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REVIEW

Arthroscopic Transarticular Distal Clavicle Resection

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ABSTRACT

Bursal and superior direct arthroscopic distal clavicle resection techniques exist. An indirect transarticular distal clavicle resection (TADCR) technique, in which the bone resection is performed directly through the acromioclavicular joint (ACJ), is presented. With the arthroscope in the lateral portal and viewing at the ACJ, the TADCR begins by inserting a needle into the ACJ to determine the angle of entrance (a 5-mm skin incision directly over the mid portion of the ACJ is made). Then, with a No. 11 blade, a 4- to 5-mm incision, which is just large enough to ensure the pass of the motorized instruments, is made in the mid portion of the superior acromioclavicular ligament (SACL) parallel to its fibers. A radiofrequency probe is inserted, and the ACJ's soft tissues are excised, taking care not to damage the SACL. Then, the saver is introduced to clean up the soft tissue's debris. Finally, a 4.0-mm oval burr is inserted and, with a fan-shaped motion, bone is resected from clavicle and acromion without damaging the superior ligament. The TADCR is an easy technique that produces consistent bone resection, sparing the SACL.

Keywords: arthroscopic, distal clavicle, resection, Munford procedure

INTRODUCTION

Open distal clavicle resection has been the procedure of choice for the treatment of refractory pain in the ACJ. With the evolution of minimally invasive techniques, the arthroscopic distal clavicle resection (ADCR) has become the standard procedure for this pathology, providing benefit to the patients with the advantages of a closed approach, such as minimal tissue dissection, avoiding deltoid disturbance, and improving recovery time.[1] Its results are proven similar to the open technique.[2]

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There are 2 basic arthroscopic techniques used to perform the ADCR: the superior approach,[3] in which 2 superior portals are used for bone resection, and the indirect bursal approach, in which the resection is performed through the standard anterior portal, viewing from the subacromial space.[4]

The ADCR is a challenging procedure and can be associated with inadequate bone resection and persistent postoperative pain.[3,5,6] Although it is accepted that a 5- to 10-mm bone resection is sufficient, with the current arthroscopic techniques, the bone resection's magnitude is always a concern because pain or instability may arise if the magnitude is inadequate.[3,5,6]

The purpose of the study is to describe a truly direct, superior approach, the arthroscopic TADCR, and to compare its results with the indirect bursal technique. We chose the term *transarticular* because the instruments enter the ACJ through the SACL, although the scope is in the subacromial space; thus, the bone resection is conducted in a *transarticular* fashion.

METHODS

Type of Study

A retrospective, comparative, transversal case and controls study was performed to evaluate the effectiveness of the TADCR compared with the traditional subacromial indirect ADCR technique.

Arthroscopic Transarticular Distal Clavicle Resection Technique

With the arthroscope in the lateral portal, the undersurface of the ACJ is cleared from soft tissues. A needle is inserted in the middle of the superior aspect of the ACJ, from the outside to the inside, to locate the joint and to calculate the proper instrument insertion angle. With a No. 11 blade, a 5-mm skin incision is made over the ACJ; then, a 4- to 5-mm incision parallel to the fibers of the SACL is made. This incision is just enough to insert the motorized instruments. A Mitek VAPR 2 Side Effect radiofrequency probe and/or a shaver tip is inserted to

resect the ACJ meniscus and chondral surfaces, taking care not to damage the SACL. This is easily accomplished if the surgeon always observes the tip of the radiofrequency device. After cleaning the ACJ from soft tissues, a 4.0-mm oval-shaped burr is inserted; the bone resection is accomplished by performing a rocking motion from the anterior to the posterior (fan-shaped motion). The complete procedure is performed under direct visualization from standard lateral and anterior portals (Fig. 1). The burr's cutting tip must be directed to the acromion and the clavicle's tip to ensure uniform bone resection, with the goal of achieving a 5- to 8-mm bone resection.

The described technique was tested before human use in 3 shoulder specimens (Fig. 2) in which adequate bone resection and preservation of the superior ACJ ligament was accomplished.

Two groups of patients were evaluated. Group A consisted of 13 patients who underwent ADCR using an indirect technique, as described by Ellman.[4] Group B consisted of 12 patients who underwent the described TADCR technique. All patients in both groups had ACJ osteoarthritis with or without concomitant rotator cuff pathology. The preoperative diagnosis was made according to history, physical examination with positive pain on palpation over the ACJ, and a positive crossover test result; the x-ray results and the results of magnetic resonance imaging studies confirmed ACJ injury. All patients were evaluated preoperatively and postoperatively using the University of California at Los Angeles (UCLA) shoulder score and the visual analog scale (VAS). The postoperative follow-up included a physical examination focused in the palpation of the ACJ, looking for residual pain or tenderness, and the crossover test and the x-ray examinations with a modified Zanca view to ensure adequate anteroposterior visualization of the ACJ in both shoulders. In the x-rays, the magnitude of the resection was evaluated, measuring the distance between the acromial and the clavicular superior and inferior edges in millimeters; then, it was compared with the contralateral shoulder. In the case of associated shoulder injuries, such as rotator cuff tears or subacromial impingement, the treatment of these pathologies was also performed at the same operation.

