Surgical treatment of chronic acromioclavicular dislocation: Comparison between two surgical procedures for anatomic reconstruction

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Introduction

Acromioclavicular (AC) joint dislocations typically occur through either a direct impact to the shoulder or by indirect force from a fall on an outstretched arm, thus affecting mainly active patients involved in contact sports.7,9,14,27 This leads to aesthetically unpleasant bulging of the lateral aspect of the clavicle, pain, fatigue, muscular weakness, and impaired shoulder function.14,28 Functions of AC joint are to suspend the scapula from the clavicle and to support the weight of the upper extremity, thus once the ligaments are destroyed, joint stability has to be maintained only by the muscles.3,17,28 For this reason, many patients develop various degrees of disability, secondary to disruption to their normal AC anatomy.

The rationale of surgical treatment is, therefore, to restore normal anatomy, giving the patient the possibility of regaining normal shoulder function. Since the first report of Cooper in 1861,8 a wide variety of surgical procedures have been reported, including transarticular pins or screws21; AC wire or suture fixation15, transfer of the coracoid muscles4,26; coracoclavicular screws5,16,29, coracoclavicular fixation with synthetic grafts10,12,24,25 Non-operative treatment has also been advocated11; however, results for types III–VI AC dislocation are poor, often leading to chronic instability. Moreover, frequently the extent of the consequences after conservative treatment of types I and II dislocation is underestimated.19

Whilst early repair of acute AC dislocations provides satisfactory results independently of the surgical procedure,2,18,23 there is less consensus on the treatment of chronic lesions and the outcome after surgery is generally less favourable.24 However, most reported surgical techniques involve a combination of coracoclavicular and AC fixation, whilst resection arthroplasty of the distal clavicle has been demonstrated not to address the joint instability.1 The aim of this study therefore is to compare the outcome of two surgical procedures of coracoclavicular reconstruction with conservative treatment by reporting our experience in the treatment of chronic AC dislocations types III–VI according to Rockwood.23

Materials and methods

A series of 90 patients treated for chronic AC dislocation by the same surgeon (G.F.) in our Department from 1999 to 2009 is
analysed here, including 84 men and 6 women. Ages ranged from 20 to 62 years, mean age of 31.5 years. The dominant extremity was involved in 66 injuries (74%). The time from injury averaged 3 months, (1–6). The injury was the result of a sport trauma in 67 patients (75%).

Patients were retrospectively divided into three groups according to the treatment received. The groups were homogeneous with respect to age, sex, type of trauma and duration of symptoms. Patients of group 1 underwent reconstruction with a Dacron vascular prosthesis (Fig. 1); patients of group 2 underwent reconstruction with LARS\textsuperscript{1} (Ligament Advanced Reinforcement System; Surgical Implants and Devices, Arc-sur-Tille, France) and two interference screws (Fig. 2); patients of group 3 were treated conservatively. In both surgical groups an acromioclavicular K-wire was placed in order to provide ante-ro-posterior stability and removed after 3 weeks. Pre-operative assessment included bilateral static plain radiographs and bilateral dynamic radiographs taken with the patients standing and holding a 5 kg weight in each hand. Inclusion criteria were as follows: (i) type III or higher AC dislocation according to Rockwood; (ii) minimum 1 month after trauma; (iii) no previous surgery performed. Post-operatively, the arm was kept in sling for 2 weeks.

Follow-up was performed by the Shoulder Unit of our Department in the outpatient’s clinic at 1 month, 6 months, and 15 months after surgery. Patients were assessed with radiographs post-operatively and after 6 months. The modified UCLA acromioclavicular rating scale was used in all patients after 15 months in order to evaluate the overall success of the procedure. This scale includes maintenance of reduction, range of motion, strength, pain, weakness, change in occupation, patient satisfaction and complication.\textsuperscript{13} In order to verify effectiveness of the procedure, the UCLA score, and the Shoulder Pain and Disability Index (SPADI) score were utilised in those patients who did not experience any complication. The various complications were separately recorded in order to highlight the safety of the procedure.

Data were statistically analysed by use of paired Mann-Whitney tests and one-way analysis of variance tests.

Results

Clinical outcome is summarized in Table 1 and in Figs. 3 and 4. After 6 months, patients of both groups 1 and 2 showed a significant ($p < 0.05$) improvement of function evaluated by the UCLA score (26 ± 1.2 and 26.9 ± 1, respectively) compared to the pre-operative assessment (15.3 ± 1.1) and also compared to patients treated conservatively (15.8 ± 0.9). After 15 months, according to the modified UCLA acromioclavicular rating scale, in group 1, 10 (33.3%) patients had excellent results, 6 (20%) had good results, 1 (3.3%) had fair results and 13 (43.3%) had poor results; in group 2, 12 (40%) patients had excellent results, 16 (53.3%) had good results, 1 (3.3%) had fair results and 1 (3.3%) had poor results. Patients of both groups 1 and 2 showed a significant ($p < 0.05$) improvement of function evaluated with the UCLA (27.9 ± 2.2, 28.4 ± 2.3, respectively) and the SPADI score (17.9 ± 4.3%, 16 ± 2.2%, respectively) compared to patients treated conservatively (UCLA: 16.2 ± 0.9; SPADI: 64.9 ± 7.3%).

