Mini-open approach for stabilization of acute complete acromioclavicular dislocation

Hatem S.A. Elgohary, Naser M. Selim

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

Correspondence to Hatem S.A. Elgohary, MD, Department of Orthopedic Surgery, Mansoura University Hospitals, Mansoura, Egypt
Tel: +20 100 659 3810;
e-mail: hatemelgohary20@yahoo.com

Received 03 November 2014
Accepted 06 September 2014

Egyptian Orthopedic Journal 2014, 49:320–325

Background
Complete acromioclavicular joint dislocation can be treated by means of surgical stabilization with or without reconstruction of the coracoclavicular ligaments. Many operative techniques through open and arthroscopic approaches have been described. The aim of the study was to evaluate the results of using the mini-open approach for stabilization of acute complete acromioclavicular dislocation.

Patients and methods
This prospective study evaluates the results of treatment of 14 patients with complete acromioclavicular dislocation at Mansoura emergency hospital. The study describes fixation of acromioclavicular joint dislocation performed through the mini-open approach using a partially threaded cancellous screw for fixation of the clavicle to the coracoid process. The Constant–Murley score was used for evaluation.

Results
All patients were satisfied with the results of their surgery. On the basis of the Constant–Murley score, 12 patients (85.7%) had excellent results, two patients (14.3%) had good results, and no patient had poor results. There was no infection, soft-tissue ossification, bone erosion, recurrent deformity, or painful scar.

Conclusion
Complete acromioclavicular joint dislocation can be treated successfully by means of screw fixation using the mini-open approach. It is a simple and reliable method of fixation with a lower incidence of complications and is performed through a cosmetic approach.

Keywords:
acromioclavicular, clavicle, mini approach

Egypt Orthop J 49:320–325

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 are classified into six types [1].

There is a general consensus to treat type I and type II injuries conservatively and type 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 [3–5]. Surgical techniques for repairing, reconstructing, or substituting 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 additional grafting may not be necessary as long as the initial fixation can remain stable during the healing process [6–11].

The following complications may result from operative treatment of AC dislocations: infection, AC arthritis, soft-tissue ossification, bone erosion by metals, late fracture due to the implant holes in the bone, second procedure for removal of the implant device, migrations of pins or wires, metal failure, recurrent deformity, and painful scar [12,13]. Aiming at decreasing the incidence of these complications, we had treated complete AC separation type III, IV, and V by means of closed reduction and CC screw fixation using the mini-open approach with the Constant–Murley score [14] to evaluate the results.

Patients and methods

This prospective study was conducted between October 2008 and October 2009; 14 patients with complete AC joint dislocation were surgically treated at Mansoura emergency hospital. History of the causative trauma and mechanism of injury were 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 view radiographies to the AC joint were performed for all patients (Fig. 1).

DOI: 10.4103/1110-1148.154094

Figure 1

Preoperative stress radiograph of a 34-year-old male patient with complete acromioclavicular dislocation.

Figure 2

The patient presented in Fig. 1 in semisitting position on the operating table.

According to the Rockwood classification [1], six patients had type III injury, four had type IV injury, and four had type V injury. There were 12 male and two female patients. The age range was between 20 and 35 years. Six patients were heavy manual workers, four were manual workers, two patients participated in active sports, and two female patients had occupations not involving heavy work. 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 means of closed reduction and fixation of the AC joint using a cancellous partially threaded screw passing from the clavicle to the coracoid base using the mini-open approach. The follow-up period was 2–3 years. The Constant–Murley score was used to assess the results.

Surgical approach

Under general anesthesia, the patient is placed in the semisitting position with the affected shoulder free at the lateral edge of the table (Fig. 2). The AC joint is examined to ensure reducibility (Figs. 3 and 4).

The shoulder region is prepared and a sterile area is draped, giving free access for surgery from the midclavicular area to the upper one-third of the arm. The area around the coracoid process should be readily accessible. A strap-like incision of ~1 inch long is made, which begins just medial to the tip of the coracoid process and extends downward and laterally. The plane between the anterior deltoid and the pectoralis major is identified and dissected until clearance of the base of the coracoid (Fig. 5).

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

Through a small skin incision 3 cm medial to the lateral edge of the clavicle, midway between the anterior and posterior borders of the clavicle, a cancellous partially threaded screw of appropriate length is passed vertically through the clavicle to pass to the coracoid base. Closed reduction of the AC followed by tightening of the screw to the coracoid base is performed (Fig. 6).

