SURGICAL TREATMENT OF ACUTE TYPE V ACROMIOCLAVICULAR INJURIES A PROSPECTIVE STUDY

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In a prospective study, 28 consecutive patients with an acute Type V acromioclavicular sprain were treated with a coracoclavicular repair using a double velour Dacron graft. All patients were reviewed after a mean follow-up period of 5.1 years (range : 1 to 9 years). At follow-up, 20 patients (71.4%) showed good or excellent results, according to the Imatani evaluation system, and 8 patients (28.6%) demonstrated a fair or poor result according to the same system. Loss of reduction was encountered in 11 shoulders (40%), despite an initial anatomical reduction. No correlation was seen between the overall scores at follow-up and the degree of residual dislocation, between the overall scores and the presence of coraco-clavicular calcifications or ossifications, between the overall scores and the development of posttraumatic arthritic changes, or between the overall scores and the presence of osteolysis of the distal clavicle.

Keywords : acromioclavicular sprain ; shoulder ; Dacron®.
Mots-clés : disjonction acromio-claviculaire ; épaule ; Dacron®.

INTRODUCTION

Whereas the choice between conservative and surgical treatment for Allman's Grade III acromioclavicular sprains still remains controversial, more agreement is found concerning the treatment of Type V lesions, where most authors recommend surgical treatment (2, 10, 12, 16, 17, 19, 22).

All previous reports on the treatment of acute complete acromioclavicular dislocations concerned the all-inclusive Allman grade III category (12, 17). Controversy in treatment arises mainly from the lack of more detailed definition of this Grade III category. Rockwood proposed a new classification which comprised six types of acromioclavicular sprains, the first three of which are the same as Allman grades, whereas Type V is a very severe Type III injury (17).

The aim of this study was to evaluate the medium-term results of surgical treatment for Type V acromioclavicular injuries in a prospective series of 28 patients. These results are compared with those from Type III acromioclavicular injuries treated in a similar way.

MATERIALS AND METHODS

From 1982 to 1990, 28 patients with an acute Type V injury of the acromioclavicular joint were treated with a double velour Dacron® coracoclavicular cerclage. Only patients of 15 to 60 years old were included in this study. No patient selection according to sex, the involved side, profession or sports participation was made.

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The mechanism of injury was a direct force produced by a fall on the point of the shoulder with the arm in adducted position in 18 patients and by a blow on the posterosuperior aspect of the acromion in 10 patients.

Eighteen patients were injured in sports (soccer (5), bike-racing (5), motorcycle-racing (2), car-racing (2), judo (2), rugby (2)) ; 6 in automobile accidents and 4 by a fall on the shoulder during work.

The length of follow-up ranged from 1 to 9 years (mean 5.1 years). All patients were personally examined by the first author at follow-up in 1991. Standard and stress radiographs of both shoulders were taken at the time of injury and at final follow-up.

The indication for operation was the presence of a Rockwood Type V lesion : a complete rupture of the acromioclavicular and the coracoclavicular ligaments, detachment of the deltoid and trapezius muscles from the distal clavicle and a very significant disparity between the clavicle and the scapula of 100 to 300% as compared to the normal side. The average age at the time of operation was 37.5 years (range 19 to 60 years). The dominant extremity was involved as often as the non dominant side.

Operative technique

Surgery was performed under general anesthesia within 24 hours of injury. The patient was placed in a half-sitting position with the shoulder slightly extended beyond the edge of the table. The shoulder was draped so that it was accessible from all sides, with the arm freely movable. We used the modified anterior approach of Roberts or the supraclavicular approach (11), which allows very good visualization of the outer edge of the clavicle, the acromioclavicular joint, the coracoid process and the coracoclavicular and coracoacromial ligaments. The ligament used was a double velour Dacron® graft, marketed by Stryker® as the 130-10 coracoclavicular cerclage.

After exposure of the coracoid process, the Dacron® graft was passed beneath the coracoid posterior to the conjoined tendons with a sharply curved instrument. Next, the lateral end of the ligament was passed posterior and superior to the clavicle through a tunnel created with the same curved instrument. After reduction of the distal clavicle with a blunt instrument, the Dacron coracoclavicular loop was tightened and secured with a square knot anterior and distal to the clavicle. A 3- to 4-mm end was left and a nonabsorbable suture was used to secure the free ends. The meniscus was left in place, except when it was torn.