As far as complications are concerned, 13 patients out of 30 (43.3%) of group 1 reported a complication including 7 (23.3%) recurrences due to neoligament rupture, 4 (13.3%) aseptic separations, 1 (3.3%) fracture of the clavicle and 1 (3.3%) fracture of the coracoid. In contrast, only 1 patient out of 30 (3.3%) of group 2 suffered from a complication, consisting in the neoligament rupture. Neither deep infection, nor nerve palsies were reported.

Discussion

We reported successful AC reconstruction after chronic AC dislocations and also identified a procedure, based on the use of LARS\textsuperscript{1} artificial ligament, which allows for both satisfactory functional outcome and low complication rate with excellent or good results in 93.3% of the patients. The other procedure, based on the application of a coracoclavicular Dacron band, was characterized by an unacceptable high complication rate (43.3%) with excellent or good results in only 53.3% of the patients. However, when a complication was not registered, also reconstruction with a Dacron...
vascular prosthesis resulted in satisfactory outcome with full return to previous athletic activities after 15 months, comparable with that of the LARS group. This suggests that reconstruction of chronic grades III–VI AC dislocation is an effective procedure which allows for anatomic reconstruction and, consequently, significantly better results than conservative treatment. In this study, also patients with chronic grade III AC were included, even if their surgical treatment had been questioned by other authors. In fact, the severity of these injuries is often underestimated in primary diagnosis and most of them during surgery turn out to be grade IV and V.

From a biomechanical standpoint, since reconstruction in the Dacron group was obtained performing a coroclavicular loop around the clavicle with an “over-the-top” knot, the clavicle is overloaded in a single point, thus increasing the risk of bone erosion and subsequent fracture. Conversely, LARS is passed through two drill holes in the clavicle and fixed with two conic interference screws, distributing the load in two points without “over-the-top” application of forces, and, therefore, transection of the clavicle from bone erosion unlikely occurs. In addition, the low rate of neoligament rupture in the LARS group can be explained by its characteristic high resistance to the mechanical forces acting in the shoulder, consistent with previous satisfactory experience with anterior cruciate ligament (ACL) reconstruction. Previous experience with Dacron materials for ACL reconstruction reported high failures rate due to poor long-term stability.

Another important issue is the rationale for late repair of chronic lesions. In the literature, early repair of AC dislocations

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Summary of results at 15 months follow-up.</th>
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<tbody>
<tr>
<td></td>
<td>Control</td>
</tr>
<tr>
<td>Number of patients</td>
<td>30</td>
</tr>
<tr>
<td>Success rate (excellent or good)</td>
<td>0%</td>
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<tr>
<td>UCLA</td>
<td>16.2</td>
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<tr>
<td>SPADI</td>
<td>64.91</td>
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<tr>
<td>Complications</td>
<td>–</td>
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<tr>
<td>Neoligament rupture</td>
<td>–</td>
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<tr>
<td>Foreign body reaction</td>
<td>–</td>
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<tr>
<td>Clavicle fracture</td>
<td>–</td>
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<td>Coracoid fracture</td>
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![Fig. 2](image-url) (A) Surgical technique for AC reconstruction with LARS. With the patient lying in beach-chair position, a 7 cm long epiclavicular skin incision is made from the tip of the acromion to the medial side of the clavicle. After identification of the coracoid process two transosseous tunnels are drilled into the clavicle. Great care is taken in performing these tunnels in oblique fashion in order not to weaken the clavicle. (B) LARS is then passed around the coracoid and through the tunnels and secured with two conic interference screws. A short acromioclavicular K-wire is ultimately placed avoiding the two screws. (C) X-ray performed 15 months after surgery showing satisfactory reduction of the AC dislocation.

![Fig. 3](image-url) Overall outcomes after 15 months from surgery according to the modified UCLA acromioclavicular rating scale.
has been reported to result in good clinical outcome. On the other hand, treatment of chronic AC dislocation is usually less effective and characterized by a higher complication rate and lower patients’ satisfaction.\textsuperscript{24,28} Weinstein et al. reported that when reconstruction is performed more than 3 months after trauma, results are significantly worse, probably because of the presence of abundant scar tissue and muscle retraction.\textsuperscript{28} Nevertheless, we obtained satisfactory results even after 3 or more months following trauma when using LARS\textsuperscript{21}. This can be explained by the fact that our series is characterized by a high number of athletes (75\%) and that the devices used in this study provided more stable reconstruction than that obtained using no. 5 nonabsorbable sutures as used in the work of Weinstein et al.\textsuperscript{28}

**Conclusion**

In conclusion, we advocate surgical treatment with anatomic acromioclavicular reconstruction with LARS\textsuperscript{26} and two interference screws on the clavicle for active and motivated patients with complete acromioclavicular dislocations. Further long-term follow-up studies are needed to ultimately assess the long term efficacy of this procedure.

**Conflict of interest**

No financial support/benefit/interest could create a potential conflict of interest with regard to the work for any of the authors.

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