

Long-term follow-up in a single-bundle arthroscopic acromioclavicular joint reconstruction after Rockwood III to VI dislocation

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This retrospective study presents the clinical and radiographic results of a single-bundle arthroscopic acromioclavicular joint reconstruction in 45 patients with a mean follow-up of 4.8 years. Patients with a Rockwood grade III or higher were included. Clinical results were based on satisfaction, pain and functional scores. These outcome scores were compared to coracoclavicular distance measurement on X-ray. Secondly, clinical outcome scores were compared between patients who had surgery in the first 6 weeks after trauma and patients treated after 6 weeks. Overall, X-ray showed a good reduction in 71.1% of the patients (less than 50% loss of reduction). These patients showed better clinical results than patients with radiographical failure in terms of satisfaction ($p = .001$), Constant ($p = .001$), DASH ($p = .031$) and SPADI ($p = .005$) scores. In total, 78% of the patient had surgery in the first 6 weeks after trauma. When treated later (mean time to surgery of 8.8 months), patients showed worse results for satisfaction ($p = .003$) and DASH score ($p = .006$), suggesting that treatment of chronic cases might warrant additional fixation techniques. As a conclusion, these results showed that, in the acute approach, single-bundle arthroscopic coracoclavicular fixation is a good treatment in acromioclavicular joint dislocation Rockwood grade III or higher.

Keywords : Trauma, shoulder, Acromioclavicular Joint, arthroscopy, surgical treatment.

INTRODUCTION

Acromioclavicular joint (ACJ) luxation is a common injury, especially in young athletes in the 3th decade. 90% of these injuries are low-grade sprains. High-grade injuries however are known to cause several months of sport or work abstinence^{1,2}. ACJ luxation is typically caused by a direct blow to the acromion with the shoulder adducted, due to player contact or cycling trauma, or by an indirect force from falling on the outstretched hand³. Surgical treatment is indicated for Rockwood IV, V and VI and still controversial⁴ but justified for Rockwood III in patients requiring more than 90° abduction and elevation for work or sports, in patients with heavy lifting requirements, for cosmetic reasons in patients with great ACJ prominence and in patients with unacceptable pain and failed nonoperative management^{3,5}. Many surgical methods exist to treat ACJ luxation, but no gold standard has been established so far. Addressing horizontal and rotational stability has gained attention in the past decade, using multiple-bundle reconstructions. However, this has been associated with the risk of

clavicle fractures⁶ and optimal biomechanical tunnel positioning is still an important questioned topic^{4,6,7}. In our centre, a full arthroscopic technique with a single synthetic construct has been used to treat acute and chronic ACJ luxation. Results of this technique vary in literature and there are few studies on the long-term⁴. The goal of this case series is to present long-term clinical and radiographic results using a single synthetic implant in treating acute and chronic ACJ luxation.

METHODS

In this retrospective monocentric study, patients were included, who had an arthroscopic ACJ reconstruction between January 2010 and June 2017 performed by one of two senior surgeons. Inclusion criteria were Rockwood grade III or higher ACJ luxation and a minimum follow-up of 18 months. Rockwood III patients were only included if they had high demand work of sport requirements, pain and failed conservative treatment. Clinical and radiological assessment occurred in January 2019. All patients gave

informed consent and approval by the local ethics committee was achieved. Exclusion criteria were distal clavicle fracture and additional stabilization techniques (e.g. concomitant Weaver-Dunn). This series comprised 71 patients, of which 26 couldn't visit the outpatient clinic because of variable reasons (mostly work obligations). This yielded a case series of 45 included patients with a mean follow-up time of 4.8 year (range 1.5 - 8.3 year) and mean age of 43 years (range 16-66). Mean time to surgery after trauma was 70 days (range 1 day - 3.3 year). 78% had surgery in the first 6 weeks after trauma, which is defined as acutely treated. Most injuries are cycling or motorcycling accidents or related to their work. No patient did professional sport activities. ACJ luxation occurred on the dominant side in about half of the cases (53%).

