TRAUMA

Long-term results of the surgical treatment of type III acromioclavicular dislocations

AN UPDATE OF A PREVIOUS REPORT

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The purpose of this study was to review the long-term outcomes of a previously reported prospective series of 46 type III acromioclavicular dislocations. These were treated surgically with temporary fixation of the acromioclavicular joint with wires, repair of the acromioclavicular ligaments, and overlapped suture of the deltoid and trapezius muscles. Of the 46 patients, one had died, four could not be traced, and three declined to return for follow-up, leaving 38 patients in the study. There were 36 men and two women, with a mean age at follow-up of 57.3 years (41 to 71). The mean follow-up was 24.2 years (21 to 26).

Patients were evaluated using the Imatani and University of California, Los Angeles (UCLA) scoring systems. Their subjective status was assessed using the Disabilities of the Arm, Shoulder and Hand and Simple Shoulder Test questionnaires, and a visual analogue scale for patient satisfaction. The examination included radiographs of the shoulder.

At a follow-up of 21 years, the results were satisfactory in 35 (92.1%) patients and unsatisfactory in three (7.9%). In total, 35 patients (92.1%) reported no pain, one slight pain, and two moderate pain. All except two patients had a full range of shoulder movement compared with the opposite side. Unsatisfactory results were the result of early redisplacement in two patients, and osteoarthritis without redisplacement in one.

According to the Imatani and UCLA scores, there was no difference between the operated shoulder and the opposite shoulder (p > 0.05). Given the same situation, 35 (92.1%) patients would opt for the same surgical treatment again.

Operative treatment of type III acromioclavicular joint injuries produces satisfactory long-term results.

The management of a dislocation of the acromioclavicular (AC) joint depends on its grade and severity. According to Collins, a type III dislocation is a complete disruption of the AC joint with associated tears of the acromioclavicular and coracoclavicular ligaments, detachment of the deltotrapezial fascia from the distal clavicle, and vertical displacement of the distal end of the clavicle with a coracoclavicular interspace between 25% and 100% greater than the normal shoulder.

The treatment of type III dislocations remains controversial. Conservative treatment can be sufficient, although some authors have reported residual symptoms of pain and weakness in up to 50% of those treated non-operatively. By contrast, other authors recommend surgery, especially in young and active patients, not only because of the aesthetically displeasing deformity of the clavicle but also for pain, fatigue, and muscle weakness. Many surgical techniques have been suggested but their outcomes are difficult to compare.

We previously reported a prospective study of 46 patients with a mean follow-up of 5.8 years (2 to 7.9) who were treated by excision of the meniscus, temporary joint stabilisation with two smooth wires, and repair of the joint capsule and superior acromioclavicular ligament, but without repair of the coracoclavicular ligament. In our opinion, the most important step was the supraclavicular reinforcement by overlap and suture of deltoid and trapezius muscles. The wires were removed after four to five weeks under local anaesthetic.

The purpose of this update is to present the longer-term outcome of the same cohort with a minimum post-operative follow-up of 21 years.

Patients and Methods

Our original study consisted of a prospective consecutive series of 46 patients with a type III AC dislocation who were followed for a mean of 5.8 years (2 to 7.9) after surgery. The surgical technique used has been described above and was the same in each case. There were 42 men...
and four women with a mean age at the time of the injury of 32.4 years (18 to 64). All were employed or active and 32 were practising a sport. The dominant shoulder was involved in 31 patients. The cause of injury was a fall in 11 patients, sport in six, and a traffic accident in 29 (21 were motor-cycle riders). There was no loss to follow-up.

The mean Imatani score\(^{12}\) after two years was 94.4 (64 to 100, 95% confidence interval (CI) 91.8 to 97.0). There were 40 patients (87%) with an excellent result; three (6.5%) were good, three (6.5%) fair, and none poor. All patients had returned to their previous occupation by 12 weeks. Full movement (shoulder abduction, forward and lateral flexion, and both medial and lateral rotation) had been regained within 12 weeks in every case. At the latest review, 42 (91.3%) patients had no pain; one had slight pain on occasion but no other disability, and three (6.5%) had mild pain and weakness at the extremes of movement, which represented a fair result.