The coracoclavicular ligaments were never sutured or reconstructed. The torn muscle attachments of the deltoid and the trapezius muscles were carefully repaired.

Suction drainage was used, and postoperatively, the extremity was protected in a broad arm sling for 6 weeks. Isometric and pendulum exercises were started after a few days, with active mobilization allowed after 6 weeks. Sports and professional occupations were resumed after 3 months. In 6 patients, the coracoclavicular repair was supplemented by an acromioclavicular joint fixation with two smooth Kirschner wires, which were removed after 6 weeks under local anesthesia.

Evaluation criteria

Injury to the acromioclavicular joint was graded using the Rockwood classification (table I) (17), and clinical evaluation at final follow-up was performed using the Imatani evaluation system (table II) (7). This functional scoring system attributes 40 points to pain ; 30 to function and 30 to motion. A score of 90 to 100 points is considered to be an excellent result ; 80 to 89 good ; 70 to 79 fair and less than 70 poor.

Roentgenographic evaluation at the time of injury, and a final follow-up included anteroposterior and scapular lateral views of both shoulders with the patient standing, as well as stress views of both shoulders. Stress views were obtained with 10 to 15 pounds of weight, depending on the size of the patient, suspended from each wrist to prevent muscle contraction and possible upward lifting of the arm.

An increase of the coracoclavicular distance of the injured shoulder over the normal shoulder by 25 to 100% was considered as a Type III injury, whereas an increase by 100 to 300% was considered as a Type V injury (17).

RESULTS

Overall results

Four shoulders (14.3%) had an excellent ; 16 (57.1%) a good ; 4 (14.3%) a fair and 4 (14.3%) a poor functional score. Referring to the excellent and good scores as satisfactory results, and to the fair and poor scores as unsatisfactory results, we obtained 20 (71.4%) satisfactory and 8 (28.6%) unsatisfactory results.

Table I. — Rockwood classification of acromioclavicular sprains

Type I :

— sprain of the acromioclavicular ligaments
— intact coracoclavicular ligaments
— intact deltoid and trapezius muscles

Type II :

— rupture of the acromioclavicular ligaments
— sprain of the coracoclavicular ligaments
— intact deltoid and trapezius muscles

Type III :

— rupture of the acromioclavicular ligaments
— rupture of the coracoclavicular ligaments
— increase of the coracoclavicular interspace with 25 to 100% on stress radiographs, as compared to the uninjured shoulder
— detachment of the deltoid and trapezius muscles from the distal clavicle

Type IV :

— rupture of the acromioclavicular ligaments
— posterior dislocation of the distal end of the clavicle into or through the trapezius muscle
— rupture of the coracoclavicular ligaments
— detachment of the deltoid and trapezius muscles from the distal clavicle

Type V :

— rupture of the acromioclavicular ligaments
— rupture of the coracoclavicular ligaments
— increase of the coracoclavicular interspace with 100 to 300% on stress radiographs, as compared to the uninjured shoulder
— detachment of the deltoid and trapezius muscles from the distal clavicle

Type VI

— rupture of the acromioclavicular ligaments
— rupture of the coracoclavicular ligaments
— dislocation of the clavicle, inferior to the acromion or to the coracoid process
— detachment of the deltoid and trapezius muscles from the distal clavicle

Table II. — The Imatani evaluation system for acromioclavicular dislocation

Pain (40 points)	None	40
	Slight, occasional	25
	Moderate, tolerable, limits activities	10
	Severe, constant, disabling	5
Function (30 points)	Weakness (proportion of pre-injury)	20
	Use of shoulder	5
	Change of occupation	5
Movement (30 points)	Abduction	10
	Flexion	0
	Adduction	10
Result	Excellent	91 to 100
	Good	81 to 90
	Fair	61 to 80
	Poor	< 61

Return to work

Manual workers returned to work after an average of 14 weeks (range 3 to 24 weeks). Clerical workers resumed their work after a mean period of 8 weeks (range 1 to 14 weeks). Twenty-four patients (85.7%) returned to the same level of physical activity as before the operation, and none of the patients had to change his or her profession.

