Minimally invasive approach for stabilization of type III acute acromioclavicular dislocation by using suture anchors

Naser M. Selim

Department of Orthopedic Surgery, Mansoura University Hospital, Mansoura, Egypt

Correspondence to Naser M. Selim, MD, Department of Orthopedic Surgery, Mansoura University Hospital, Mansoura, 35516, Egypt; Tel: 01224214290; fax: +20 (50) 239733/ +20 (50) 2397900; e-mail: dr.nasserselim728@yahoo.com

Received 1 August 2013
Accepted 20 September 2013

The Egyptian Orthopaedic Journal
2017, 52:1–5

Background
Acute complete acromioclavicular (AC) joint dislocation can be treated by surgical stabilization with or without reconstruction of the coracoclavicular ligaments.
Aim
The aim of the study was to evaluate the results of using mini-open approach for the stabilization of acute complete AC dislocation, by using suture anchors.
Patients and methods
This study evaluated the results of treatment of 30 patients with acute complete AC dislocation operated in Mansoura Emergency Hospital. The study described fixation of AC joint dislocation performed through mini-open approach, using suture anchors.
Results
Overall, 80% of patients were satisfied with the results of their surgery. According to Constant–Murley score, 18 (60%) patients had excellent results, six (20%) patients had good results, and six (20%) patients had poor results. There were no incidences of infection, soft tissue ossification, bone erosion, or painful scar. Four (20%) patients had recurrent deformity.
Conclusion
Acute complete AC joint dislocation can be treated by suture anchor fixation through mini-open approach. It is a simple and reliable method of fixation with lower incidence of complications and can be carried out through cosmetic approach, but it carries the risk for recurrent deformity.

Keywords:
acromioclavicular dislocation, stabilization type III, suture anchors

Egypt Orthop J 52:1–5

1110-1148

Introduction

Acute acromioclavicular (AC) separation is a common injury among young individuals following a direct trauma to the shoulder or a fall on outstretched hand with the arm adducted. AC injuries were classified into six types [1].

There is a general consensus to treat types I and II injuries conservatively, and types IV, V, and VI operatively, whereas the treatment of type III AC injury remains controversial [2]. More than 100 surgical techniques have been reported, but there is no gold standard for the treatment of AC dislocations [3]. Surgical techniques for repairing, reconstructing, or substituting coracoclavicular (CC) ligaments have evolved over the last several decades; however, acute dislocations can be treated surgically with or without reconstruction of these ligaments. In the acute setting, there is a robust healing response after ligament rupture, and tendon grafting may not be necessary as long as the initial fixation can remain stable during the healing process [4–7].

The following complications may result from operative treatment of AC dislocations: infection, AC arthritis, soft tissue ossification, bone erosion by metals, late fracture through the implant holes in the bone, migrations of pins or wires, metal failure, recurrent deformity, and painful scar [8]. A second procedure for the removal of the implant device may be needed. Aiming at decreasing the incidence of these complications, I had treated complete AC separation by closed reduction and suture anchor fixation through mini-open approach with the use of Constant–Murley score [9] to evaluate the results.

Patients and methods

In this prospective way carried out during the period between May 2009 and October 2010, 30 patients with complete AC joint dislocation were surgically treated at Mansoura Emergency Hospital. History of the causative trauma and mechanism of injury was obtained from all patients. General examination was carried out to exclude any associated injuries. Local

examination of the affected shoulder and AC joint was carried out. Standard standing anteroposterior and stress anteroposterior views to the AC joint were done for all patients (Fig. 1). Informed conscent was taken. This study approved by the Ethical committee of Faculty of Medicine Mansoura University Hospital, Mansoura, Egypt.

According to the Rockwood classification, all patients had type III injury. All patients were males. Twenty-one injuries were road traffic accidents and nine injuries were because of falling from height. The age ranged between 20 and 35 years. Eighteen patients were heavy manual workers, 12 patients were employers, and six patients participated in active sports. There were no associated injuries with the AC dislocations in all patients. The mean time interval between injury and surgical intervention was 3 days.

