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To evaluate the long-term results and to identify predictive factors of functional outcomes of floating shoulders treated either conservatively or surgically

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Abstract

Introduction: The 'floating shoulder' is a rare injury^[1] consisting of ipsilateral fractures of the clavicle and glenoid neck. It was first described by Ganz and Noesberger in 1975. Subsequently, Goss expanded on their definition by describing it as a 'double disruption' of the superior shoulder suspensory complex.

Aim of the study: The aim of this study is to evaluate the mid-term results and functional outcomes of floating shoulders treated either conservatively or surgically.

Discussion: Floating shoulder is rare injury and is usually seen in high velocity injuries. It is accepted in published literature that floating shoulder can be treated either conservatively or operatively. The purpose of our study was to evaluate the mid-term results and functional outcomes of floating shoulders treated with either modality of management before.

Conclusion: This preliminary study adds to the growing body of literature indicating that the functional outcome of floating shoulder is good when surgical treatment is undertaken, which could be in the form of clavicle fixation, glenoid neck fixation, or both fixation.

Keywords: Floating shoulder, scapula, clavicle, Ac joint

Introduction

The 'floating shoulder' is a rare injury^[1] consisting of ipsilateral fractures of the clavicle and glenoid neck. It was first described by Ganz and Noesberger in 1975. Subsequently, Goss expanded on their definition by describing it as a 'double disruption' of the superior shoulder suspensory complex. The superior shoulder suspensory complex 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^[1]. 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. The complex can be subdivided into three units: 1) the clavicular-acromioclavicular joint-acromial strut; 2) the three-process-scapular body junction; and 3) the clavicular-coracoclavicular ligamentous-coracoid (C-4) linkage. Double disruption of superior shoulder suspensory complex types are Complete Acromioclavicular joint dislocation (grade 3) Coracoclavicular and Acromioclavicular ligament disrupted, displaced fracture of lateral end of clavicle Coracoclavicular ligament injury with fractures, Fracture clavicle with fracture glenoid neck. Glenopolar angle (GPA)^[2] is the angle between the line connecting the most cranial with the most caudal point 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. It provides a value for the obliquity of the glenoid articular surface in relation to the scapular body. GPA ranging 30-45 degree as normal. Rotational malalignment of the glenoid through the measurement of GPA and defined a GPA of <20 Degree as severe glenoid rotational malalignment.

Aim of the study

The aim of this study is to evaluate the mid-term results and functional outcomes of floating shoulders treated either conservatively or surgically.

Objective of the study

To evaluate the shoulder function using the Constant Murley score.

AO classification

Type A: Non displaced fracture of the scapula with stable shoulder girdle

Type B: Displaced fractures of the scapula with a stable shoulder girdle

Type C: Fractures of the scapula with an unstable shoulder girdle

Materials and methods

Patient Selection

In a retrospective - study from November 2014 to December 2015, all the patients with traumatic clavicle and scapular neck fracture treated surgically or conservatively in orthopaedic department, Mangalore from Jan 2008 to 2013 were enrolled in the study. A total of 24 patients were admitted during this time frame.

The patient Inclusion criteria were

1. All Patients with isolated traumatic clavicle and scapular neck fracture only
2. Age > 18 years

Exclusion criteria were

1. Patient not willing to enter the study
2. Patient lost to follow up.
3. Associated with ipsilateral limb injury
4. Polytrauma patients.

After the exclusion criteria, 24 patients were part of the final study. The patients were explained about the nature of the study. Consent for the same was taken. All the patients underwent any one of the following treatment-

1. Conservative management by resting the arm in a broad arm sling, and clavicular brace
2. Open reduction and internal fixation with plate osteosynthesis for clavicle or scapular neck or both under general anaesthesia.

Among 24 patients, eleven patients were treated nonoperatively and thirteen patients were treated operatively, among those only clavicle fracture was fixed in seven and only glenoid neck fixed in three, and both clavicle and glenoid fixed in three.

The choice of the procedure was based on the following indications.

1. Undisplaced/Minimally displaced fractures of the glenoid neck, and clavicle fracture and relatively stable floating shoulder injuries were treated conservatively.

Indication for ORIF of clavicle only in

- Complete fracture displacement of clavicle
- Severe displacement of clavicle causing tenting of the skin with the risk of puncture
- Clavicle Fractures with more than 2 cm of shortening
- Comminuted clavicle fractures with a displaced transverse fragment.

Indication for scapular neck fixation

- Grossly displaced fracture of scapular neck (>1cm displacement, >40 degree angulation, and GPA <20)
- Scapular neck fracture combined with an acromion or scapular spine fracture plus coracoclavicular and acromioclavicular ligament disruption.
- Scapular neck fracture with grade 3-4 acromioclavicular injuries

Both clavicle and scapular neck fixation

- In unstable injuries with displaced clavicle fracture with grossly displaced scapular neck fracture exiting lateral to coracoid process.

Therapeutic measures

1. Conservative treatment

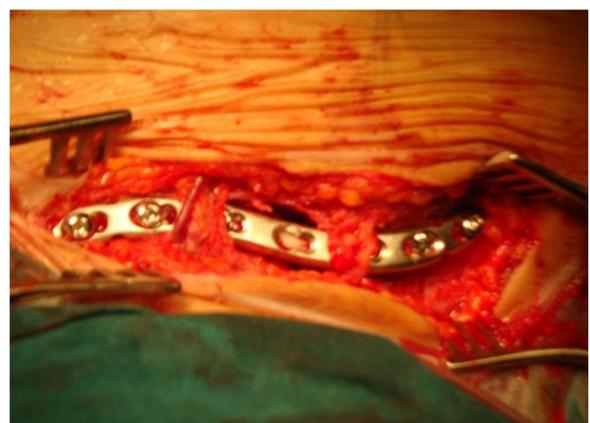
The injured limb was immobilized in a broad arm sling and clavicular brace for 3weeks followed by pendulum exercises and passive mobilization exercises till 6weeks and at 6weeks, active shoulder mobilization exercises were started and rotator cuff strengthening exercises at 2months.

