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ORIGINAL ARTICLE

A prospective study of coracoclavicular ligament reconstruction with autogenous peroneus longus tendon for acromioclavicular joint dislocations

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Background: Anatomic coracoclavicular (CC) ligament reconstruction (ACCR) provides good outcomes for Rockwood type III and VI acromioclavicular (AC) joint dislocations. Various grafts have been used, but complications from graft harvesting are not uncommon. This study examined the clinical and radiographic outcomes of patients with AC joint dislocations repaired with the autogenous anterior half of the peroneus longus tendon (AHPLT) to achieve ACCR.

Methods: Patients with a Rockwood type III to V AC joint dislocation and magnetic resonance imaging of the disruption of the CC ligaments, as well as the AC capsule, were prospectively recruited. Patients received ACCR using an autogenous AHPLT graft and were evaluated clinically and radiographically preoperatively and at 1, 3, 6, and 12 months postoperatively.

Results: A total of 18 patients (mean age, 51 years) were prospectively recruited and received an autogenous AHPLT graft ACCR. Fifteen patients completed clinical and radiographic follow-up examinations at 12 months. The mean Constant score (CS) was 51 preoperatively and 93 at 12 months ($P < .005$). No significant difference was noted at 12 months between the CS of the injured and contralateral shoulder. The mean American Orthopedic Foot and Ankle Society score at 12 months was 99, and this was not different from the value at any other time point. Loss of reduction occurred in 10 patients (56%), and tunnel widening was observed in 9 (50%), but neither was significantly correlated with functional outcome.

Conclusion: Autogenous AHPLT appears to be a reliable tendon graft source for CC ligament reconstruction.

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

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Keywords: Acromioclavicular joint; anatomic reconstruction; dislocation; graft; peroneus longus tendon; coracoclavicular ligament

The Shanghai Sixth People's Hospital Institutional Ethics Committee approved this study before patients were recruited, reference number: 2013-50-(1). Our institution reviews studies such as this yearly, and updated reference numbers are provided. Because the last patient was enrolled in April 2015, the final approval number was 2015-50-(1).

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Acromioclavicular (AC) joint dislocations account for about 9% to 10% of all shoulder injuries,³⁹ are more common in men (male-to-female ratio, 8.5:1), and are most commonly sports related.^{10,26} Dislocations are typically graded with the Rockwood classification system, which takes into account the acromioclavicular (AC) joint and the coracoclavicular (CC) ligament, the deltoid and trapezius muscles, and the direction of dislocation of the clavicle with respect to the acromion.⁴⁷ The classification has 6 grades, ranging from type I, in which the clavicle is not elevated with respect to the acromion and the ligaments are intact, to type VI, in which the clavicle is inferiorly displaced behind coracobrachialis and biceps and tendons are ruptured or detached.⁴³ The most common type of AC joint dislocation is Rockwood type III and most commonly occurs in individuals aged 20 to 39 years.^{10,26}

Surgery is indicated for certain Rockwood type III and for all type IV, V, and VI injuries.^{1,2} More than 60 surgical procedures have been described to treat AC joint dislocation.⁸ Surgical treatment is divided into categories that are broadly based on the method used to treat the torn CC ligament.^{6,16,37} The most commonly used method is rigid fixation, in which metal implants, such as plates and Bosworth screws, are used to maintain AC joint reduction. Other methods include ligament reconstruction using artificial ligaments, techniques such as the Endobutton (Smith & Nephew, Memphis, TN, USA) and Flip-Button (Karl Storz, Tuttlingen, Germany), nonanatomic reconstruction, such as the Weaver-Dunn method, and anatomic reconstruction using autologous ligaments.