Patients were clinically evaluated in the outpatient department by one of two residents with the use of the Constant score⁵. Furthermore, all patients were asked to fill in the Disabilities of Arm Shoulder and Hand score (DASH) and the Shoulder Pain and Disability Index (SPADI) score^{8,9}. Patient satisfaction was measured using the Visual Analogue Satisfaction scale (VAS). Return to sport, when applicable, was measured by asking the patient at what level he performed (%) in comparison with his level before trauma. Postoperative wound infection or delayed wound healing was questioned and verified in the patient's file. Furthermore, peroperative associated rotator cuff, labrum or cartilage damage was noted. Need for revision surgery was registered. X-rays of both shoulders were taken in a radiographic centre of the patient's preference. Using the Zanca view, the coracoclavicular (CC) distance was measured from the superior side of the coracoid process to the inferior side of the clavicle at the smallest distance between clavicle and coracoid process^{10,11}. This was compared to the normal contralateral side. Coracoclavicular distance was accepted as a good result when there was 0-50% difference in distance, partial failure when 50-100% difference was seen and complete failure when more than 100% increase in distance was observed. Other radiographic parameters were AC joint widening, (complete) button migration, coracoclavicular ligament calcification, clavicle osteolysis around the button, distal clavicle osteolysis and coracoid process fracture.

All patients were operated in beach chair position under general anaesthesia with a single shot interscalene block. Every surgery was performed by one of the two senior authors¹². First, arthroscopic

intra-articular evaluation was performed with treatment of concomitant pathology if necessary. Afterwards, the coracoacromial ligament was followed from the acromion to the tip of the coracoid process through a subacromial view. The lateral border and the undersurface of the coracoid were cleared to have a good view on the base of the coracoid. A small incision was made on top of the clavicle between 2 and 3 centimetres medial from the AC joint. A drill guide was used to drill a guidewire through the clavicle and the coracoid process, ending as posterior as possible on the base of the coracoid process, close to the anterior glenoid. Next, the guidewire was overdrilled with a 4.5 mm drill and a TightRope construct (Arthrex, Naples, FL, USA) was inserted antegrade under direct arthroscopic vision. The construct was tightened after manual reduction of the clavicle. No additional distal clavicular resection was performed in the acute cases.

Postoperatively, patients were given a sling for 3 weeks. Automobilization of elbow, wrist and hand were encouraged from the first day with a gradual increase in shoulder mobilization. If rehabilitation went too slow at 3 weeks, physiotherapy was started.

Statistical analysis compared different groups with a 95% confidence interval in all comparisons. The first test is a one-way ANOVA to see whether there are any statistically significant differences ($p < .05$) between the means of the independent groups. The second test is calculating all pairwise comparisons with Tukey. Compared groups are first of all the no failure, partial failure and complete failure groups. Secondly the acute and chronic treated groups were compared.

RESULTS

Pooling of results yielded an overall satisfaction score of 8.7 (range 0-10) and a DASH score of 6.5 (range 0-32), which was classified as very mild disability¹³. SPADI score was overall 9 (range 0-51) and Constant score was 83.7 (range 57-93). In this study population, 69% practised sport on recreational level. These patients generally lost about 10% of their sport capacities (compared to the level before trauma). Two patients (4.4%) presented with postoperative wound healing problems, but eventually they all healed properly. No hardware removal because of wound problems was necessary. Additional treatment because of concomitant lesions was needed in 29% of all patients, such as rotator cuff tears (anchor fixation or debridement), labrum lesions and SLAP lesions

(anchor fixation). Revision surgery was necessary in 3 patients (6.7%) because of insufficient results. One was treated with a hookplate, one with a Weaver and Dunn technique and the last one with removal of Tightrope, according to the surgeon's assessment and evaluation.

X-ray assessment showed a good reduction in 71.1% of all patients. Partial failure was seen in 17.8% of the cases and complete failure in 11.1%. Loss of reduction occurred in all cases within the first 3 months after surgery. When clinical outcome parameters were compared between no radiographic failure and complete radiographic failure, a statistically significant difference was found for satisfaction ($p = .001$), Constant score ($p = .001$), DASH ($p = .031$) and SPADI ($p = .005$). However, no significant difference between no failure and partial failure was seen for satisfaction ($p = .76$), Constant score ($p = 0.9$), DASH ($p = .233$) or SPADI ($p = .9$). Patients with partial failure on X-ray presented with significant better results when compared to patients with complete radiographic failure in terms of satisfaction ($p = .014$), Constant score ($p = .004$) and SPADI ($p = .045$), but not for DASH score ($p = .585$) (Fig. 1).