Postoperative care

The arm is immobilized in a shoulder immobilizer in slight abduction for 6 weeks. Postoperative anteroposterior and scapular radiographies are performed for all patients (Figs. 7 and 8). After 6 weeks, the immobilizer is discontinued and the patient is allowed to use the arm for most everyday living activities but was cautioned to avoid lifting, pushing, and pulling for another 6 weeks. The screw is removed 12 weeks after surgery under local anesthesia.

Results

After a follow-up period of 2–3 years, all patients were satisfied with the results of their surgery (Table 1). No cases with complete loss of reduction occurred, but a minor superior displacement (<4 mm) of the distal

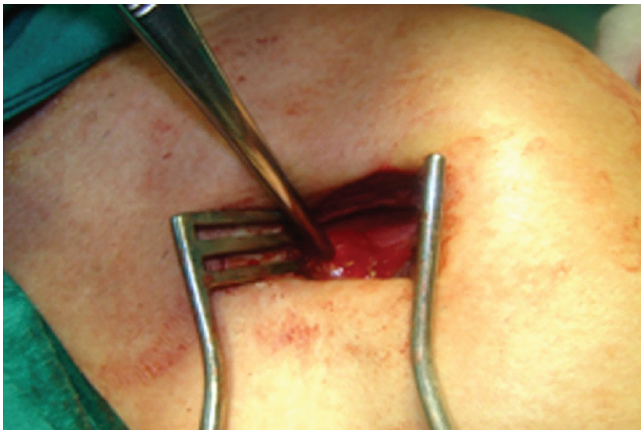
Figure 3

The patient presented in Fig. 1 before reduction of dislocation.

Figure 4

The patient presented in Fig. 1 after reduction of the dislocation.

Figure 5

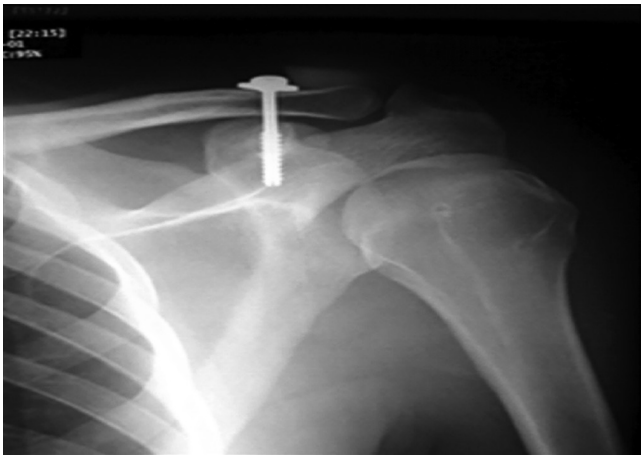


The patient presented in Fig. 1 undergoing the mini-open approach.

Figure 6

The patient presented in Fig. 1 after fixation.

Figure 7



The patient presented in Fig. 1 postoperative AP view.

Figure 8

The patient presented in Fig. 1 postoperative scapular view.

clavicle was noted on radiographs at the final follow-up in one case. All other cases showed a reduced and stable AC joint.

Ten patients were completely free of pain, three patients had mild pain, and two patients had pain after minor effort. A total of 12 patients regained their full

range of shoulder motion and two patients had mild restriction of shoulder abduction. All patients had full muscle power. Twelve patients regained all the former shoulder functions and were able to do all their daily activities (sleep, work, recreation, and sport). Two patients had mild restriction in their shoulder function.

On the basis of the Constant–Murley score [14], 12 patients (85.7%) had excellent results, two patients (14.3%) had good results, and no patient had poor results (Table 2). There was no infection, soft-tissue ossification, bone erosion, recurrent deformity, or painful scar.

Discussion

There is a general consensus to treat type I and II AC injuries conservatively and type IV, V, and VI operatively [2]. However, some authors reported surgical repair for selected incomplete dislocations [15,16] and conservative treatment for medically unfit patients with type IV, V, and VI injuries [17–19]. 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 [20]. However, 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 [21].

Although there are more than 100 surgical techniques that have been reported, there is no gold standard for the treatment of AC dislocations [3–5]. In 1941, Bosworth [22] introduced a new method of repairing acute complete AC joint dislocations in which a noncannulated coracoclavicular lag screw was inserted using a blind technique. He recommended neither repair of the coracoclavicular ligaments nor exploration of the AC joint. In 1968, Kennedy [23] reported good results with open reduction through debridement of the AC joint and fixation using a coracoclavicular screw. He placed the bone dust created by drilling the hole for coracoclavicular fixation into the coracoclavicular space in an effort to gain permanent bone fixation between the clavicle and the coracoid as an extra-articular arthrodesis of the AC joint.

