for grade III dislocations remains controversial.[9] At present, there are >100 surgical techniques for the treatment of ACJ dislocation.[10] These procedures, which aim to recover the static and dynamic joint anatomy,[11] include transarticular fixation of the ACJ (Kirschner wires, tension band, screws, and plates), coracoclavicular fixation with screws (Bosworth), suture anchors or fascial slings, dynamic muscle transfers, ligament repair, and ligament reconstruction.[12]

Despite the several surgical techniques described to date, there is lack of consensus regarding the best surgical treatment option. In patients undergoing surgical treatment, there are literature reports of deformity recurrence in up to 29% of patients, residual pain in up to 34% of cases,[13] and chronic pain in 42% of cases.[12] In general, these adverse events are related to insufficient fixation during the healing process of soft tissues during the postoperative period, which affects joint support and stabilization, and the violation of the joint with metallic devices, such as Kirschner wires, Steinman pins, screws, or plates.

The purpose of this paper is to clinically and radiographically evaluate patients with acute ACJ dislocation who underwent surgical treatment with a combination of coracoclavicular fixation with suture anchor, coracoclavicular ligament transfer, and temporary fixation of ACJ with the use of a Kirschner wire between the distal third of the clavicle and the base of the spine of the scapula.

MATERIALS AND METHODS

Study subjects were recruited sequentially between January 2003 and April 2005 from the section of Shoulder and Elbow Surgery, Hand and Upper Limb Surgery Division, Department of Orthopedics and Traumatology at the Federal University of Sao Paulo (UNIFESP).

The inclusion criteria were acute ACJ dislocation (< 4 wk) occurring in skeletally mature individuals and agreement to participate in the study. The exclusion criteria were chronic dislocation (> 4 wk), previous surgical procedures of the shoulder, and ipsilateral upper limb fracture.

The diagnosis of acromioclavicular dislocation, as well as classification of the dislocation, was made clinically and using 3 x-ray views: anteroposterior, with the ray beam centered on the sternum and images obtained from both ACJs on the same film; axillary view, from the affected shoulder; and Zanca incidence, an anteroposterior view with the beam directed at the ACJ with a 10-degree cephalic tilt.[3,4]

The primary outcome of the study was the functional outcome of the patients as assessed by the UCLA score, which

was translated and validated to Portuguese.[14,15] The secondary outcomes evaluated were complications and method failure. Failure was defined as the need for a subsequent surgical procedure or changes to the proposed surgical technique. Furthermore, the radiographic outcome was assessed by the presence of redislocation after the surgical procedure in the anteroposterior, axillary, and Zanca views.

All outcomes were evaluated for a minimum of 13 months after surgery.

Surgical Technique

The patients were placed in a beach chair position and underwent interscalene brachial plexus nerve block and general anesthesia.

In each patient, a skin incision was made 1 cm medial to the ACJ from the posterior edge of the clavicle to 1 cm superior to the upper edge of the coracoid process. When intact, the deltotrapezial fascia was incised parallel to its fibers. Next, the deltoid muscle was blunt-dissected to identify the coracoacromial ligament, which was dissected to its acromial insertion, where it was transected, along with an osseous fragment 0.5 cm in length. This ligament was repaired for future transfer to the lateral third of clavicle.

Through delicate dissection, the base of the coracoid process was exposed, allowing the insertion of a 5.0 mm suture anchor loaded with 2 nonabsorbable sutures (Ethibond 5; Ethicon Inc., Ciudad Juarez, Chihuahua, Mexico). The sutures were passed through holes made on the coracoclavicular (conoid and trapezoid) ligament insertion sites on the clavicle, taking care not to position the holes too anteriorly to protect against anterior displacement of the clavicle.

Before coracoclavicular fixation with anchor sutures and ligament transfer, the ACJ was anatomically reduced and fixed with a 2.5-mm Kirschner wire. While the assistant surgeon performed the ACJ reduction maneuver, the surgeon performed the fixation, directing the Kirschner wire from the anterosuperior edge of the lateral third of the clavicle to the base of the scapular spine. The procedure is performed by placing the index finger on the base of the spine of the scapula and directing the wire to this point, that is, to the tip of the index finger. After crossing the posterior cortex of the scapula, the wire was bent against the anterior cortex of the clavicle to prevent migration (Fig. 1).

The anchor sutures, previously passed through bone holes on the clavicle, were tied and the coracoclavicular ligament

FIGURE 1. Plastic model of acromioclavicular joint showing the position of the Kirschner wire.

