



Fixation of clavicle alone in floating shoulder injury : functional and radiological outcome

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The aim of this study was to evaluate the clinical and radiological results of fixation of clavicle alone in floating shoulder injury. From 2007 to 2011 thirteen patients with floating shoulder injury (ipsilateral clavicle and scapular neck fracture) were treated by isolated fixation of the clavicle by plate osteosynthesis. Assessment of the shoulder function was performed using the university of California at Los Angeles (UCLA) shoulder rating scale. The mean duration of follow up period was 24.3 months. All the fractures were united, fractures of the clavicle united from 11 to 16 weeks after surgery and that of scapula from 12 to 16 weeks. The overall UCLA shoulder rating scale was 32.3 (range from 30-34). Isolated plate fixation of clavicle fracture in floating shoulder injuries results in high rates of both clavicular and scapular fracture healing provided the integrity of coracoclavicular ligament and involvement of the coracoids process with the distal scapular fragment.

Keywords : floating shoulder, fracture clavicle, glenopolar angle, coracoclavicular ligament.

INTRODUCTION

Floating shoulder is a rare injury consisting of ipsilateral fracture clavicle and glenoid neck, Herscovici et al (10) consider this combination of injuries to be unstable.

Goss (7) introduced the concept that a double disruption of the superior shoulder suspensory complex causes a floating shoulder injury. The superior shoulder suspensory complex (SSSC)

is essentially, a bone and soft-tissue ring secured to the trunk by superior and inferior bony struts from which the upper extremity is suspended. The ring is composed of the glenoid process, coracoid process, coracoclavicular ligament, distal clavicle, acromioclavicular joint, and acromial process. The superior strut is the middle third of the clavicle, while the inferior strut is the junction of the most lateral portion of the scapular body and the most medial portion of the glenoid neck.

Initial understanding of the instability of the scapular neck fracture associated with a floating shoulder was based on the fracture of the clavicle, losing the suspensory and stabilizing function of the clavicle leads to displacement of the scapular neck fracture secondary to the unopposed muscular forces acting on the scapula (1,8).

Similar displacement is possible with ligamentous disruption in the absence of a clavicle fracture. In any floating shoulder pattern, the firm point of attachment for soft tissue structures is lost, which disrupts the normal stability of the glenohumeral

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joint. Consequently, the combination of gravity, the weight of the arm, and muscle forces may result in anteromedial displacement of the glenoid. With loss of the normal lever arm of the rotator cuff. As a result, the mechanical advantage of the rotator cuff muscles decreases (8, 14,16,17).

The purpose of this study was evaluation of the functional and the radiological results of operative fixation of displaced fracture clavicle in patients with floating shoulder injury at our institution.

PATIENTS AND METHODS

From February 2007 to December 2011 thirteen patients with a floating shoulder injury ,whose mean age was 34.2 years old (range 23-45),were the subjects of this study .Eight had right shoulder injured .The causes of injury were traffic accidents in 10 patients and falling from height in three .Ten of them were males. After initial assessment according to Advanced Trauma Life Support ® (ATLS) principles, specific radiographic evaluation of the injured shoulder was done as soon as patient is in a stable condition. Two radiographes were done; true anteroposterior view perpendicular to the plane of the scapula and axillary lateral view or scapulolateral view.

All the patients had a displaced fracture clavicle ≥ 10 mm or shortening ≥ 20 mm (no one had fracture lateral end) , and all the scapular fractures were in the neck region , including the coracoid with the distal fragment with no fracture involve the coracoid itself. The glenopolar angle (GPA) is the angle between the line connecting the most cranial and most caudal points of the glenoid cavity and the line connecting the most cranial point of the glenoid cavity with the most caudal point of the scapular body . Bestard et al (3) consider GPA 30° - 45° as normal. The mean preoperative GPA in our patients was 26.3° (range 25° - 29°).

Nine patients had associated injuries; rib fracture in five patient, haemopneumothorx in 2 patients, lung contusion in 3 patients, mild head injury in 5 patients and fracture tibia in one patient, the mean period from injury to surgery was 10 days (range 6-14).

Intraoperative assessment of coracoclavicular ligament integrity was done and primary stabilization of the clavicle was done in all patients by 3.5mm AO reconstruction plate. The stability of scapula fracture was assessed by use of image intensifier .Postoperatively the arm was placed in a sling for comfort and passive mobilization was started as soon as possible. Four weeks after surgery the patients started range of motion exercises.