All cases were treated by closed reduction and fixation of the AC joint using a 5-mm suture anchor (Fastin anchor; FastIn® RC, DePuy Mitek, Westwood, MA) passing from the clavicle to the coracoid base using the mini-open approach. The follow-up period was 2 years. The Constant–Murley score was used for all patients to assess the results.

Surgical approach

Under general anesthesia, the patient is placed in the semi-sitting position, with the affected shoulder free at the lateral edge of the table. The AC joint is examined for reducibility; it should be reducible.

A strap-like incision is made and is ~1 inch long. It begins just medial to the tip of the coracoid process and extends downwards and laterally. The plane between the anterior deltoid and the pectoralis major is identified and dissected till clearance of the base of the coracoid (Fig. 2).

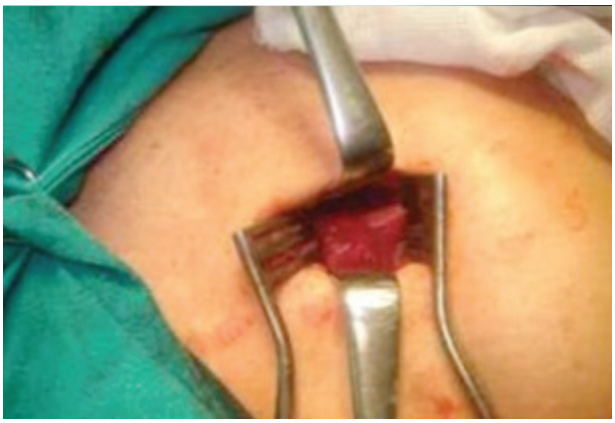
The coracoid process is now visible, with its attachments of the conjoined tendon antero-inferiorly, the coracoacromial ligament anterolaterally and the CC ligaments medially. The pectoralis minor and the transverse scapular ligament are attached to the coracoid process medial to conjoined tendon. Medial to the coracoid process the neurovascular bundle is present.

Through a small skin incision 1 inch medial to the lateral end of the clavicle, midway between the anterior and posterior borders of the clavicle, a 5 mm suture anchor is passed vertically through a predrilled hole in the clavicle to the coracoid base (Fig. 3). 0.5 cm medial to the first anchor, a second anchor is passed obliquely (Fig. 4). Closed reduction of the AC is done, and then tightening

Figure 1

Preoperative stress x-ray.

Figure 2

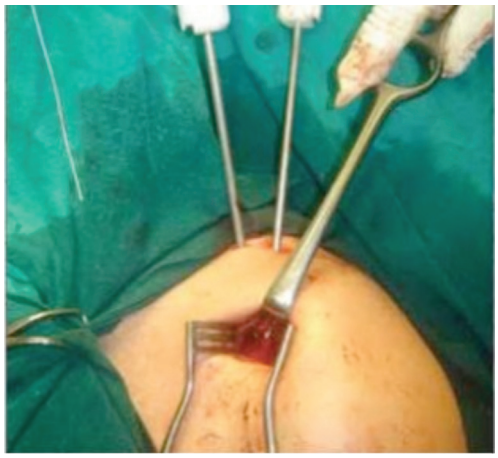


Minimally invasive approach.

Figure 3

First anchor fixation.

Figure 4



Second anchor fixation.

of the sutures of the two anchors over the bone bridge of the clavicle in between is carried out.

The arm was immobilized in a shoulder immobilizer in slight abduction for 6 weeks. Postoperative antero-posterior radiography was done for all patients (Fig. 5). After 6 weeks, the immobilizer was discontinued and the patient could use the arm for most of the day living activities but was cautioned to avoid lifting, pushing, and pulling for another 6 weeks.

