Acute acromioclavicular dislocations: results of coracoclavicular screw fixation

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Background
The vast majority of traumatic dislocations of the acromioclavicular joint (ACJ) occur either during sports or other daily activities. Most frequently, the mechanism of injury is force acting on the shoulder from the lateral side with the arm in an adducted position.

Patients and methods
Twenty patients with recent complete acromioclavicular dislocation were treated operatively by coracoclavicular screw fixation, repair of torn ligaments, together with exploration and debridement of the ACJ. Sling immobilization for 2 weeks and early postoperative rehabilitation were carried out.

Results
Patients were followed up for a period ranging from 6 to 30 months (average 18 months). According to Constant score, 14 patients had an excellent score, four had a good score, and two had a fair score, and there were no poor results.

Complications
Implant failure with backing out of the screw occurred in one patient 6 weeks postoperatively, with no influence on the final outcomes, and a superficial wound infection occurred in three patients and required no further surgical treatment; only dressing and oral antibiotics were required for 2 weeks. Shoulder stiffness was mild in two patients and did not affect the patient's daily activities.

Conclusion
Good results can be obtained in complete types III, IV, and V (ACJ) on separation by repair of both acromioclavicular and coracoclavicular ligaments, proper fixation of the screw, repair of deltotrapezius muscles and fascia, and meticulous adherence to the postoperative rehabilitation program.

Keywords:
acromioclavicular joint, shoulder dislocations, coracoclavicular screw fixation

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Introduction

The vast majority of traumatic dislocations of acromioclavicular joint (ACJ) occur either during sports or during other daily activities [1–3]. Most frequently, the mechanism of injury is force acting on the shoulder from the lateral side with the arm in an adducted position [4]. On the basis of the direction and extent of clavicular displacement, Rockwood *et al*. [5] introduced a classification of acromioclavicular (AC) dislocations from grades I to VI (Fig. 1). It is mostly accepted that grade I and II lesions can be treated conservatively [6,7]. There is also a wide consensus that type IV, V, and VI injures should be treated operatively. For type III ACJ injuries, the debate on conservative or operative treatment is still controversial [2–4]. There are well over 100 citations in the literature reviewing the operative treatment of AC dislocations; all of these methods can be categorized into the following three groups: primary ACJ fixation, primary coracoclavicular (CC) fixation on excision of the distal clavicle, and dynamic muscle transfer. These reports offer many modifications of previously reported techniques such as CC screw fixation, primary ligamentous repair, transfer of surrounding soft tissues, use of synthetic materials, fascial grafts, and the hook plate technique [6,8–25]. The different varieties of procedures indicate the interest among orthopedic surgeons to develop a procedure offering minimal morbidity to the surrounding tissues and a biomechanically sound solution for reconstruction of the displaced ACJ. The aim of this study is to report the functional outcome of cases with complete ACJ dislocation managed by open reduction, CC screw fixation, with repair of ligaments and surrounding soft tissues.

Patients and methods

In this study, 20 patients with AC dislocations were treated in the Al-Azhar University Hospital in new Damietta in the period from 2006 to 2010. There were 19 men and only two women. The mean age of the patients was 32 years, with a range from 18 to 40 years (Table 1).

Figure 1

Classification of acromioclavicular injuries.

The cause of injury was motorcycle accidents in 11 patients, motor car accidents in five, and sports injury in four (Table 2).

The right ACJ was injured in 12 patients and the left ACJ in eight patients (Table 3); there was no predilection for either the dominant or the nondominant side.

Table 1 Age distribution

Age (years)	*N* (%)
25	6 (30)
25–35	12 (60)
35–40	2 (10)
Total	20 (100)

Table 2 Causes of injury

Causes of injury	*N* (%)
Motorcycle	11 (55)
Car accidents	5 (25)
Sport injury	4 (20)
Total	20 (100)

Table 3 Side of injury

Sides affected	*N* (%)
Right side	12 (60)
Left side	8 (40)
Total	20 (100)

Table 4 Type of acromioclavicular joint injuries

Types of injury	*N* (%)
III	4 (20)
IV	10 (50)
V	6 (30)

Clinical picture

Acute AC dislocation was diagnosed clinically by the presence of a swelling with prominence of the lateral end of the clavicle. There was localized tenderness over the ACJ and painful shoulder movements, especially abduction.

Radiography

Two anteroposterior standing radiographs for both shoulders were taken with the x-ray tube placed at the level of the ACJ and the rays perpendicular to the joint.

In the first view, the patient was asked to stand relaxed with the arms adducted and the forearms pronated. In the second view, 8 kg were suspended from the wrists [12].

As an example, type III AC dislocation was diagnosed by prominence of the lateral end of the clavicle by at least one full width of its lateral end above the acromion. The CC interspace was 25–100% greater than a normal shoulder, but in type V, the interspace may be 300% wider than the normal shoulder. Table 4 shows the number of patients in relation to the type of injury.