2. Open reduction and plate osteosynthesis

The patient was positioned in a prone position with the arm hanging free by the side of the operating table. Through the posterior Judet approach, in between the infra-spinatus and teres minor the fracture fragments were reduced and fixed with a 3.5mm non locking T-plate or L-plate depending on the fracture pattern.

Clavicle was fixed with anatomical locking plate (in middle third fractures) or reconstruction plate (in lateral third fractures) with patient in supine position. Both scapula and clavicle were fixed in cases where both fractures were grossly displaced.

Post-operative radiograph collected from patient during follow-up and constant score is assessed on the follow up.



Discussion

Floating shoulder is rare injury and is usually seen in high velocity injuries. It is accepted in published literature that floating shoulder can be treated either conservatively or operatively. The purpose of our study was to evaluate the mid-term results and functional outcomes of floating shoulders treated with either modality of management.

Before 1970, most floating shoulder injuries were treated nonoperatively. This changed when Ganz and Noesberger noted that scapular fractures associated with an ipsilateral clavicular fracture were displaced more often and more severely than those that were not. The cause is a loss of the stabilizing effect of the clavicle, which is still accentuated by the ipsilateral muscular forces acting on the scapula. Since then, all ipsilateral fractures of the clavicle and scapula, the so called floating shoulder, were considered unstable injuries, and regardless of initial displacement, some form of internal fixation was undertaken to reduce the risk of eventual scapular dissociation. The authors used nonoperative stabilization only as a way out in case of severe associated injuries. Ganz and Noesberger reported operative treatment of five patients with stabilization of both the clavicle and the scapula. Four patients achieved full range of motion. One patient had reduced shoulder function because of a nerve palsy. Herscovici *et al.* Operated on seven patients, and in view of good results, the authors recommend operative treatment in the form of the clavicle fixation done. Rikli *et al.* [41] reported operative treatment of 12 patients with a double disruption of superior shoulder suspensory complex. Eleven patients underwent ORIF of the clavicle alone; in one case, both the clavicle and the scapula were fixed because of displaced intra-articular fractures. Leung and Lam managed 15 ipsilateral fractures of the scapular neck and the clavicle by means of open reduction and internal fixation of both the scapula and the clavicle, and in view of a good-to-excellent result in 14 cases recommend an operative treatment of all patients with this complex injury pattern.

The operative treatment of floating shoulder in general has a favourable outcome. Several authors noted fair to poor results after conservative treatment of severely displaced scapular neck fractures. This is probably the reason for the increasing interest in the open reduction and internal fixation of these fractures in the more recent literature. It is also suggested that patients with malunion of the scapular neck commonly suffer from (some) loss of range of motion, particularly abduction, forward elevation, external and internal rotation.

In our study, the common mode of injury was motor vehicle accident followed by fall from height with no sex predominance and both sides equally involved. As there is no definitive consensus among literature regarding management of floating shoulder, we formulated our own protocol in which the Undisplaced and minimally displaced fractures can be managed conservatively.

The indications for operative treatment of floating shoulder were modified from those of literature and are as follows, floating shoulder injuries with

1. Grossly displaced clavicle fracture, and clavicle fracture fragment tenting of the skin with the risk of puncture,
2. Comminuted clavicle fracture with displaced fragment,
3. Grossly displaced fractures of scapular neck (>1cm displacement, >40degree angulation and GPA < 20°),
4. Scapular neck fracture with grade 3-4 acromioclavicular injuries, displaced acromion and coracoid fractures.

The primary plan was to fix clavicle in all floating shoulder injuries and the secondary plan of fixation of scapula was

dependant on indirect fracture reduction of scapula intra-operatively. The patients in whom the fracture line of scapular neck exited lateral to coracoid and was unstable, fixation of both clavicle and scapula was done.

Our retrospective study includes 24 patients, of which 11 are non operative and 13 operative. Among the operative 7 were only clavicle fixation and 3 scapular neck fixation, and remaining 3 both clavicle and neck fixation was done.

Total 10 patients with history of RTA underwent surgical fixation, the cases where only scapula was fixed were those with gross scapula displacement, but conservatively treatable clavicle fracture.

Result & Conclusion

We have used the Constant-Murley score for evaluating the functional outcome which is validated for pain, activities of daily living, range of movements and power. All the patients evaluated at the end of 3 years from the treatment. Minimum of 1 year and maximum 5 year. (Average of 3 year).

In our study, 13 operated cases in that we had 11 excellent results, 2 satisfactory, 11 non operative cases in that we had 2 excellent, 3 satisfactory, 4 good, 2 poor, result when Constant Murley scores of patients were considered.

Compare to published literature our study was found that there was good correlation in between Constant Murley scores of patient operative group and non-operative group. In sub classification of surgical fixation including only clavicle fixation, glenoid fixation or both fixation has no statistical significance in functional outcome.

We have assessed each component of the constant score like pain, level of activity, position of limb like forward elevation, lateral elevation, external rotation, internal rotation, power. In our study Pain, level of activity, and power has no statistical difference between operative group and non-operative group. Forward elevation, lateral elevation, external rotation and internal rotation have better functional outcome in operative group compared to non-operative group.

Total four of our patients had malunion of scapula neck fractures treated conservatively. They had restricted movements like internal rotation, external rotation, forward elevation and lateral elevation. The outcome of treatment is dependent on the proper selection for surgical intervention.

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