ACJ widening was seen on X-ray in 22.2% of all patients. We found no difference in terms of

satisfaction (respectively 8.4 and 8.8), DASH score (6.8 and 6.7), SPADI score (7 and 9.1) and Constant score (86.6 and 83.2) when compared to patients without ACJ widening. Button migration occurred in 1 patient (2.2%), who showed no failure of reduction on X-ray. Coracoclavicular ligament calcification was observed in 6 patients (13.3%). There was 1 case (2.2%) of clavicle osteolysis.

When looking at the acutely treated group separately, mean time to surgery was 14 days (range 1-42 days) and mean follow-up time 54 months. This patient group was compared to the chronically treated group with a mean time to surgery of 8.8 months and mean follow-up time of 70 months. A good radiological result was shown in 68.6% in the acute group versus 80% in the chronic. Partial failure was seen in 20% in the acute group versus 10% in the chronic. 11.4% in the acute group and 10% in the chronic had complete loss of reduction. There was a significant difference in patient satisfaction ($p = .003$) and DASH score ($p = .006$) with better results in the acutely treated group. Furthermore, there is a trend towards better results in the acutely treated group, however not significant, for SPADI score ($P = .099$) and Constant score ($p = .077$) (Fig. 2). Associated lesions occurred almost equally in both groups (28.6% acute versus 30.0% chronic).