Return to sports

The mean time for return to sports was 12 weeks. All patients returned to the same level of sports activity as before injury.

COMPLICATIONS

Revision surgery

In 3 patients (10.7%) a second operation had to be performed for loss of reduction. One patient was operated again 4 days after the first intervention due to an unsatisfactory postoperative reduction. The Dacron® graft was untied and knotted again after a proper acromioclavicular reduction.

Another patient also experienced a loss of reduction during the fourth postoperative month. During the repeat operation, a migration to the lateral side of an intact Dacron® graft with an intact knot was noted. This probably occurred because of a too medial placement of the loop on the clavicular side. Again, the Dacron® graft was untied and knotted again after reduction and put in a more lateral position.

A third patient showed a sudden loss of reduction 5 months postoperatively. He experienced a sharp pain in his operated shoulder after lifting a very heavy weight. A rupture of the Dacron® graft was found. A new Dacron® graft was put in place, supplemented by an acromioclavicular fixation with two smooth K-wires.

Other complications

One patient (3.6%) showed a deep wound infection which necessitated secondary wound closure under general anesthesia. Two out of 6 patients (7.2%) in whom an additional acromioclavicular fixation with K-wires was performed, showed an extra-articular position of the K-wires, which could be removed under local anesthesia. At follow-up, 8 patients (28.6%) showed a residual increase of the coracoclavicular distance of the injured shoulder over the normal shoulder by 100 to 200% and another 3 patients (10.7%) by 25 to 100%. Posttraumatic arthritis developed in 6 patients (21.4%) (fig. 1). In 14 patients (50%), calcification or ossification of the coracoclavicular ligaments could be shown (fig. 2). Erosion of the clavicle at the site of the Dacron® graft was found in 6 patients (21.4%) (fig. 3). Six patients (21.4%) demonstrated osteolytic changes of the distal end of the clavicle (fig. 4).

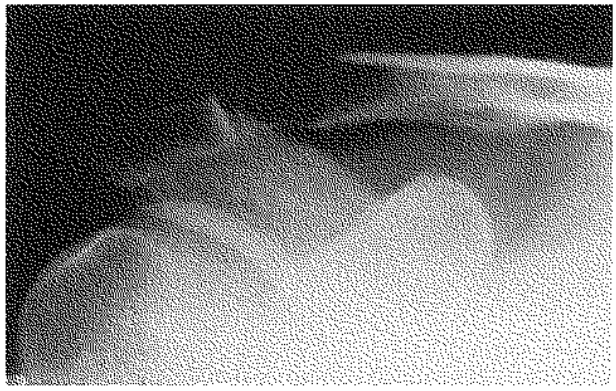

Fig. 1. — Posttraumatic arthritic changes are observed at the acromioclavicular joint.

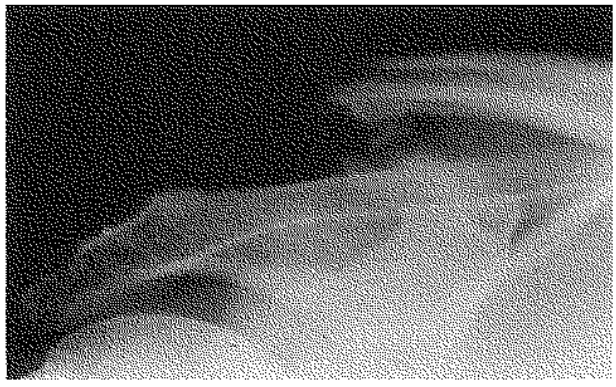

Fig. 2. — A distinct ossification is present at the site of the coracoclavicular ligaments.

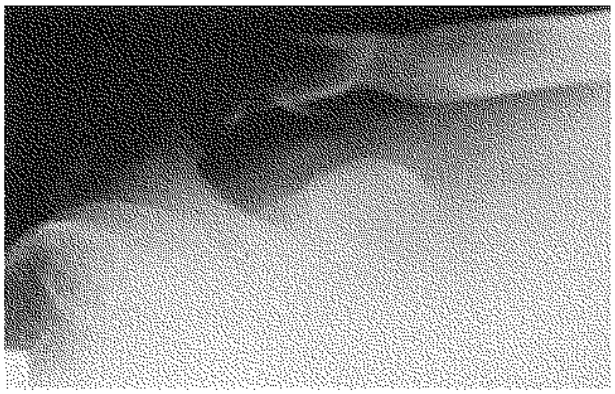

Fig. 3. — Pressure necrosis or erosion of the clavicle results from putting the Dacron graft around the clavicle.