There were a small number of surgical complications in the original study. One patient had a wound infection which required early removal of the wires, drainage and antibiotics, resulting in redisplacement of the AC joint and a fair clinical result; another had early lateral migration of wires, AC redisplacement and a fair result; and a third patient had medial migration of a wire and a good result. Overall, there were five (10.9%) patients in whom the AC joint redisplaced.

In March 2010 we designed a new study to update the outcomes of the cohort described above, on this occasion with a minimum follow-up of 21 years. Our Institutional Review Board approved a protocol and consent form to review the medical records, contact the patients, and invite them to return for clinical and radiological evaluation. Two independent observers (JSR, SGP) assessed the clinical and radiological results at the time of this new study.

The clinical and functional results were evaluated using two objective scores. According to the Imatani\(^{12}\) 100-point score (which comprises pain, range of movement (ROM), and function, strength being included under function), the results were classified as excellent (90 to 100 points), good (80 to 89), fair (70 to 79), and poor (≤ 70), with satisfactory (excellent and good) or unsatisfactory (fair and poor) ratings to summarise the results. According to the University of California, Los Angeles (UCLA)\(^{13}\) 35-point score (which includes pain, function, strength, active motion, and patient satisfaction) the results were classified as satisfactory (≥ 27 points) or unsatisfactory (< 27). Strength was assessed by manual muscle-testing and motion using a goniometer.

In addition, the patients were evaluated with use of the Disabilities of the Arm, Shoulder and Hand questionnaire (quick-DASH),\(^{14}\) Simple Shoulder Test (SST),\(^{15}\) and a patient satisfaction score using a 10-point visual analogue scale (VAS). The maximum DASH score is 100, with higher scores indicating better function. The maximum SST score is 12, with higher scores once again indicating better function.

The examination included anteroposterior radiographs of both shoulders and a Zanca view\(^{16}\) of the involved shoulder. Radiographs were assessed to evaluate the position of the AC joint (according to the criteria described by Collins),\(^{17}\) changes of post-traumatic osteoarthritis, and coracoclavicular ossification. Redisplacement was defined as elevation of the distal clavicle of more than 25% in relation to the coracoid process. According to Calvo et al,\(^{3}\) AC osteoarthritis was considered to be either absent; mild, when there was narrowing of the joint space; moderate, when there was evidence of subchondral sclerosis or osteophytes, and severe when the joint was badly deformed. Statistical analysis. SPSS Spanish v.11.0 software (SPSS Inc., Chicago, Illinois) was used for statistical analysis. The numerical data are presented as mean, SD and 95% confidence intervals (CI). The means were compared using the paired Student’s t-test. A value of p < 0.05 was considered statistically significant.

Results
Of the 46 original patients, one had died, four could not be traced and three declined to return for follow-up, leaving 38 patients (82.6%) in this new study. To the best of our knowledge, on the basis of phone interviews, none of the patients who had died or declined to participate had a problem with their shoulder. Among the 38 remaining patients there were 36 men and two women with a mean age at the time of the present study of 57.3 years (41 to 71). The mean follow-up was 24.2 years (21 to 26).

At 21-year follow-up, the mean Imatani score was 91.9 (64 to 100), which was slightly lower than that at the 2-year follow-up (94.4) but not significantly different (p = 0.205). The mean Imatani score for the uninjured shoulder was 93.1 (72 to 100); the mean Imatani score difference between injured and uninjured shoulders was not significant (p = 0.323). The mean UCLA score was 30.8 (12 to 35) for the injured and 32.3 (1 to 35) for the uninjured shoulder, which was not significant (p = 0.071). The clinical result was satisfactory in 35 (92.1%) patients and unsatisfactory in three (7.9%) patients. Overall, 35 patients (92.1%) were pain-free, one had slight and occasional pain, and two had moderate pain. All but two patients had full shoulder movements compared with their opposite shoulder.