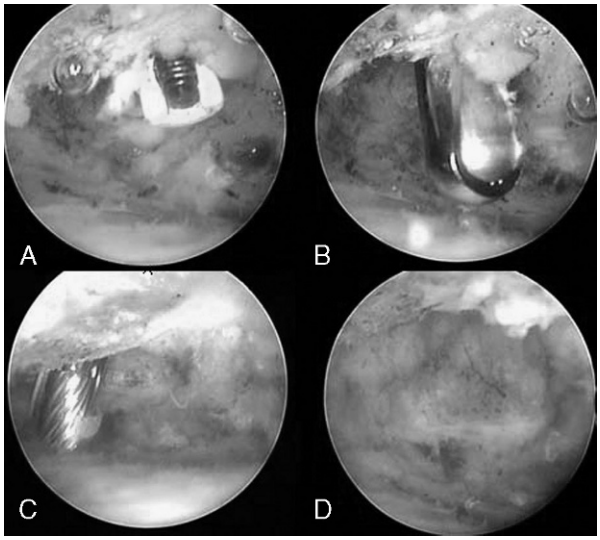

FIGURE 1. Arthroscopy view of the TADCR technique. A-B, Soft tissue resection with radiofrequency probe and shaver. C, Bone resection with oval burr. D, Final view.

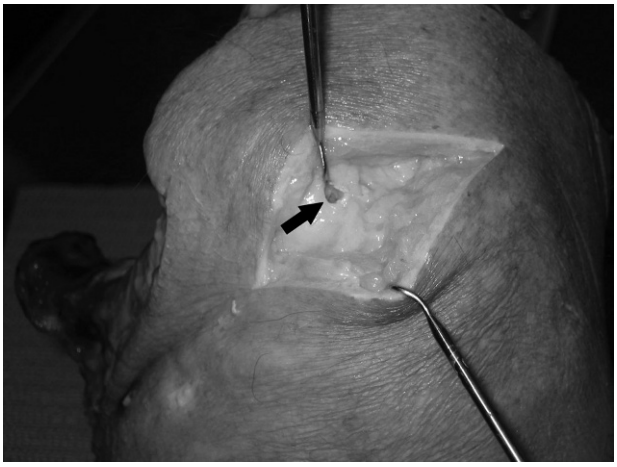

FIGURE 2. Small puncture (black arrow) just large enough to pass the burr in the SACL is shown in a cadaver specimen.

Statistical Analysis

Descriptive statistical analysis was performed with the SPSS software version 10.0.1 for Windows, using χ^2 test and Student t test. Confidence interval was set at 95%.

RESULTS

For both groups, the mean age was 54.8 years (SD, ±11 years); the mean preoperative VAS score was 8.76 (SD, ±2), and the mean UCLA score was 10.68 (SD, ±4). Both groups were comparable: there were no significant differences in sex (P = 0.82), occupation (P = 0.26), operated side (P = 0.63), age (P = 0.55), preoperative pain (P = 0.17), and UCLA score (P = 0.82). The only variable with a statistical difference was the follow-up time (P = 0.007), which was longer in group A.

Group A (n = 13,) had a mean follow-up time of 17 months (range, 4–36 months). Associated injuries included 9 rotator cuff tears, 3 subacromial impingements, 2 partial articular biceps tendon injuries, and 2 superior labral anterior posterior injuries; all pathologies were properly addressed in the same operation. The VAS score improved from 9.2 ± 2 to 2.7 ± 3. Seven patients (53%) had postoperative tenderness on ACJ

palpation; 2 of them also had a positive crossover test result. The UCLA score also improved from 12.4 ± 4 to 31 ± 5 postoperatively; 9 patients scored very good or excellent. The mean bone resection was 7.7 ± 4 mm in the superior edge and 9.43 ± 6 mm in the inferior one. In 2 patients, the resection was at more than 10 mm in the superior edge and at 4 mm in the inferior border. In general, the13 bone resections were uniform without bone irregularities.

Group B (n = 12) had a mean follow-up time of 9 months (range, 3–15 months; $P = 0.007$ [statistical difference with group A]). Associated injuries included 6 rotator cuff tears, 7 subacromial impingements, 2 partial articular biceps tendon injuries, and 2 superior labral anterior posterior injuries. The VAS score improved from 8.2 ± 2 to 0.8 ± 1. Seven patients (58%) had postoperative tenderness on ACJ palpation. None had a positive crossover test result. The UCLA score improved from 9.2 ± 3 to 32.6 ± 2 points postoperatively, qualifying all of these scores in the *very good* or *excellent* categories. The mean bone resection was 6.3 mm (SD, ±3 mm) in the superior border and 8.7 mm (SD, ±5) mm in the inferior one. In 4 patients (33.3%), a less regular bone resection was observed; however, none of them had a positive crossover test result.