Surgical technique

The top of the patient's shoulder should be completely free. The semisetting position is favored under general anesthesia.

A shoulder strap incision of about 10 cm is made starting 2 cm posterior to the clavicle and then across the clavicle about 3 cm medial to the ACJ and extends downwards to a point distal to the tip of the coracoids process.

A transverse incision is made in the fascia and periosteum over the lateral third of the clavicle reaching laterally to the ACJ splitting of the anterior fibers of the deltoid to visualize the coracoids process. The distal end of the clavicle is lifted upward to expose the torn ends of the CC ligaments and the base of the coracoids process. Debridement of the ACJ and excision of the disc is performed if torn. Two Prolene 2/0 sutures are inserted into the free ends of the CC ligaments if they are torn in the middle. In two instances, the ligaments were avulsed from the clavicle and curled over the coracoid. In these cases, drill holes were made in the clavicle through which stay sutures were passed. These sutures were not tied. With ACJ reduced, a vertical drill have with a 2.7 drill bit is made passing from the clavicle to the base of coracoids process. Measurement of the length of a suitable screw is performed using an AO depth gauge. A partially threaded 4 mm cancellous screw of a suitable length and a washer is then inserted. When the clavicle becomes level with the superior border of the acromion, the sutures in the CC ligaments are tied. Another half a turn is applied

to the screw to take any tension off the sutures. Repair of all soft tissues including AC ligaments, deltoid, and trapezius tears is then performed. Also, the fascia and the periosteum over the clavicle are repaired, followed by skin closure.

Postoperative care

The arm was supported in a sling for 1–2 weeks. After 1–2 weeks, the use of the sling was discontinued. The patient could use the arm for most everyday activities, but was cautioned to avoid pushing, lifting, and pulling for 6 weeks. The patient, ordinarily, had a good range of functional range of motion that allowed the patient to begin daily activities. The screw was routinely removed 12 weeks after surgery, usually under local anesthesia. After removal, full active and passive range of motion is encouraged. Once full range of motion and strength were obtained, return to athletic competitions was permitted.

Results

All patients were followed up for a period of 6–30 months, with an average of 18 months. Radiologically, the standard radiograph films were prepared and the CC distance was measured on either side. Clinically, the patients were assessed at the end of the follow-up period. The functional outcome was evaluated using the Constant and Murley [26] score. This score has a maximum of 100 points. According to the points obtained, the results were grouped into excellent (>89 points), good (80–89 point), fair (70–79 points), and poor (<70 points) outcomes. According to the Constant score, 14 patients had an excellent score, four had a good score, and two had a fair score, and no poor results were obtained. All patients returned to previous work after a maximum of 1 year, especially manual labor (Fig. 2).

Complications

One implant failure with backing out of the screw occurred 6 weeks postoperatively and the screw was removed after detection, without affecting the final result. A superficial wound infection occurred in two cases without the need for further surgical treatment; only dressing and oral antibiotics were required for 2 weeks. Shoulder stiffness was mild in one case and did not impair the patient's daily activities. No deep infection or neurovascular injuries were found. Radiological evaluation by stress view films, to confirm the reduction and healing of the CC and AC ligaments, indicated good reduction. All patients returned to previous work after a maximum of 1 year, especially manual labor (Table 5).

In all patients, the AC and CC ligaments were torn; the tear in the CC ligaments was in the mid substance in 18 patients. The CC ligaments were avulsed from the clavicle in two patients. These two cases were graded as excellent. Debridement of the ACJ was carried out in all cases and the disc was found to be torn in two patients in whom excision of the disc was performed. In these cases, the results were acceptable (excellent and good). In one case, excision of the lateral 2 cm of the clavicle was performed after exploration of the ACJ and avulsion of articular cartilage from the lateral end of the clavicle. The patient was 45 years old and the outcome of the procedure was graded as fair (Table 6).

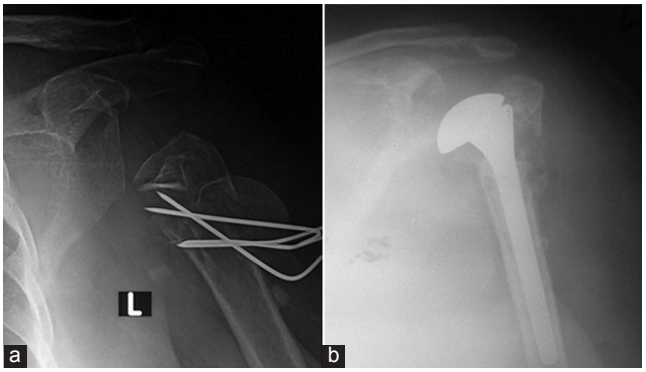
Discussion

Early repair of acute ACJ dislocations provides good overall clinical results independent of the surgical methods [1,4,7,27]. Whereas surgical treatment is recommended for type IV to VI ACJ injuries, the

Table 5 Constant score for clinical shoulder evaluation

Parameters	Degree	Points
Pain	None	15
	Mild	10
	Moderate	5
	Severe	0
Activities of daily living (activity level)	Full work	4
	Full recreation/sport	4
	Unaffected sleep	2
Arm positioning	Up to the waist	4
	Up to the xiphoid	2
	Up to the neck	6
	Up to the top of the head	8
	Above the head	10
Range of motion		40
Power (1 point per pound of weight held in abduction by arm at 90°)		25
Total		100

Figure 2



(a) Preoperative, (b) postoperative, (c) 1 year after removal.