At the 21-year follow-up, the mean DASH score was 89.1 (36 to 100) and the mean SST was 11.5 (7 to 12). The mean VAS for satisfaction was 8.1 (3 to 10). Overall, 34 (89.5%) were satisfied, one (2.6%) was only partially satisfied because of AC redisplacement, and three (7.9%) were dissatisfied because of pain. Given the same situation, 35 (92.1%) patients said they would opt for surgical treatment again while three (7.9%) said they would prefer conservative management.

Of the three patients with an unsatisfactory result, one was a 78-year-old woman who had redisplacement of the AC joint with moderate pain and osteoarthritis of the contralateral shoulder. The second patient was a 64-year-old
man with redisplacement and osteoarthritis of the AC joint and moderate pain. The third patient was a 71-year-old man with osteoarthritis of the AC joint and occasional pain, although with a reduced AC joint.

None of the patients had changed their job during the course of this study. At 21-year follow-up, 15 patients had heavy jobs (such as firefighting, heavy industry, construction, etc.), five had manual jobs, 14 sedentary jobs and four were pensioners. At follow-up, 23 (60.5%) patients were participating in competitive or recreational sports such as golf, tennis or cycling.

Radiologically there were five patients with redisplacement of the AC joint (the same as in the original study), of whom three had satisfactory and two unsatisfactory results because of moderate pain (Fig. 1). There were no signs of post-traumatic acromioclavicular osteoarthritis in 27 patients (71.1%). In five (13%) there were mild signs, in three (7.9%) moderate, and in three (7.9%) severe. All but one patient, with no signs of mild or moderate osteoarthritis of the AC joint, had satisfactory results. Of the three patients with severe osteoarthritis, one had no pain and a satisfactory result, and the other two had unsatisfactory results because of redisplacement and pain. Some degree of coracoclavicular ossification was seen in ten patients, none of whom had pain. There were two (5.3%) patients with osteoarthritis of the glenohumeral joint (degenerative changes and humeral head elevation), of whom one was a 71-year-old man with a stable but osteoarthritic AC joint, and the other a 78-year-old woman with bilateral osteoarthritis of the shoulders. She had undergone early removal of the wires due to superficial infection which resulted in AC redisplacement.

Discussion
The limitations of this study include the lack of a conservatively-treated control group and a loss to follow-up of eight patients (17.4%). Randomised studies of type III acromioclavicular injuries are difficult to conduct, because of their relatively low frequency and because, in our country, most patients prefer to be treated operatively mainly for fear of not being able to participate in sports. We have found only three prospective randomised studies in the literature.5,12,17

Many ways of treating this condition have been proposed. However, it is difficult to compare the results of different series, due to the variety of surgical techniques described and differing methods of evaluation. Thus, we can draw valid conclusions only about the specific surgical technique we have used. It should be appreciated that as our technique does not repair the coracoclavicular ligaments, it cannot be considered an anatomical reconstruction.

Operative treatment of a type III acromioclavicular dislocation using the technique we have described gives a satisfactory outcome at a mean follow-up of 24 years. The improvement is maintained over time and allows most patients to return to their previous level of activity. In this series, there were no serious post-operative complications. The latest radiographs confirmed reduction of the AC joint in 33 (86.8%) patients. Of the five patients (13.2%) in whom the reduction was lost, only two were symptomatic, both because of early complications (infection or lateral migration of the wires). We found moderate or severe AC osteoarthritis in six patients (16%), but there were only two patients with osteoarthritis of the glenohumeral joint. We think this could be because
23 (60%) of our patients were aged 60 or younger at their last visit.