Assessment of the shoulder function was performed using the university of california at Los Angeles (UCLA) shoulder rating scale which was stratified into good to excellet result (27-35) or fair to poor result (< 27 points) (2). It allocates points for pain ,function,movements,and patient satisfaction with over all maximum 35 points . statistic software SPSS14.0 was used to analyze the data. Apaired t-test was used to compare GPA preoperative and at end of follow up. A-p value < 0.05 was considered significant.

RESULTS

The mean duration of follow up period was 24.3 months (range, from 22-36 months).All the fractures were united, fractures of the clavicle united from 11to 16 weeks (mean, 13.3 weeks) after surgery and that of scapula from 12to16 weeks (mean, 14.5 weeks) (Figure 1).No intraoperative vascular or neurologic damage was reported .six patients needed a plate removal after solid fracture union because of discomfort in the clavicle area. The mean GPA at the end of follow up was 31° (range 28° - 35°), the difference between the mean pre and end follow up GPA was significant ($p = 0.000$) The overall UCLA shoulder rating scale was 32.3 (range from 30-34) (Table I).

DISCUSSION

The combination of a fracture of the scapular neck with an ipsilateral fracture of the clavicle is often referred to as a “floating shoulder”. Since its first description (5), many clinical and biomechanical studies have focused on this complex shoulder injury and the definition of a floating shoulder has been updated over the last decades.