FIGURE 2. Axillary views showing the position of the Kirschner wire, the location of the suture anchor, and the holes made in the clavicle.

was transferred to the anteroinferior edge of the lateral third of the clavicle using one of the anchor sutures. The wound was vigorously irrigated with saline solution. The deltotrapezial fascia was carefully sutured; the subcutaneous and skin tissues were sutured in the usual manner with the end of the Kirschner wire buried under the skin and subcutaneous tissue (Figs. 2, 3).

Postoperative Care

The arm was immobilized in a sling for 6 weeks. The patient was instructed to immediately begin smooth rotational exercises to maintain the normal range of medial and lateral rotation. Shoulder elevation above 45 degrees was prohibited in an effort to prevent wire breakage or loosening.

After 6 weeks, the Kirschner wire was removed under local anesthesia and the patient was allowed to perform all shoulder movements and begin physiotherapy rehabilitation according to a protocol that aimed to recover the normal shoulder girdle range of motion and strength. A return to the practice of contact sports was permitted 3 months after surgery.

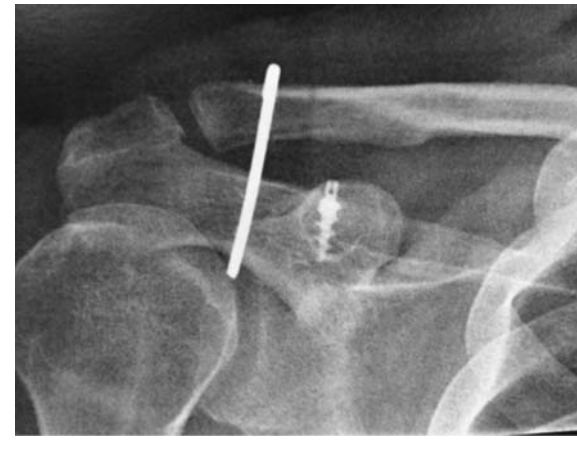

FIGURE 3. Anteroposterior views showing the position of the Kirschner wire, the location of the suture anchor, and the holes made in the clavicle.

RESULTS

We recruited 52 patients with grades III, IV, and V acute ACJ dislocation; however, 27 patients were excluded: 14 had chronic injuries (>4 wk); 8 had associated lesions that might have compromised the outcome evaluation; 3 were skeletally immature; and 2 refused to participate in the study.

Thus, 25 patients were sequentially managed by surgical treatment. Of these, 4 patients were lost to follow-up and were excluded from evaluation, yielding 21 remaining patients for study evaluation.

Of the 21 study patients, 18 were male, and 3 were female patients. The average patient age was 35 years and varied from 18 to 55 years. The dominant limb was affected in 13 patients. The mechanisms of injury were a fall in 11 patients, being struck by a car in 4 patients, injury during sports in 3 patients, and a motorcycle accident in 3 patients.

According to the Rockwood classification,[8] 7 patients had grade III lesions, 3 had grade IV lesions, and 11 cases were classified as grade V (Table 1).

The time between trauma and the surgical procedure varied from 7 to 19 days with an average of 12 days. The mean follow-up period was 18 months with a range of 13 to 23 months.

According to the UCLA scoring system,[14,15] the results were judged satisfactory in 20 patients; 7 cases were scored excellent, and 13 were scored good.

The mean shoulder elevation was 154 degrees (100 to 180 degrees); the mean external rotation was 57 degrees (30 to 90 degrees), and the internal rotation varied from T7 to L5.

Twenty patients declared themselves satisfied with the surgical result.

Two complications were described: an excessively prominent wire caused discomfort on the posterior shoulder region, and a case of early wire loosening was reported. Both cases were treated by removing the wire in the sixth postoperative week.

We found no cases of surgical failure or Kirschner wire migration using the newly proposed technique.

DISCUSSION

Nonsurgical treatment is well established for Rockwood grades I and II ACJ dislocation, whereas surgery is the treatment of choice for grades IV, V, and VI lesions. The best treatment method for grade III lesions has yet to be defined. Some authors describe similar results from surgical and nonsurgical treatment of grade III lesions.[16–19] Others have indicated unsatisfactory results with nonsurgical treatment, particularly residual pain and decreased muscle strength of the shoulder girdle in up to 50% of cases. These unfavorable results appear to favor surgical treatment in the acute setting.[16,20–22]

There are >100 described surgical techniques, and because reports for each technique are restricted to a limited number of patients, it can be difficult to evaluate the risks, benefits, and differences between them.[23,24] Among the most commonly used techniques are transarticular fixation of the ACJ with Kirschner wires or Steinman pins.[25,26]

TABLE 1. Number of Dislocations, According to Rockwood's Classification

Grade	Number
III	07
IV	03
V	11
Total	21

In the only randomized-clinical trial that compared the use of a coracoclavicular screw and transarticular fixation of the ACJ with metallic wires,[23] greater results was shown with the use of metallic wires across the joint. However, this technique is associated with a high complication rate, including infection, loss of reduction, development of osteoarthritis, and breakage and migration of the metallic wire. The latter complication has been extensively described in the literature with migration occurring at several locations, including the mediastinum and lungs.[27–30] Thus, some authors[30–34] argue that this technique should no longer be used due to the potential risks to the patient.