Results

After a follow-up period of 2 years, 24 patients were satisfied with the results of their surgery (Table 1). There were four cases with loss of reduction. A minor superior displacement (<4 mm) of the distal clavicle was noted on radiographs at final follow-up in another two cases. All other cases showed a reduced and stable AC joint.

Twenty-four patients were completely free of pain and regained their full range of shoulder motion, and six patients had pain after minor effort and had mild restriction of shoulder abduction. In total, 24 patients regained all the former shoulder function and were able to do all their daily activities (sleep, work, recreation, and sport). Two patients had mild restriction in their shoulder function.

According to the Constant–Murley score, 18 (60%) patients had excellent results, six (20%) patients had good results, and six (20%) patients had poor results (Table 2). There were no incidences of infection, soft tissue ossification, bone erosion, or painful scar. Four (20%) patients had recurrent deformity.

Figure 5

Postoperative AP view.

Table 1 Final results and patient satisfaction

Patient satisfaction	*N* (%)
Satisfied	24 (80)
Unsatisfied	6 (20)
Total	30 (80)

Table 2 Final results and end result scoring

Constant–Murley score	Patients [*N* (%)]
Excellent	18 (60)
Good	6 (20)
Poor	6 (20)

Discussion

There is a general consensus to treat types I and II AC injuries conservatively and types IV, V, VI operatively [2]. However, some authors reported surgical repair for selected incomplete dislocations [10,11] and conservative treatment for medically unfit patients with types IV, V, and VI injuries [12,13]. The treatment of type III AC dislocations remains controversial [2]; the current view remains in favor of conservative treatment of acute type III injuries and a survey of orthopedic surgeons treating professional throwing athletes in North America revealed an overall preference for such management [14]. However and despite a lack of compelling evidence, it is often suggested that patients with a type III injury who have a high level of functional demand on the shoulder may benefit from early surgical intervention [15].

Although more than 100 surgical techniques have been reported, there is no gold standard for the treatment of AC dislocations [3]. In 1941, Bosworth [16] introduced a new method of repairing acute complete AC joint dislocations in which a noncannulated CC lag screw was inserted by using a

blind technique. He did not recommend either repair of the CC ligaments or exploration of the AC joint. In 1968, Kennedy [17] reported good results with open reduction, thorough debridement of the AC joint and fixation using a CC screw. He placed the bone dust created by drilling the hole for CC fixation into the CC space in an effort to gain permanent bone fixation between the clavicle and the coracoid as an extra-articular arthrodesis of the AC joint.

In 1989, Tsou [18] introduced the percutaneous CC fixation concept. A cannulated screw was specially designed and the technique of percutaneous insertion under fluoroscopic image control was developed. A total of 53 AC dislocations were treated by using this method. There were 40 type III, five type IV, and three type V dislocations and five dislocations with distal clavicle fractures in conjunction with complete CC ligament tears. Technical failures, which occurred in 17 of 53 (32%) patients, included the following: failed percutaneous insertion in two; early screw pullout in three; late screw pullout in four; subluxation after screw removal in six; and malreduction of type IV dislocation in two. There was no screw breakage or evidence of migration. Serous drainage occurred in two patients.

CC cerclage is a well-established technique and has been carried out using numerous materials including tendon grafts, wire loops, and synthetic ligament substitutes such as Dacron, mersilene tape, or polydioxanone [19,20]. Although techniques of cerclage provide more secure reconstruction of the reduction, failure may still occur from a stress fracture of either the clavicle or the coracoid as a result of a 'cheese-wire' effect, or by failure of the graft itself [21,22]. Anterior subluxation, which may occur using complete clavicular cerclage [18], injury to underlying neurovascular structures, and dislocation of the lower portion of the cerclage loop off the front of the coracoid may also occur [13].

Kirschner wires have been used extensively to transfix the AC joint temporarily after reduction [23]. These give relatively poor fixation, may precipitate osteoarthritis within the joint, and severe complications may occur from distant migration of the wire to the lung, spinal cord, or neck. Given the wider range of better implants that are now available, the use of these wires is now contraindicated [24].