Calvo et al\(^\text{3}\) have reported on the rate of moderate or severe AC osteoarthritis in relation to the treatment. In their surgically-treated group in which the AC joint was transfixted with wires, there was a prevalence of AC arthritis of 37% in the affected shoulder and 7% in the contralateral shoulder, while in the non-surgical group it was 18% in both shoulders. Taft et al\(^\text{2}\) found osteoarthritis of the AC joint in 43% of patients who were treated conservatively, and in 34% of those treated surgically with wire transfixion. They also found that osteoarthritis developed in 45% of the patients in whom anatomical reduction was not maintained and in 15% when it was. They also found that AC osteoarthritis did not influence the clinical results.

Rawes and Dias\(^\text{18}\) followed 30 patients treated non-surgically for 10 years, and found that all except one had a good outcome; none had changed their job or given up any sporting activities because of the injury. The acromioclavicular joint remained subluxed or dislocated in every case, but only three patients disliked the cosmetic appearance. In our study, there was only one patient with occasional symptoms and another two (5.3%) with moderate pain; 34 (89.5%) were completely satisfied, and 35 (92.1%) would choose to have the same operation again under similar circumstance.

The treatment of type III dislocations remains controversial. Excellent results can be achieved with both surgical and conservative methods of treatment.\(^\text{2,5}\) The trend in recent years is towards non-operative management in most cases because it is perceived that conservative treatment can give as good a clinical result as operative treatment but without the potential risk and, on occasion, the need for a second operation. Operative treatment is reserved for active patients who have a heavy job or are involved in demanding sports.\(^\text{3,4}\)

However, most systematic reviews\(^\text{19-23}\) have been unable to determine whether operative or non-operative treatment is more appropriate for type III acromioclavicular dislocations in adults. Additionally, the preference of individual surgeons varies from country to country. In a survey from the USA,\(^\text{24}\) more than 80% of surgeons advocated non-operative treatment of a type III AC dislocation while in Germany\(^\text{25}\) 84% preferred operative treatment, mostly by using temporary wires.

Of the three prospective comparative studies that we have found, Imatani et al\(^\text{12}\) compared non-surgical and surgical treatment in 23 patients. They used either Bosworth coracoclavicular fixation\(^\text{26}\) or temporary fixation of the acromioclavicular joint with a Steinmann pin. They concluded that the two groups had similar outcomes after 12 months.

Larsen et al\(^\text{17}\) in a prospective randomised study of 48 patients with type III injuries, compared conservative treatment with temporary AC joint fixation with smooth or threaded Kirschner wires. They found that after 13 months there was no difference in the clinical results. There were no complications in the non-operative group, whereas in the surgical group there were six cases (14.6%) of both migration of the smooth wires and superficial infection, and 16 cases (39%) of breakage of the threaded wires. However, all but two patients had an excellent result despite the complication, and in the other two the result was good. They concluded that most Type III AC dislocations should be treated non-operatively, although two patients in the surgical group and three in the non-surgical group needed re-operation with resection of the distal clavicle because of residual pain within one year.

Bannister et al\(^\text{1}\) prospectively compared non-operative and operative treatment in 54 patients with complete AC dislocation and with a follow-up of four years. The surgical technique involved fixation of the AC joint with a screw and repair of the deltotrapezial fascia, but the coracoclavicular ligaments were not reconstructed. Overall, they found that the two groups had similar outcomes after four years. Unfortunately, they did not specify the degree of injury or the classification of AC dislocation used, but reported that in 12 cases with AC separation greater than 2 cm, there were four out of five fair or poor results in the non-operative group, and two of seven in the operated group. They concluded that non-surgical treatment was better for most acute dislocations, but that younger patients with severe displacement might benefit from early surgical treatment.

We have obtained good long-term results with our operative methods of treatment, although the current trend is towards conservative treatment as the results are similar with both methods. We believe that the treatment of acute type III AC dislocation depends mainly on the demands and expectations of the patient. Several factors may play a significant role in a patient’s decision regarding treatment, specifically the type of injury, the patient’s occupation, activity level, physical demands of daily living, and involvement in sports. Each of these plays a considerable role in the overall level of patient satisfaction.

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**References**