We believe that coracoclavicular fixation with suture anchors is an important consideration that simplifies coracoclavicular fixation, and the coracoacromial ligament transfer acts as a biological reinforcement for ACJ stabilization. In our view, the temporary fixation between the clavicle and scapular spine is beneficial. Not only does it help to avoid loosening of the anchor sutures in the first weeks after surgery, but it also allows for better healing of soft tissue, which appears to help maintain reduction, after Kirschner wire removal

Regarding the radiographic results, Weaver and Dunn,[35] despite high physical demands of their patients, found that 86% of their patients had no evidence of recurrent deformity. These results are in agreement with those described by Guy et al[22] who found no recurrent deformity in 82% of 23 patients and Pavlik et al[36] who noted no recurrent deformity in 92% of 17 patients.

Several studies have shown a clinical and radiographic dissociation regarding the surgical treatment of acute acromioclavicular dislocation, wherein despite the high incidence of complications, such as implant breakage, development of osteoarthritis, and loss of reduction, the functional results were similar to those observed in patients who received nonsurgical treatment.[9,36]

Shin et al,[37] in his study that examined the use of suture anchors as a method of reinforcement and protection of the coracoclavicular ligament reconstruction, obtained good to excellent functional results in all patients, regardless of the radiographic changes observed. However, 2 (33%) patients presented with residual pain and swelling at the end of the follow-up period.

With respect to the use of a hook plate, several studies have shown that despite the ease of use and a low rate of deformity recurrence, this procedure has a high rate of complications due to the positioning of the implant, including acromial osteolysis or fracture, subacromial bursitis, and ACJ violation leading to osteoarthritis.[38–40] These complications require implant removal, transferring the responsibility for maintenance of reduction solely to the healed soft-tissue, thus favoring recurrence.[38] Coracoclavicular screw fixation, as described by Bosworth,[41] provides excessive rigidity to the ACJ, leading to implant breakage or acromial or clavicular osteolysis, which in turn may result in screw loosening (pull-out).[11,42,43] Furthermore, there are reports of complications related to the screw placement site, such as skin irritation and infection.[42,44]

While considering an alternative method that might avoid the cited complications and simplify temporary ACJ fixation, we described a new technique that in addition to avoiding new damage to the ACJ, results in a more rapid procedure, decreases damage to soft tissues and provides effective temporary fixation of the joint.

We evaluated the clinical and radiographic outcomes, failures, and complications related to this new procedure. Functionally, we obtained results similar to those found in the literature.[22,45–47] Using UCLA scoring, 7 results were excellent, 13 were good, and only 1 was rated as unsatisfactory. All patients regained functional range of motion of the affected shoulder, and only in 1 case was the clinical outcome deemed unsatisfactory due to residual pain, deformity recurrence, and restricted range of motion of the operated shoulder secondary to the long period of immobilization.

In our study, we observed 3 cases of recurrence, a rate similar to that described in the literature.[37,47] Of note, only 1 case of recurrence had an unsatisfactory functional outcome, thereby confirming the clinical and radiographic dissociation that can occur in such cases.

Using the new technique evaluated in our study, only 2 patients had complications. One case involved wire loosening, most likely due to excessive movement by the patient (nonadherence to the treatment protocol), and 1 case had discomfort due to prominence of the wire on the posterior scapular edge. Both were treated by wire removal 6 weeks after surgery. We did not encounter any cases of wire migration.

Our study was limited by the lack of evaluation of the surgical treatment results for each dislocation grade and different levels or severity of soft-tissue lesions for each grade might interfere with the final outcomes; a brief follow-up period, with uncertainty as to how these cases will behave in the future; and a practical inability to compare the huge number of surgical techniques and the results described in the literature with the techniques and results in our study.

Further studies with a larger number of patients and more elaborate study designs should be performed to assess the need for temporary acromioclavicular fixation.

We conclude that the surgical treatment of ACJ dislocation is associated with good clinical and radiographic outcomes. The new fixation method described in this paper provides adequate, strong fixation of the joint, simplifies the surgical procedure, and shows a low complication rate. Thus, it is a viable and cost-effective option for the treatment of acute ACJ dislocations.

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