Paavolaincn and Bjorkenhcim [25] described the use of malleolar screw to transfix the AC joint in 36 patients, with repair of the CC and AC ligaments, but he had many technical difficulties occurring in 19 patients, with only 80% of the joints accurately reduced.

A hooked dynamic compression plate designed to engage under the posterior part of the acromion has been used successfully to maintain reduction of acute AC dislocations [26]. This closely reproduces the stability of the intact joint [27], but its prolonged retention can produce stiffness of the shoulder, clavicular osteolysis, and periprosthetic fracture, whereas its early removal may lead to resubluxation of the joint [28].

Cerclage wire carries the risk for neurovascular injury, cheese wiring effect of the coracoids, or the clavicle, and also leads to anterior subluxation of the clavicle. AC transfixation by using hooked plate has many complications including AC osteoarthritis, violation of superior AC ligament, stiffness of the shoulder, clavicular osteolysis, and periprosthetic fracture.

In this study, the mini-open approach preserved the remaining soft tissue attached to distal clavicle, decreased the surgical trauma, decreased the incidence of deep infection, avoided soft tissue ossification, avoided prominent painful scar, and preserved cosmetic appearance.

The reduction is done by closed method. Slight abduction and elevation of the arm with downward pressure on the clavicle obtains the reduction. In some patients just positioning on the table of the theater reduces the dislocation. However, torn capsular ligaments trapped in the joint space lose pieces of articular cartilage or a detached intra-articular meniscus inside the joint can prevent closed reduction. Accurate and correct reduction is maintained by passing the suture anchor in the center of the clavicle (or slightly anterior), 2–3 cm medial to lateral end of the clavicle, directed under vision to the base of the coracoid process, and hence avoids faulty insertion, anterior subluxation, broken tip, or waist of coracoid.

The stabilization is done without repair of the CC ligaments. Short ligaments, mid-substance tear, brush teeth of the torn ends, and difficult repair, all decrease the integrity and security of repair. Robust healing power in acute injuries and hematoma at CC ligaments encourages the mini-open approach.

The suture anchors are technically easier to place than CC screws or wires. Furthermore, Harris *et al.* [29] showed that CC suture anchors provided strength similar to that of the CC ligament with respect to uniaxial loading.

Conclusion

Acute complete AC joint dislocation can be treated by suture anchor fixation through the mini-open approach. It is a simple and reliable method of fixation, with lower incidence of complications and can be carried out through cosmetic approach, but it carries the risk for recurrent deformity.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1 Rockwood CA, Williams GR, Young DC. Disorders of the acromioclavicular joint. In: Rockwood CA, Masten FA III, (editors). The shoulder. 2nd ed. Philadelphia, PA: WB Saunders; 2000. pp. 483–553.

2 Nissen CW, Chatterjee A. Type III acromioclavicular separation: results of a recent survey on its management. Am J Orthop 2007; 36:89–93.

3 LaPrade RF, Hilger B. Coracoclavicular ligament reconstruction using a semitendinosus graft for failed acromioclavicular separation surgery. Arthroscopy 2005; 21:1277e1–1277e5.

4 Bishop JY, Kaeding C. Treatment of the acute traumatic acromioclavicular separation. Sports Med Arthrosc 2006; 14:237–245.

5 De Baets T, Truyen J, Driesen R, Pittevils T. The treatment of acromioclavicular joint dislocation Tossy grade III with a clavicle hook plate. Acta Orthop Belg 2004; 70:515–519.

6 Dimakopoulos P, Panagopoulos A, Syggelos SA, Panagiotopoulos E, Lambiris E. Double-loop suture repair for acute acromioclavicular joint disruption. Am J Sports Med 2006; 34:1112–1119.

7 Kwon YW, Iannotti JP. Operative treatment of acromioclavicular joint injuries and results. Clin Sports Med 2003; 22:291–300.