Table 6 Clinical and radiological results of the follow-up period

Parameters	Postoperative complications		Radiological results		Clinical constant score	value
	Superficial infection	2	Anatomical reduction	18	Excellent	14
	Implant failure	1	Subluxation	2	Good	4
	Limited range of motion	1	Redislocation	0	Fair	2
	No complication	16			Poor	0
Total		20		20		20

management of type III injuries is still controversial. Depending on the surgical method, one has to be aware of complications such as wound infection, osteomyelitis, nerve injuries, ossifications, osteoarthritis, stiffness, and implant failure. For these reasons, several authors recommend surgical reconstruction exclusively for young patients, in athletes, or for those involved in heavy manual labor [1,10,21], and there is still discussion on whether ACJ injuries of type III should be treated by conservative or operative methods. In contrast, Mouhsine *et al.* [28] reported poor results (52%) of conservative treatment in grade I and II ACJ dislocations and they concluded that the severity of the consequences after grade I and II AC sprains is underestimated. The difficulties associated with surgery as reported in the literature are usually concomitant with either AC fixation using a smooth threaded k-wire, CC fixation using stainless-steel wire loops or soft tissue grafts, transfer of coracoacromial ligaments, and transfer of coracoid process. Migration of pins, breakage of the wires, erosion of the bone, and failure of fixation with subsequent recurrence of the deformity are the most common complications [5,29]. In some cases, the pins have been found in the heart, lungs, and great vessels [30,31]. CC screw fixation was popularized by Boswarth. The use of screws has been described alone and in combination with ligament reconstructions [32]. The use of CC screw fixation, especially if accompanied by repair of torn ligaments, will ensure enough protection of these ligaments until complete healing is achieved [5]. The most frequent complication associated with CC screw fixation is the formation of bony bar in the CC space; most investigators have reported that even in the presence of this calcification, patients had full range of shoulder motion [11]. Larsen *et al.* [31] found that this calcification occurred in conservatively treated cases in almost equal percentages as cases treated operatively. However, in this series, none of the cases developed CC calcification; this may be because of the relatively earlier operative interference and thorough washing of the bone debris resulting from drilling of the clavicle and coracoid.

Pulling out of the screw from the coracoid and subsequent loss of reduction have been reported by some authors [32]. This complication can occur either in older age groups with osteoporotic bone or because of fixation of the screw to the tip or the waist of coracoid rather than its base. This complication was not encountered in this series as all patients were young (18–47 years) and screw fixation to the base of the coracoid was always feasible.

Although some authors do not recommend repair of the CC ligament [3,32], others do strongly stress the importance of their repair and have reported more favorable results [2]. It was found in this study that this repair was easy, restoring almost normal anatomy and yielding highly favorable results (24 of 25 patients showed excellent and good results).

Most studies comparing both conservative and operative treatments of complete AC separation have not reported superior results by surgical means [33], but in heavy manual workers and young athletes, conservative treatment may not be feasible. Even the most enthusiastic supporters of conservative treatment do recommend surgical methods in these patients and consider these patients as an exceptional indication for surgery [6].

Five patients in this series had no visible deformity on clinical examination and the range of shoulder motion was almost normal. The only clinical sign was tenderness over the ACJ. All these patients had complete dislocation of the ACJ in both ordinary and stress radiographs. Therefore, it is concluded that no clinical findings are completely reliable for diagnosis and that ordinary and stress radiographs should be prepared in all cases of AC injuries to verify the type of dislocation; these findings are in agreement with the observations of other authors [34] . It was interesting to find no visible injury on operation of both trapezius and deltoid muscles in these five patients; this may explain the absence of deformity as the intact muscles could contract and fix the clavicle, preventing its upward displacement [31].

The need for a second operation to remove the screw cannot be considered as a disadvantage of the procedure. This screw can be removed under local anesthesia, guided by the cross scratch in the skin over its head; the operation takes a few minutes and a single stitch is needed.

Although the number of cases is too small to draw definite conclusions, it can be concluded that this procedure is easy, reliable, and yields highly favorable results, provided that the steps mentioned in the operative technique are strictly followed.

Conclusion

Good results can be obtained in complete types III, IV, and V AC separation by repair of both the AC and the CC ligaments, proper fixation of the screw, imbrication of the deltotrapezius muscles and fascia over the clavicle, and meticulous adherence to the postoperative rehabilitation program.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

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