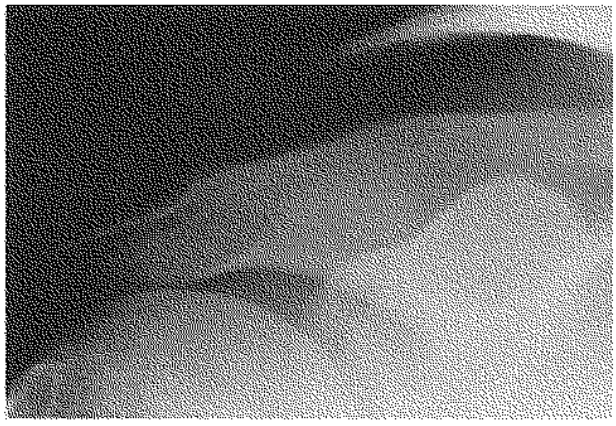

Fig. 4. — Osteolysis of the distal clavicle, associated with residual dislocation of the acromioclavicular joint.

DISCUSSION

To the best of our knowledge, the treatment of Type V acromioclavicular injuries has received little attention in the literature. Until recently, Type III as well as Type V lesions were classified in the all-inclusive Allman Grade III category. In the Allman classification, acromioclavicular injuries are graded on the amount of injury to the acromioclavicular and coracoclavicular ligaments. They are referred to as either Grade I, II or III with a Grade III sprain being a rupture of both the acromioclavicular and coracoclavicular ligaments with dislocation of the acromioclavicular joint (12, 17). No further distinction in this category is made between patients with a severe to very severe displacement of the distal clavicle.

Rockwood published a new classification which comprised six types of acromioclavicular injuries, the first three of which are the same as Allman's grades and with type V being a very severe Type III injury (table I) (17).

Type V lesions are characterized by a disruption of both the acromioclavicular and coracoclavicular ligaments, a detachment of the deltoid and trapezius muscles from the distal end of the clavicle, resulting in an acromioclavicular joint dislocation with an increase in the coracoclavicular interspace of 100 to 300% on stress radiographs, as compared to the normal shoulder (17). In Type III lesions, this increase in coracoclavicular interspace amounts 25 to 100%, as compared to the uninjured side (17). Clinically, Type V lesions can be diagnosed by the presence of a significant tenting of the skin (17, 19).

Until now, all previous reports on treatment of Grade III injuries of the acromioclavicular joint dealt with Type III as well as Type V injuries. Controversy about the optimal treatment of Grade III lesions originated from this lack of subclassification. Although prospective randomized studies, as well as retrospective studies comparing operative versus nonoperative treatment favor conservative treatment for Type III lesions (2, 4, 5, 6, 7, 10, 18, 20, 22), other authors still advocate surgical treatment, especially for heavy laborers and athletes (1, 12, 15).

On the other hand, there is better agreement about the treatment of Type V lesions. Nearly all authors recommend surgical treatment as the optimal treatment (2, 6, 12, 16, 17, 19).

In our series, all patients were treated with an extra-articular coracoclavicular repair. A double velour Dacron® coracoclavicular loop was used for fixation. In six other patients, additional transfixation of the acromioclavicular joint with two smooth Kirschner wires was performed.

In our study, we obtained 71.4% satisfactory and 28.6% unsatisfactory clinical results. We were not able to reproduce the satifactory clinical results, namely 90% or more for patients with Type III lesions treated in a similar way (3, 8, 9, 13).

Twenty-four (85.7%) of the patients obtained the same level of physical activity as before the operation, while none of the patients had to change his profession due to persisting complaints. All patients returned to the same level of sports activity as before the injury. However, we need to emphasize that the involved sports (soccer, bike-racing, motorcycle-racing, car-racing) are not so demanding on the shoulder.