8 Glick JM, Milbum LJ, Haggerty JF. Dislocated acromioclavicular joint: follow-up study of 35 unreduced acromioclavicular dislocation. Am J Sport Med 1977; 5:264–270.

9 Constant CR, Murley AH. A clinical method of functional assessment of the shoulder. Clin Orthop 1987; 214:160–164.

10 Cook DA, Heiner JP. Acromioclavicular joint injuries. Orthop Rev 1990; 19:510–514.

11 Cox JS. The fate of acromioclavicular joint in athletic injuries. Am J Sports Med 1981; 9:50–53.

12 Gerber C, Rockwood CA Jr. Subcoracoid dislocation of the lateral end of the clavicle: a report of three cases. J Bone Joint Surg [Am] 1987; 69-A:924–927.

13 Verhaven E, Castelyn PP, de Boeck H, Handelberg F, Haentjens P, Opdecam P. Surgical treatment of acute type V acromioclavicular injuries: a prospective study. Acta Orthop Belg 1992; 58:176–182.

14 McFarland EG, Blivin SJ, Doehring CB, Curl LA, Silberstein C. Treatment of grade III acromioclavicular separations in professional throwing athletes: results of a survey. Am J Orthop 1997; 26:771–774.

15 Dias JJ, Steingold RF, Richardson RA, Tesfayohannes B, Gregg PJ. The conservative treatment of acromioclavicular dislocation: review after five years. J Bone Joint Surg [Br] 1987; 69-B:719–722.

16 Bosworth BM. Complete acromioclavicular dislocation. N Engl J Med 1941; 241:221–225.

17 Kennedy JC. Complete dislocation of the acromioclavicular joint: 14 years later. J Trauma 1968; 8:311–318.

18 Tsou PM. Percutaneous cannulated screw coracoclavicular fixation for acute acromioclavicular dislocations. Clin Orthop 1989; 243:112–121.

19 Morrison DS, Lemos MJ. Acromioclavicular separation: reconstruction using synthetic loop augmentation. Am J Sports Med 1995; 23:105–110.

20 Stam L, Dawson I. Complete acromioclavicular dislocations: treatment with a Dacron ligament. Injury 1991; 22:173–176.

21 Fullerton LR Jr. Recurrent third degree acromioclavicular joint separation after failure of a Dacron ligament prosthesis: a case report. Am J Sports Med 1990; 18:106–107.

22 Moneim MS, Balduini FC. Coracoid fracture as a complication of surgical treatment by coracoclavicular tape fixation: a case report. Clin Orthop 1982; 168:133–135.

23 Lizaur A, Marco L, Cebrian R. Acute dislocation of the acromioclavicular joint: traumatic anatomy and the importance of deltoid and trapezius. J Bone Joint Surg Br 1994; 76:602–676.

24 Lancaster S, Horowitz M, Alonso J. Complete acromioclavicular separations: a comparison of operative methods. Clin Orthop 1987; 216:80–88.

25 Paavolaincn P, Bjorkenhcim JM. Surgical treatment of acromioclavicular dislocation: a review of 39 patients. Injury 1983; 14:415–420.

26 Sim E, Schwarz N, Hocker K, Berzlanovich A. Repair of complete acromioclavicular separations using the acromioclavicular-hook plate. Clin Orthop 1995; 314:134–142.

27 McConnell AJ, Yo DJ, Zdero R, Schemitsch EH, McKee MD. Methods of operative fixation of the acromioclavicular joint: a biomechanical comparison. J Orthop Trauma 2007; 21:248–253.

28 Nadarajah R, Mahaluxmivala J, Amin A, Goodier DW. Clavicular hook-plate: complications of retaining the implant. Injury 2005; 36:681–683.

29 Harris RI, Wallace AL, Harper GD, Goldberg JA, Sonnabend DH, Walsh WR. Structural properties of the intact and the reconstructed coracoclavicular ligament complex. Am J Sports Med 2000; 28:103–108.