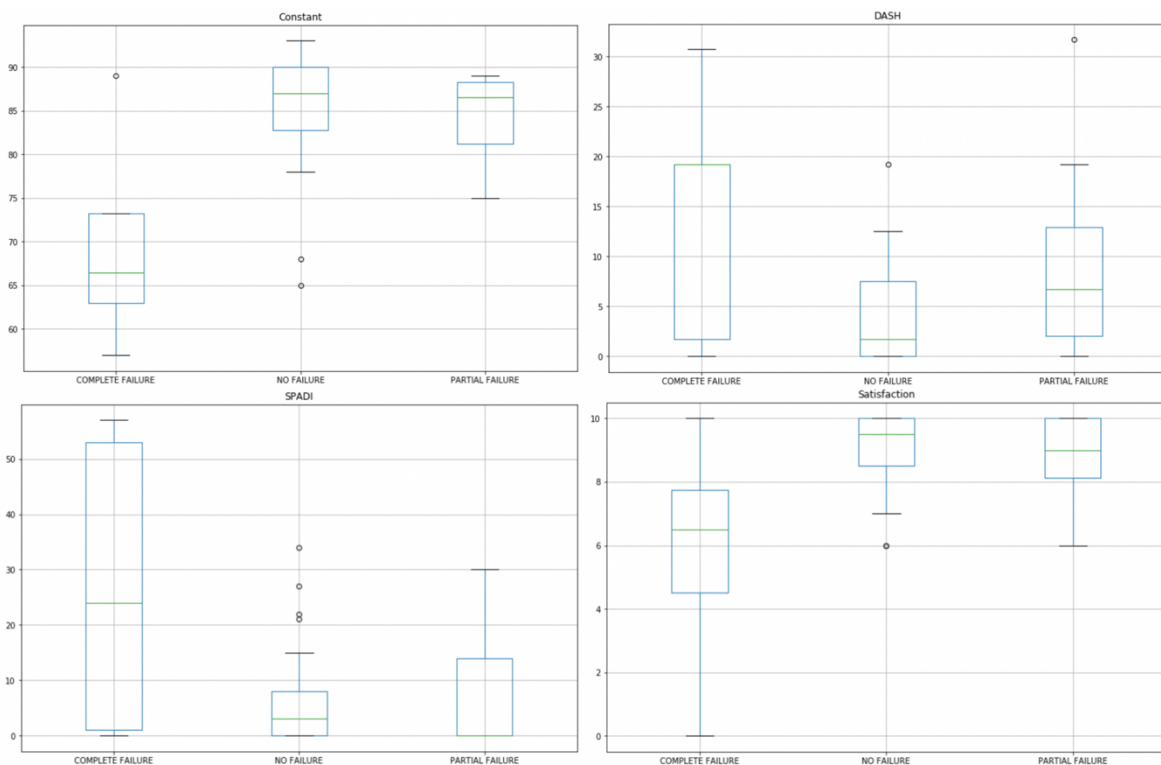


Fig. 1 — Clinical results in patients with no radiographic failure (satisfaction 9.1, DASH score 4.3, SPADI score 6 and Constant score 85.3), partial failure (satisfaction 8.7, DASH score 9.8, SPADI score 8.3) and complete failure (satisfaction 5.8, DASH score 14.2; SPADI score 27 and Constant score 69.8).

DISCUSSION

There are various surgical options when considering an ACJ reconstruction. However, no gold standard has been established so far. There is a tendency to more minimal invasive procedures and as such more arthroscopic approaches since introduction in 2001 in which for the first time a guide pin was drilled through the clavicle and the base of the coracoid under arthroscopic view¹². Advantages of arthroscopy are optimal cosmetic results, no deltoid injury, no sacrifice of the CA ligament, the possibility of diagnosing and treating associated injuries at the same time, and no hardware removal¹⁴. Although these arguments all seem reasonable, a recent meta-analysis by Gowd et al. could not confirm a difference in loss of reduction, complication rate and revision rate between open and arthroscopic techniques³. Furthermore, comparison between single- and double-bundle technique showed no biomechanical difference^{6,15}.

Radiographically, there are no standardized cut-off values available. In this study, good reduction was defined as an increase in CC distance of less than 50% when compared to the normal contralateral side, partial loss of reduction as an increase of 50-100% and complete loss of reduction as an increase of more than 100%. Previous studies of ACJ reconstruction

with the use of a TightRope construct classified loss of reduction as a CC distance of > 2 mm in coronal plane under anteroposterior stress¹⁶, CC distance of $> 25\%$ of contralateral side (17) and CC distance of $> 50\%$ compared to the postoperative X-ray¹⁸, but most studies did not report any specification about loss of reduction¹⁹⁻²⁵. Under these criteria, 20.5% of all TightRope constructs in literature were classified as failure. In this study 28.9% did meet the criteria of loss of reduction, which is consistent with reported literature⁴.

It is suggested that limited correlation exists between clinical and radiographic outcome parameters after ACJ reconstruction¹⁷. In this study however, long-term clinical results after 4.8 years of follow-up are significantly better in patients with good results on X-ray (no or partial failure) compared to patients with complete loss of reduction radiographically. Our results suggest that radiographic parameters could be a valuable method to evaluate success or failure after ACJ reconstruction. Furthermore, this highlights the need for standardized radiographic cut-off values for successful treatment.

Pooled complication rates known in literature after TightRope reconstruction are infection (2.6%), clavicle or coracoid process fracture (3.2%), total hardware (button) failure (9.2%), ligament or hole