Loss of reduction was encountered in 11 patients (40%). In the literature this varied from 5 to 29% in surgically treated Type III and Type V patients (2, 5, 10, 14, 20). No correlation could be demonstrated between the degree of residual dislocation and the clinical results. Only 1 patients in which reduction could not be maintained showed a poor clinical score. Two other patients had a fair score, while 8 others showed a good score.

Posttraumatic arthritic changes were found in 6 patients (21.4%). Posttraumatic arthritis could be correlated with the degree of residual dislocation, as well as with the use of transarticular fixation. Loss of reduction of the acromioclavicular joint, as well as the use of transarticular pins or screws produced traumatic degenerative changes in the acromioclavicular joint (14, 17, 20). The existence of posttraumatic arthritis did not correlate with the clinical results.

Coracoclavicular calcification or even ossification occurred in 14 patients (50%). No correlation with the clinical results could be found. Calcification or ossification of the acromioclavicular or coracoclavicular ligaments was the rule rather than the exception and occurred independently of the method of treatment used (14, 17, 19, 21).

Pressure necrosis of the clavicle at the site of the Dacron graft was noted in 6 patients (21.4%). The use of wires, silk or Dacron around the clavicle can cause pressure necrosis of the clavicle. To avoid this, some authors propose to pull the Dacron® graft through the clavicle via drill holes, rather than around it (12, 15, 17, 19).

Osteolysis of the distal clavicle was found in 6 patients (21.4%), including 5 men and 1 woman. One of these patients, a man complained of a dull ache and weakness of the shoulder. Abduction was limited to 120°. A resection of the distal end of the clavicle was performed, after which the patient was free of symptoms. Interestingly, all patients with osteolysis of the distal clavicle also showed a residual dislocation of the acromioclavicular joint. Osteolysis can be a manifestation of stress protection, in which the distal end of the clavicle is deprived of its normal function due to incongruity of the acromioclavicular joint (14). Osteolysis has been reported after an acute injury or in men who put repeated stress on the shoulder, as do weight-lifters (17, 19). If disabling symptoms persist, or if osteolysis increases or occurs in both shoulders, other conditions such as multiple myeloma, hyperparathyroidism, scleroderma, rheumatoid arthritis, gout or Gorham's massive osteolysis must be excluded (16, 17, 19). Resection of the distal clavicle is recommended as treatment for persisting symptoms (16, 17, 19).

CONCLUSION

Surgical treatment for Type V acromioclavicular lesions provides fewer good results than does similar treatment for Type III lesions. Loss of reduction was encountered in 40% of the patients, despite an initial anatomical reduction. Neither the degree of residual dislocation, the development of posttraumatic arthritis, nor the presence of coracoclavicular ossification or osteolysis of the distal end of the clavicle interfered with the clinical results.

REFERENCES

1. Bakalim G., Wilppula E. Surgical or conservative treatment of total dislocation of the acromioclavicular joint. Acta Chir. Scand., 1975, 141, 43-47.
2. Bannister G. C., Wallace W. A., Stableforth P. G., Hutson M. A. The management of acute acromioclavicular dislocation. J. Bone Joint Surg., 1989, 71-B, 848-850.
3. Bargren J. H., Erlanger S., Dick H. M. Biomechanics and comparison of two operative methods of treatment of complete acromioclavicular separation. Clin. Orthop., 1978, 130, 267-272.
4. Bjernfeld H., Hovelius L., Thorling L. Acromioclavicular separations treated conservatively : a 5-year follow-up study. Acta Orthop. Scand., 1983, 54, 743-745.
5. Dias J. J., Steingold R. F., Richardson R. A., Tesfayohannes B., Gregg P. J. The conservative treatment of

