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ORIGINAL ARTICLE

Loss of reduction and complications of coracoclavicular ligament reconstruction with autogenous tendon graft in acute acromioclavicular dislocations

Nam Hong Choi, MD, Seok Min Lim, MD, Sang Young Lee, MD, Tae Kang Lim, MD*

Department of Orthopaedic Surgery, Eulji Hospital, Eulji University School of Medicine, Seoul, Republic of Korea

Background: This study was conducted to report loss of reduction and complications after single-tunnel coracoclavicular (CC) ligament reconstruction with autogenous semitendinosus tendon graft for acute acromioclavicular (AC) joint dislocations.

Methods: This retrospective study included patients with acute, unstable AC dislocations (surgery within 6 weeks after trauma). We excluded patients with chronic injury and distal clavicle fractures with CC ligaments disruption. We measured the CC distance on anteroposterior radiographs of both clavicles, preoperatively, immediately postoperatively, and at the final follow-up visit. We evaluated clinical outcomes using the American Shoulder and Elbow Surgeons Shoulder Assessment and the University of California, Los Angeles Shoulder Rating Scale scores and perioperative complications.

Results: There were 30 patients (27 men and 3 women) with mean age of 41 years (range, 19-70 years). The mean follow-up period was 31 months (range, 12-186 months). Mean CC distance was 15.5 ± 3.7 mm (84% ± 14% of the contralateral shoulder) preoperatively, 8.9 ± 2.6 mm (9% ± 40%) immediately postoperatively ($P < .001$), and 10.6 ± 3.3 mm (24% ± 39%) at the final assessment ($P < .001$), showing an increase of the CC distance during the follow-up. Loss of reduction (defined as >25% increase of CC distance) developed in 14 patients (47%), and complications occurred in 6 patients (20%), including 3 distal clavicle fractures through the tunnel. Final clinical scores were significantly lower in patients with complications (27 vs. 33 of the University of California, Los Angeles assessment [$P < .001$] and 81 vs. 95 of the American Shoulder and Elbow Surgeons Shoulder assessment [$P < .001$]).

Conclusion: In acute AC joint dislocation, single-tunnel CC ligament reconstruction using autogenous tendon graft resulted in loss of reduction rate of 47% and a complication rate of 20%. The development of complications adversely affected clinical outcomes.

Level of evidence: Level IV; Case Series; Treatment Study

Keywords: acute, acromioclavicular joint; AC joint; reconstruction; tendon graft; complication

Operative treatment of the acromioclavicular (AC) joint dislocation remains contentious because of the lack of consensus regarding the optimal surgical technique. Accordingly, a recent systematic review of the 821 citations on the PubMed database on October 2010 revealed 120 studies describing 151

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*Reprint requests: Tae Kang Lim, MD, Department of Orthopaedic Surgery, Eulji Hospital, Eulji University School of Medicine, 68, Hangeulbiseok-ro, Nowon-gu, Seoul, Korea 139-711.

E-mail address: shouldertk@gmail.com (T.K. Lim).

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techniques for operative reconstruction of the AC joint.[2] Many of the current techniques focus on reconstruction of the coracoclavicular (CC) ligaments in reference to anatomic studies that have emphasized the biomechanical importance of the CC ligaments for vertical stability in reconstructions of the AC joint.

Reconstruction of torn CC ligaments with the use of a free tendon graft places the CC distance in an anatomic position attempting to reproduce the trapezoid and conoid ligaments, and a tendon graft has been shown to biomechanically replicate the intact CC ligament complex. Costic et al[5] demonstrated that the anatomic CC reconstruction approximates the stiffness of the native CC ligaments more closely than does the Weaver-Dunn repair. Mazzocca et al[14] also showed that anatomic reconstruction of both conoid and trapezoid ligaments can control superior displacement under cyclic load and approximate the anterior and posterior displacement observed in the intact CC ligament specimen. These biomechanical results were supported by several clinical studies with good outcome in AC joint dislocations.[9,17,22]