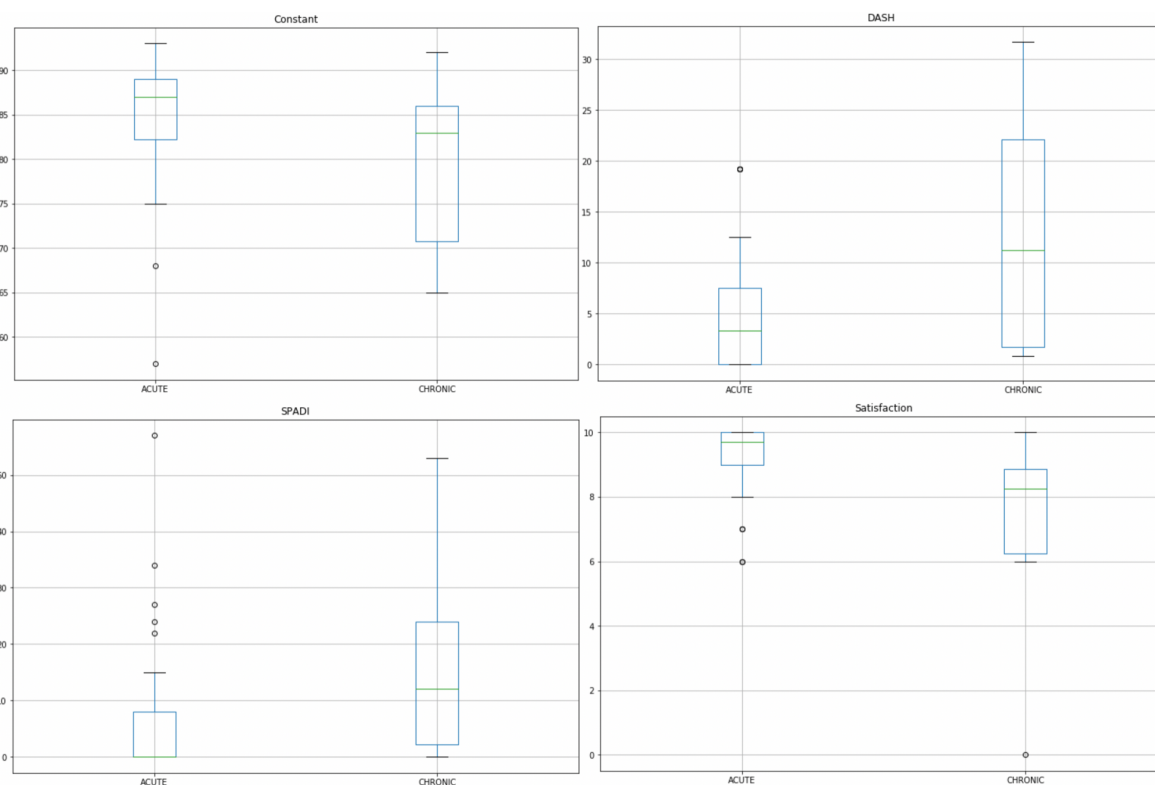


Fig. 2 — Clinical results in acute and chronic groups for patient satisfaction (9.2 versus 7.3), DASH score (4.8 versus 13.6), SPADI score (7.2 versus 16.5), Constant score (84.9 versus 79.9).

calcification (6.3%) and osteolysis (2.6%) (3). Our study showed consistent results, but we did not see any infection or clavicle or coracoid process fracture. Furthermore, radiographic assessment of our included patients showed ACJ widening in 22.2 %. The exact reason for this is not yet known, possible explanations are residual luxation (Rockwood III) or abnormal or excessive translation resulting in lateral osteolysis of the clavicle. Interestingly, when comparing functional outcome parameters of patients with or without ACJ widening, the results were similar, but further statistical analysis is needed before conclusions can be drawn on this topic.

Acute treatment of ACJ luxation was defined as treatment within 6 weeks after trauma. All patients treated after 6 weeks were defined as chronically treated. In other studies, chronically reduced injuries were those treated ranging from 3 weeks to 6 months of nonoperative attempt^{3,26,27}. In this study, a cut-off date of 6 weeks was chosen because of practical reasons. Patients used to come in through the emergency department and are referred to the outpatient clinic. Surgical indication is usually made at this point. This process may take up to 6 weeks. Results tend to be better in the acute cases at the long term. Statistically significant better satisfaction and DASH scores were found in the acute group. These results suggest that this technique is a valuable option in the acute treatment of ACJ luxation and that chronic luxation may need additional fixation techniques.

A first limitation is that in order to increase the patient file, patients had the opportunity to have their radiological follow-up in a center of preference. Patients were however only included in the study results when a Zanca view was taken. Another limitation is that no difference is made in results between Rockwood III to VI in this case series. This warrants the need for further research.

CONCLUSION

A long-term follow-up of 4.8 years shows that an arthroscopic technique using a single-bundle synthetic implant is a valuable option in the acute management of ACJ luxation with overall satisfying results. Clinical results are clearly better when a good reduction is achieved. In chronic cases, this technique yields worse clinical results than in patients treated in the first 6 weeks after trauma.

Conflicts of interest: No benefits in any form have been received or will be received from a commercial party related

directly or indirectly to the subject of this article.

Funding statement: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Ethical approval details: The research protocol was approved in advance by the appropriate ethical committee. There was acted according to the ethical standards in the 1964 Declaration of Helsinki.

Informed consent details: Informed consent had been obtained.

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