acromioclavicular dislocation. J. Bone Joint Surg., 1987, 69-B, 719-722.
6. Galpin R. D., Hawkins R. J., Grainger R. W. A comparative analysis of operative versus nonoperative treatment of Grade III acromioclavicular separations. Clin. Orthop., 1985, 193, 150-155.
7. Imatani R. J., Hanlon J. J., Cady G. W. Acute, complete acromioclavicular separation. J. Bone Joint Surg., 1975, 57-A, 328-332.
8. Kappakas G. S., McMaster J. H. Repair of acromioclavicular separation using a Dacron prosthesis graft. Clin. Orthop., 1978, 131, 247-251.
9. Laboureau J. P., Cazenaeve A., Baert D. Disjonction acromioclaviculaire : technique et résultats d'une ligamentoplastie artificielle après 6 ans d'espérience. J. Traumatol. Sport, 1990, 7, 176-180.
10. Larsen E., Bjerg-Nielsen A., Christensen P. Conservative or surgical treatment of acromioclavicular dislocation : a prospective, controlled, randomized study. J. Bone Joint Surg., 1986, 68-A, 552-555.
11. McRae R. Practical orthopaedic exposures. Churchill Livingstone, Edinburgh, 1987, 34.
12. Neer C. S. Shoulder reconstruction. W. B. Saunders Company, Philadelphia, 1990, pp. 341-355.
13. Nelson C. L. Repair of acromioclavicular separations with knitted Dacron graft. Clin. Orthop., 1979, 143, 289-292.
14. Paavolainen P., Bjorkenheim J. M., Paukku P., Slatis P. Surgical treatment of acromioclavicular dislocation : a review of 39 patients. Injury, 1983, 14, 415-420.
15. Park J. P., Arnold J. A., Coker T. P., Harris W. D., Becker D. A. Treatment of acromioclavicular separations : a retrospective study. Am. J. Sports Med., 1980, 8, 251-256.
16. Post M. Current concepts in the diagnosis and management of acromioclavicular dislocations. Clin. Orthop., 1985, 200, 234-247.
17. Rockwood C. A., Matsen F. A. The Shoulder. W. B. Saunders Company, Philadelphia, 1990, 413-476.
18. Rosenorm M., Brix Pedersen E. A comparison between conservative and operative treatment of acute acromioclavicular dislocation. Acta Orthop. Scand., 1974, 45, 50-59.
19. Rowe C. R. The Shoulder. Churchill Livingstone, New York, 1988, pp. 293-313.
20. Taft T. N., Wilson F. C., Oglesby J. W. Dislocation of the acromioclavicular joint. J. Bone Joint Surg., 1987, 69-A, 1045-1051.
21. Vandekerckhove B., Van Meirhaeghe J., Van Steenkiste M., De Groote W., Verbeke R., Vertongen P. Surgical treatment of acromioclavicular dislocations. Acta Orthop. Belg., 1985, 51, 66-79.
22. Warren-Smith C. D., Ward M. W. Operation for acromioclavicular dislocation. J. Bone Joint Surg., 1987, 69-A, 715-718.

SAMENVATTING

E. VERHAVEN, P. P. CASTELEYN, H. DE BOECK, F. HANDELBERG, P. HAENTJENS en P. OPDECAM. Heelkundige behandeling van akute Type V acromioclaviculaire letsels.

In een prospectieve serie werden 28 consecutieve patiënten met een akuut Type V acromioclaviculair letsel behandeld met een coracoclaviculaire cerclage door middel van een Dacron®-ligament.
De klinische resultaten bij follow-up zijn minder gunstig dan die van Type III lesies, behandeld volgens een gelijkwaardige methode.
Noch de graad van residuele luxatie, noch het bestaan van acromioclaviculaire arthrose, noch de aanwezigheid van coracoclaviculaire ossificaties of van osteolyse van de distale clavicula beïnvloeden de klinische resultaten.

RÉSUMÉ

E. VERHAVEN, P. P. CASTELEYN, H. DE BOECK, F. HANDELBERG, P. HAENTJENS et P. OPDECAM. Traitement chirurgical des luxations acromioclaviculaires aigues de Type V.

Dans une série prospective, 28 luxations acromioclaviculaires aigues de Type V furent traités par fixation coraco-claviculaire par un ligament synthétique en Dacron®.
Les résultats cliniques sont moins favorables que ceux des lésions de Type III, traitées de la même façon.
Ni le degré de luxation résiduelle, ni la présence d'une arthrose acromio-claviculaire ou de calcifications coraco-claviculaires ou d'une ostéolyse de la partie distale de la clavicule ne semblent influencer les résultats cliniques.