The historical choice of material for stabilization of the CC ligament mainly depends on the clinical setting, with synthetic material (sutures or tapes) in acute injury and tendon graft in chronic injury.[11] Therefore, the effectiveness of autogenous tendon grafting for CC ligament reconstruction is rarely reported in acute AC joint injury compared with chronic injury. Several studies reporting good clinical outcomes after CC ligament reconstruction using tendon graft have some limitations in terms of small series (only 2 and 9 patients were included),[9,17] mixed group of patients with acute and chronic injuries,[17,22] and the use of allograft tendon.[17] However, we postulated that the tendon autograft may have theoretic advantages when used in the acute setting. In acute AC joint dislocations, narrowing the CC interspace by the graft may allow sufficient healing of the freshly ruptured ligaments. Disrupted CC ligaments may be healed along the tendon autograft. Even if the tendon autograft fails to heal, it may provide a lasting stability, as expected in chronic injury. However, complications unique to this technique involving tunnel placement through the distal clavicle and coracoid process and morbidity in the knee joint for autogenous tendon harvest can be concerns.

Therefore, the purpose of this study was to report clinical outcomes after single-tunnel CC ligament reconstruction with autogenous tendon graft for acute injury, focusing on a loss of reduction and perioperative complications associated with this technique. We hypothesized that the technique would provide sufficient stability of the AC joint with good clinical outcome, while some complications specific to this technique might exist.

Materials and methods

Patient selection

This was a retrospective study of 61 patients (61 consecutive shoulders) who underwent CC ligament reconstructions using autogenous semitendinosus tendon grafting by the senior author (N.H.C.) between March 1999 and December 2013. Our surgical indication of this technique was disruption of the CC ligament accompanied by the AC dislocation (Rockwood grade III, IV, or V) or by displaced fracture of the distal clavicle. For grade III injury, surgical option was offered in young and active patients after careful discussion about nonsurgical or surgical options between the patient and treating surgeon.[6,12] Of these, we included 30 patients with AC dislocation after acute injury (surgery was performed within 6 weeks after trauma). We excluded patients with chronic injury, distal clavicle fractures with CC ligament disruptions, and CC ligament reconstructions with sutures (not using autograft tendon).

Surgical technique

The patient was placed on an operating table in a beach-chair position under general anesthesia. First, we harvested the semitendinosus tendon from the ipsilateral knee joint in a usual manner. Both ends of the semitendinosus tendon were prepared with Krackow stitches. A 6-cm transverse skin incision was made over the distal clavicle. After the deltotrapezial fascia was opened, the clavicle, the acromioclavicular joint, and the coracoid process were exposed, and complete disruptions of the AC and CC ligaments were identified.

Under the image intensifier, we manually reduced the AC joint and introduced the Kirschner wire from the acromion to the distal clavicle for temporary fixation. A tunnel was made using 4.5-mm reamer on the distal clavicle 3.0-cm lateral from the AC joint and anterior one-third of the distal clavicle. Then, we passed 5 nonabsorbable No. 5 Ethibond sutures (Ethicon, Somerville, NJ, USA) through this hole. We looped these sutures under the coracoid with a passer hook, which was carefully placed close to medial cortex of the coracoid process to minimize the risk of the musculocutaneous nerve injury. The semitendinosus tendon graft was passed under the coracoid in a loop fashion using Ethibond sutures as a shuttle relay (Fig. 1). One limb of the graft was passed through the clavicle tunnel along one strand of multiple sutures, and the other was routed anterior to the clavicle.

While maintaining the reduction of the AC joint, we fixed both free ends of the semitendinosus tendon together over the clavicle, using tendon square knot tying, and added multiple side-to-side sutures to secure the tendon knot. The remaining nonabsorbable sutures were also tied for augmentation. We did not perform distal clavicle resection. We repaired the deltotrapezial fascia carefully with absorbable sutures and completed wound closure. The patient's arm was placed in Velpeau brace for 6 weeks postoperatively.

Radiographic evaluations

Simple anteroposterior radiographs of both clavicles were used to check all patients, without weight-bearing, preoperatively, immediately postoperatively, and at the final follow-up visit. We used these images to measure the distance of CC interspace (CC distance) of the injured and the noninjured shoulder, which was determined as the shortest distance from the most superior cortex of the coracoid to the most inferior cortex of the distal clavicle. All radiographic measurements were done on the Picture Archiving and Communications System (General Electric, Chicago, IL, USA) by use of a mouse cursor with automated distance calculation. Two senior orthopedic residents (S.M.L. and S.Y.L.), who were trained in identifying the variables, reviewed radiographs independently. They performed measurements on