Table 1 Final results and patient satisfaction

Patient satisfaction	*n* (%)
Satisfied	14 (100)
Unsatisfied	0 (0)
Total	14 (100)

Table 2 Final results and end result scoring

Type	Excellent	Good
Type III AC dislocation	6	–
Type IV AC dislocation	3	1
Type V AC dislocation	3	1
Total	12	2

AC, acromioclavicular.

In 1989, Tsou [24] introduced the percutaneous coracoclavicular 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 with 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 coracoclavicular ligament tears. Technical failures, which occurred in 17 of 53 patients (32%) included the following: failed percutaneous insertion in two; screw pullout in seven; 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.

Coracoclavicular 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 [2,25,26]. 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 [27,28], from anterior subluxation, which may occur on using complete clavicular cerclage [25], from injury to underlying neurovascular structures, and from dislocation of the lower portion of the cerclage loop off the front of the coracoid [18].

Kirschner wires have been used extensively to transfix the AC joint temporarily after reduction [29]. 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, which is now available, the use of these wires is now contraindicated [30].

Paavolaincn and Bjorkenhcim [31] described the use of malleolar screw to transfix the AC joint in 36 patients, with repair of the coracoclavicular 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 [32]. This closely reproduces the stability of the intact joint [33], 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 [34].

In our study, the mini-open approach preserves the remaining soft-tissue attached to the distal clavicle, decreases the surgical trauma and the incidence of deep infection, avoids soft-tissue ossification and prominent painful scar, and preserves cosmetic appearance.

The reduction was performed by means of a 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 operating table, the dislocation reduced. However, torn capsular ligaments trapped in the joint space, loose pieces of articular cartilage or a detached intra-articular meniscus inside the joint can prevent closed reduction.

Accurate and correct reduction was maintained by placing the screw in the center of the clavicle (or slightly anterior), 3 cm medial to the lateral end of the clavicle, directed under vision to the base of the coracoid process, thus avoiding faulty insertion, anterior subluxation, broken tip or waist of coracoid and screw pullout.

The method of fixation was performed with a lag screw. Cerclage wire carries the risk of neurovascular injury, cheese wiring effect of the coracoid or the clavicle, and also leads to anterior subluxation of the clavicle. AC transfixation by means of hooked plate leads to osteoarthritis, violation of superior AC ligament, stiffness of the shoulder, clavicular osteolysis, and periprosthetic fracture.

The stabilization was performed without repair of the coracoclavicular ligaments. Short ligaments, midsubstance tear, brush teeth of torn ends, and difficult repair, all decrease the integrity and security of repair. Robust healing power in acute injuries and hematoma at coracoclavicular ligaments encourages the mini-open approach.

Conclusion

Complete (AC) joint dislocation can be treated successfully by means of screw fixation through the mini-open approach. It is a simple and reliable method of fixation, with a lower incidence of complications, and performed through a cosmetic approach.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

References

1 Rockwood CA, Williams GR, Young DC. In: Rockwood CA, Masten FA III, editors. Disorders of the acromioclavicular joint. The shoulder. 2nd ed. Philadelphia: WB Saunders; 2000. 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 Fukuda K, Craig EV, An KN, Cofield RH, Chao EY. Biomechanical study of the ligamentous system of the acromioclavicular joint. J Bone Joint Surg 1986; 68-A:434–440.

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

5 Mazzocca AD, Santangelo SA, Johnson ST, Rios CG, Dumonski ML, Arciero RA. A biomechanical evaluation of an anatomical coracoclavicular ligament reconstruction. Am J Sports Med 2006; 34:236–246.

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

7 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.

8 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.

9 Guy DK, Wirth MA, Griffin JL, Rockwood CA Jr. Reconstruction of chronic and complete dislocations of the acromioclavicular joint. Clin Orthop 1998; 347:138–149.

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

11 Pavlik A, Csepai D, Hidas P. Surgical treatment of chronic acromioclavicular joint dislocation by modified Weaver-Dunn procedure. Knee Surg Sports Traumatol Arthrosc 2001; 9:307–312.

12 Carr AJ, Broughton NS. Acromioclavicular dislocation associated with fracture of the coracoid process. J Trauma 1989; 29:125–126.

13 Click JM, Milbum LJ, Haggerty JF. Dislocated acromioclavicular joint: follow-up study of 35 unreduced acromioclavicular dislocation. J Sport Med 1987; 5:264–270.

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

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

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

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

18 Verhaven E, Casteleyn 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.

19 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.

20 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.

21 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.

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

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

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

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

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

27 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.

28 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.

29 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; 602–676.

30 Malcapi C, Grassi G, Oretti D. Posterior dislocation of the acromioclavicular joint: a rare or an easily overlooked lesion? Ital J Orthop Traumatol 1978; 4:79–83.

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

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

33 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.

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