Comparing both groups in the postoperative evaluation, there was no statistical difference in the UCLA scores ($P = 0.82$); however, there was a statistical difference in the VAS scores ($P = 0.035$), being better in the TADCR group. A difference on the bone resection magnitude was not demonstrated (superior border, $P = 0.38$; inferior border, $P = 0.74$). There were no differences in the postoperative tenderness on palpation ($P = 0.83$) or crossover test results in either technique ($P = 0.17$).

DISCUSSION

Arthroscopic distal clavicle resection has become a standard procedure in patients with symptomatic ACJ disorders without major instability.[3–6] The arthroscopic technique offers the advantages of the minimally invasive procedures, which involve less soft tissue dissection, less blood loss, smaller incisions, shortened recovery time, and less postoperative pain. It has proven to be as effective as the open technique in the laboratory[1] and in the clinical setting, improving postoperative pain and functional status.[2,4]

The ADCR using the direct technique is rarely performed and is mainly indicated for the treatment of the isolated acromioclavicular recalcitrant pain.[7] More frequently used is the indirect or subacromial technique,[3,5,6] which is easier to perform and in which good results have been reported when performed concomitantly with other associated injuries, such as subacromial decompression,[8] because the same standard arthroscopic portals are used.

With arthroscopic techniques, the magnitude of bone resection is always a concern, especially if excessive, in which case instability may occur. In a recent study, Renfree[9] demonstrated that although there are significant sex-related differences in the insertional distances of the coracoclavicular ligaments, a resection of less than 11.0 mm should not violate the trapezoid ligament, and a resection of less than 24.0 mm should not violate the conoid ligament in either sex in 98% of the general population. Resection of more than 7.6 mm of the distal clavicle in men and 5.2 mm in women, performed using an arthroscopic approach, may violate the SACL.[9]

We find it hard to accurately determine intraoperatively the amount of bone to resect during the indirect subacromial technique and, as reported in the literature,[3,5,6] we have had previous cases where the resection was insufficient, especially on the superior aspect of the distal clavicle just beneath the SACL. These patients have had persistent postoperative pain and positive crossover test result, requiring revision surgery. In an effort to minimize complications with traditional arthroscopic techniques, we developed the TADCR technique. Before using it in patients, it was tested in 3 cadaver specimens (Fig. 2); it proved that it produced consistent bone resection through a 5-mm puncture parallel to the superior acromioclavicular ligament fibers and that it spared the superior acromioclavicular ligament, thus being difficult to produce postoperative instability.

When comparing both techniques in our series, the results were similar. We could not demonstrate statistical differences in functional status according to the UCLA scores ($P = 0.82$), but there was a difference in the VAS scores ($P = 0.035$), being better in the TADCR group. A difference on the bone resection magnitude could not be demonstrated (superior border, $P = 0.38$; inferior border, $P = 0.74$). There were no differences in the postoperative pain on palpation or crossover test results in either technique ($P = 0.17$). There was a high percentage of postoperative pain on palpation in both techniques; however, no statistical difference was found ($P = 0.83$) and it was not correlated with the crossover test result.

In both techniques, the bone resection, according to its measurements, had a trapezoid shape, with its base being the inferior cortex of the clavicle. Although no statistical differences were found, the indirect ones tend to be larger resections, especially at the base (4 patients in group A had resections larger than 10 mm, compared with 2 patients in group B). In addition, there was less variability in the amount of bone resection using the transarticular technique.

One advantage of the TADCR is that it also serves as an arthroscopic portal either for viewing, evaluating the tear, or working especially for rotator cuff tears. The view provided by this portal is similar to that of a Neviaser[10] or a supraclavicular fossa portal.[11]

The study has several potential disadvantages: (1) we do not have any biomechanical study that supports the finding that instability does not occur when the superior acromioclavicular ligament is punctured; (2) the patients did not have isolated ACJ pathology (however, in our setting, this is very unusual); (3) The VAS and UCLA scores evaluate the shoulder as a unit, and not purely the ACJ; and (4) it is a retrospective study with small groups and a short follow-up time.

CONCLUSIONS

The proposed TADCR technique provides consistent bone resection sparing the SACL, yielding functional results similar to the traditional indirect subacromial distal clavicle resection, and offering an arthroscopic portal for evaluating/repairing rotator cuff tears. Further biomechanical investigations are required to evaluate the residual posterior acromioclavicular instability.

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