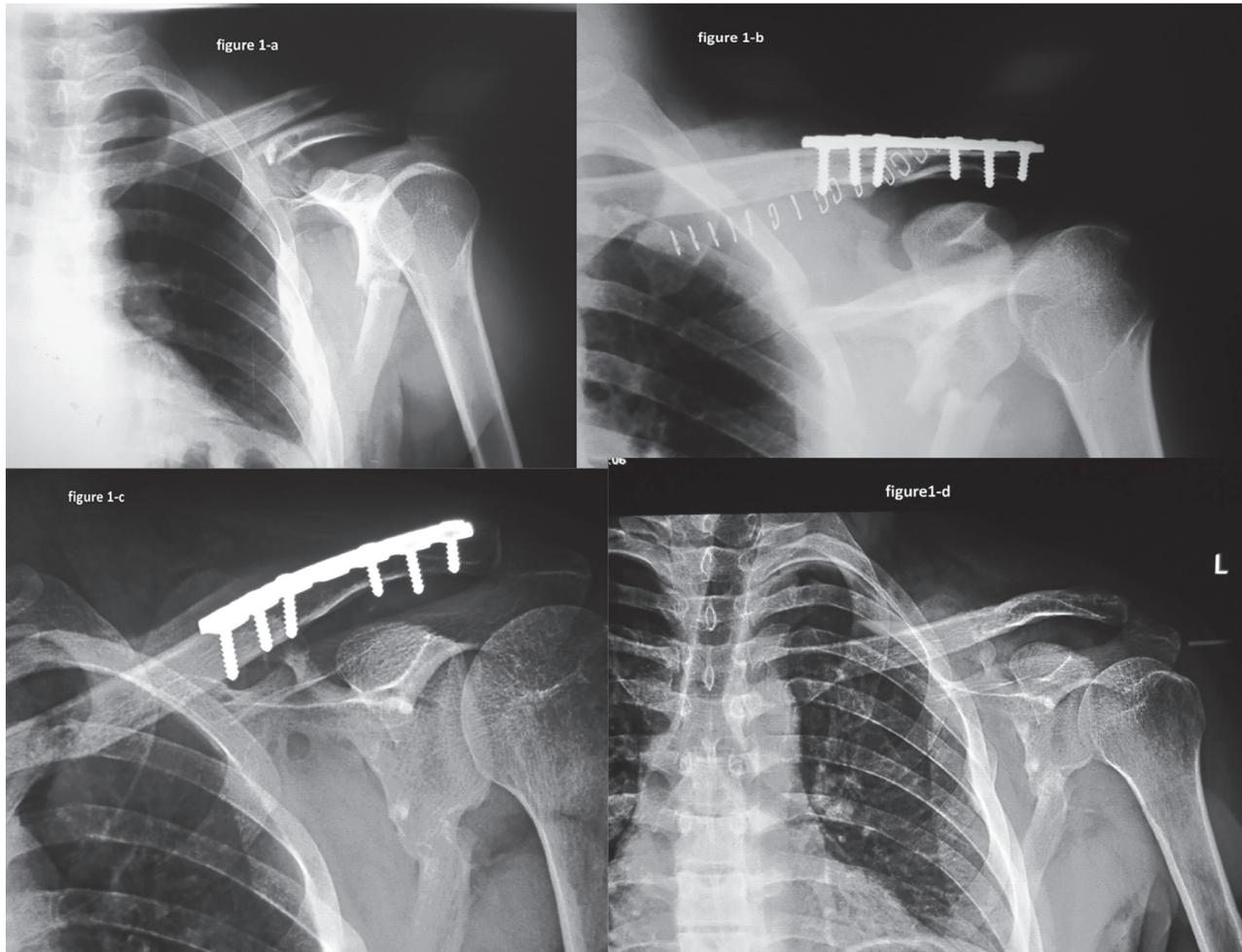


Fig. 1. — A preoperative x ray of patient with floating shoulder injury ; B, postoperativex ray after fixation of clavicle ; C, complete healing of fractures ; D, after metal removal .

Treatment of patients with floating shoulders is complicated by several factors. First, for the osseous component, the definitions of stability and significant displacement are highly variable, and the implications for shoulder function are poorly understood. Second, disruption of acromioclavicular ligaments may be readily diagnosed on physical examination or with stress radiographic views, but the diagnosis of coracoacromial and coracoclavicular ligament disruption is extremely difficult ; reliable methods to aid in the diagnosis of such lesions are not well established. Unless there is an acromion fracture, distal clavicle fracture, or disruption of the acromioclavicular joint, the

extent of ligamentous injury is difficult to define. Finally, clinical outcomes reported in the literature are, for the most part, comparable for surgical and nonsurgical management. However, the studies are primarily retrospective, they lack concurrent control groups, and most do not include sufficient patients to detect potentially important trends (6).

Advocates of only clavicle fixation (6,12,15,18) suggest that it is a relatively simple compared with open reduction and internal fixation of scapula ,and by fixing the clavicle ,the scapula neck fracture is indirectly reduced. GPA of 30° to 45° was considered normal whereas 20° was arbitrarily defined as severe rotational malalignment.

Table I. — patient's data and final assessment.

Number	Age	side	Time of Surgery (days)	GPA° (preop)	Clavicle Union (weeks)	Scapula Union (weeks)	Duration of Follow up (months)	GPA° (end)	UCLA Scoring
1	25	RT	10	25	12	14	24	31	33
2	30	RT	11	27	14	14	23	30	30
3	36	RT	9	29	12	16	24	34	33
4	23	LT	6	25	11	12	36	31	34
5	40	RT	8	29	14	14	23	35	32
6	37	LT	12	27	14	14	22	32	30
7	29	RT	11	25	12	13	23	30	34
8	30	RT	14	25	16	15	24	29	33
9	35	LT	9	25	14	15	27	28	34
10	41	RT	8	28	14	16	23	30	32
11	39	RT	8	25	14	15	22	31	31
12	34	LT	6	27	13	15	22	32	34
13	45	RT	9	25	14	16	23	31	30

Yadav et al (18) reported significant improvement of GPA after clavicular fixation alone in 12 patients with floating shoulder injury. In this study, there was significant improvement of GPA at the end of follow up, with satisfactory clinical outcome. GPA is a two dimensional measure and might not truly reflect the angulation of the neck in relation to the body of the scapula (18). However, despite anatomical reduction of the clavicle fracture and integrity of acromioclavicular and coracoclavicular ligaments, some displacement of scapular neck fracture will persist (11,15). This is not caused as suggested in literature by medial displacement of the glenoid fragment, but explicitly by lateral displacement of the mobile scapular body (13). The presumption that significant shortening of the scapular neck will result in rotator cuff dysfunction by shortening of its lever arm makes sense, but is not hitherto confirmed in clinical studies. It is possible that shortening of the rotator cuff lever arm is compensated for by small increases in force in other muscles with larger moment arms (4).

The stability of scapular neck fracture depend on an intact clavicle and coracoclavicular ligament (8). Fractures of scapula neck region not involving the coracoid process in the distal fragment, or clavicular fracture lateral to the attachment of the trapezoid

ligament is problematic, if internal fixation of the clavicle alone is performed. In such problematic injuries, the scapula neck fracture will not be stable. In our study all clavicle fractured was not involve lateral end and the coracoclavicular ligament integrity was assessed intraoperative.

In conclusion, isolated plate fixation of the clavicular fracture in floating shoulder injuries results in high rates of both clavicular and scapular fracture healing with good

to excellent outcomes provided the integrity of coracoclavicular ligament and involvement of the coracoids process with the distal scapular fragment.

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