The hook plate is the most widely used rigid fixation method; however, relatively high complication rates have been reported.^{6,15} Early nonanatomic reconstruction procedures, most notably the Cadenat procedure or the Weaver-Dunn procedure, involve transfer of the coracoacromial (CA) ligament, with or without distal clavicle excision. However, these procedures are associated with incomplete reduction, recurrence, avulsion, or pullout of the transferred CA ligaments and residual symptomatic anteroposterior instability.^{16,60,61}

Anatomic CC ligament reconstruction (ACCR) aims to recreate the conoid and trapezoid ligaments to restore horizontal and vertical stability.^{6,8,16,37} The most widely used tendon grafts for ACCR are semitendinosus (ST) allograft or autograft.^{8,30,34,54} Compared with autograft, allografts have decreased osteoinductive and osteoconductive characteristics as well as a prolonged incorporation time.^{3,29} The use of a ST autograft is also associated with problems such as nerve injury caused by harvesting of the ST tendon^{4,57} and knee pain after harvesting of the hamstring tendon with an incidence of 9.3% to 32.2%.^{31,44}

Zhao et al⁶⁷ recently reported a tendon harvesting method that uses the anterior half of the peroneus longus tendon (AHPLT). Because of its anatomic characteristics, harvesting the AHPLT is comparatively easy and quick. Studies have demonstrated that the AHPLT is acceptable for use as an autograft with respect to its strength, safety, and donor site morbidity for reconstruction of the anterior cruciate ligament (ACL) and ankle ligaments.^{32,38,67} However, we have

searched PubMed, Embase, and Ovid and found no reports of using the AHPLT for AC joint reconstruction after dislocation.

The purpose of the present study was to examine the clinical and radiographic outcomes of patients with Rockwood type III to V AC joint dislocations repaired with ACCR using an AHPLT graft. We believe using this graft will provide good clinical outcomes, without the donor site morbidity associated with other autografts.

Materials and methods

Patients

This was a prospective study conducted between June 2013 and April 2015 at the Shanghai Sixth People's Hospital, Shanghai, China. Consecutive patients seen with Rockwood type III to V AC joint dislocations meeting the surgical criteria were prospectively recruited to receive repair with an autogenous AHPLT graft. Criteria for surgery were (1) bilateral anteroposterior (AP) and axillary radiographs indicated a Rockwood type III to V AC joint dislocation; (2) magnetic resonance imaging (MRI) of the shoulder indicated disruption of the CC ligaments (both the trapezoid and conoid ligaments), and the AC capsule; and (3) shoulder pain resulted in restriction of work or activities of daily living, or both. Patients aged younger than 18 years or with concomitant pathologies, such as fractures or rotator cuff tears, were excluded. All patients provided written informed consent for all procedures performed and for inclusion in this study.

Radiographic examination

All patients received bilateral AP and axillary view radiographs. A computed tomography (CT) scan of the injured shoulder was obtained to verify the position of the AC joint and to exclude fractures of the clavicle, scapula, and proximal humerus. Preoperative MRI was used to estimate the integrity of the CC (conoid and trapezoid portions) and AC ligaments. The MRI scanning method described by Schaefer et al⁵¹ was used to clearly assess the AC and CC ligaments.

Surgical technique

Surgery was performed with the patient under general anesthesia. The surgical goal was anatomic reconstruction of the CC ligament using an AHPLT graft. The tendon harvesting technique described by Zhao et al⁶⁷ was used, with slight modification. In brief, a longitudinal incision of approximately 2 cm is made at the posterior border of the lateral malleolus and just over the peroneus tendon. The deep fascia is dissected to expose the PLT, which is then levered out of the skin window with a mosquito hemostat. The tendon is split longitudinally through the middle with a knife. Then, the AHPLT is sutured with a No. 2 polyester suture (Ethicon, Inc., Somerville, NJ, USA) in a whipstitch style, with the distal site as the tendon end.

With the ankle and foot in plantar flexion, the tendon is pulled proximally and cut off at its most distal section. A tendon stripper is used to harvest the AHPLT from the muscular part of the tendon. The thin deep fascia in the incision is closed with a suture, followed by closure of the wound. The proximal end of the AHPLT

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