Section: Orthopaedics and Traumatology

Original Research Article

PROSPECTIVE STUDY ON FUNCTIONAL OUTCOME OF SURGICAL MANAGEMENT OF SCAPULA FRACTURES

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Abstract

Background: Fractures of the scapula, affecting 3-5% of shoulder fractures, are often caused by high-energy trauma. Glenoid neck fractures account for 5% of all cases of scapular fractures. Early surgical intervention improves glenohumeral joint function; however, instability can occur due to other factors. **Aim: Material and Methods**: This study included 20 patients with scapular fractures treated at the Government Rajaji Hospital, Madurai, between June 2019 and December 2021. The study involved a prone or lateral position and a posterior approach to scapular surgery. The patient was evaluated for history, clinical features, baseline investigations, and radiological findings. The study assessed shoulder function by recording the subjective ability to perform daily activities over a week. The final functional outcome was calculated using the constant-Murley score. **Results**: The mean age was 36.5 years including 16 males and 4 females. 20% of the patients presented with associated injuries (multiple fractures, pelvic fractures, and spinal injuries). 30% of the patients had multiple rib fractures and haemothorax which were managed with an intercostal drain. Seventeen patients had road traffic accidents (85%), with a mean score of 74. Six patients (30%) had excellent outcomes, 8 patients (40%) had good outcomes, 4 patients (20%) had moderate outcomes, and 2 patients (10%) had poor outcomes. **Conclusion**: Surgical treatment of scapular fractures involves open reduction and internal fixation using a reconstruction plate and cortical screws, enhancing fracture stability, early mobilisation, wound healing, and patient functional outcomes.

INTRODUCTION

The scapula is known as a shoulder blade and articulates with the humerus at the glenohumeral joint, clavicle at the acromioclavicular joint, and thorax at the scapulothoracic joint, thereby connecting the upper extremity and axial skeleton. A full range of movements at the shoulder joint requires movement of all three articulations. Fractures of the scapula account for 3-5% of all fractures of the shoulder, are most often caused by high-energy trauma, and are frequently associated with multiple traumas. Among scapular fractures, glenoid neck fractures accounted for 5%. Significantly displaced glenoid neck fractures and glenoid neck fractures associated with clavicle fractures (floating shoulder), acromioclavicular joint disruption, coracoclavicular and coracoacromial ligament injury, coracoids, and acromion process fractures lead to glenohumeral joint instability, thereby affecting the range of movements at the glenohumeral joint. Early surgical intervention with replantation and rehabilitation significantly improved glenohumeral joint function.

Aim

To study the role of surgery in improving functional outcomes and quality of life for patients with scapula fractures.

MATERIALS AND METHODS

This study was conducted on 20 patients with scapular fractures at the Government Rajaji Hospital, Madurai, between June 2019 and

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December 2021. The study was approved by the institutional ethics committee before initiation, and informed consent was obtained from all patients.

Inclusion Criteria

Medial/lateral displacement (M/L) > 20 mm, M/L > 15 mm if angular deformity >30°, double lesion of the superior shoulder suspensory complex (SSSC) with displacement >10 mm in both lesions, glenopolar angle (GPA) < 22° glenohumeral instability, > 25% glenoid involvement with subluxation of the humerus, > 5 mm of glenoid articular surface step-off or major gap, excessive medicalisation of the glenoid, and floating shoulder were included.

Exclusion Criteria

Patients with traumatic head injury with poor recovery, ipsilateral brachial plexus injury, contralateral upper limb fracture, and acromion and coracoid fractures were excluded.

The study involved a prone or lateral position and posterior approach to scapular surgery. The patient was evaluated for history, clinical features, baseline investigations, and radiological findings. The procedure involved dividing the deltoid muscle and exposing the lateral margin of the scapula to avoid damage to the axillary nerve and the posterior circumflex humeral artery. Posterior arthrotomy was necessary to verify articular reduction and fixation by using a reconstruction plate designed for angularly stable screws. After surgery, the wound was irrigated, the joint capsule was closed, and a drain was placed beneath the infraspinatus and teres minor muscles. The deltoid muscle and fascia were reattached to the remaining cuff of the deltoid on the acromion and the spine of the scapula.

Postoperative care involved drain tube removal, wound inspection, a shoulder immobiliser for a week, IV antibiotics for 5 days, and analgesic suture removal. Maintaining the full mobility of unaffected joints is crucial for reducing arm swelling and preserving joint motion. Exercises included straightening and flexion of the elbow, bending the wrist, and squeezing the shoulder blades together. As the pain subsided, the patient gradually transitioned from passive to assisted active range of motion exercises, ensuring that abduction was performed without shoulder elevation. Examples include external rotation, internal rotation, and abduction.

The study assessed shoulder function by recording the subjective ability to perform daily activities over a week. It uses a goniometer to measure the active range of movement in two planes and a dynamometer to measure shoulder strength. The best attempt was recorded and the strength score was calculated by multiplying the score by a factor of 2.2. The final functional outcome was calculated using the Constant-Murley score: poor (0-55), moderate (56-70), good (71-85), and excellent (86-100). All data were entered into MS Excel, and the data were expressed as frequency and percentage. Scoring was assigned to various categories to assess shoulder function.

RESULTS

Figure 1: Pre and Postoperative - ORIF with Recon plate fixation for Scapula fracture

Figure 2: Functional outcome - ORIF with Recon plate fixation for Scapula fracture

The majority of patients fell within the age range of 26-45 years, constituting 65% of the total population studied. Patients aged 16-25 years comprised 25% of the cohort, while those aged 46-60 years represented 10%. This indicates that scapula

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fractures predominantly affect individuals in the young to middle-aged demographic. There was a significant male predominance, with males constituting 80% of the study population compared to 20% females. This gender distribution suggests a potential difference in the incidence or severity of scapula fractures between males and females. Fractures were slightly more prevalent on the left side (55%) compared to the right side (45%), although the difference is relatively minor. This finding may reflect underlying anatomical or biomechanical factors influencing fracture patterns. Road traffic accidents (RTA) were the leading cause of scapula fractures, accounting for the vast majority (85%) of cases. Accidental falls accounted for a smaller proportion (15%) of the fractures. The predominance of RTAs underscores the association between high-energy trauma and scapula fractures. The most common duration of surgery was 120 minutes, with 45% of patients undergoing procedures lasting this duration. Procedures lasting 110 minutes constituted 35% of cases, followed by 90 minutes (20%). This distribution suggests variability in surgical complexity and the extent of injury among patients. The majority of patients experienced surgical blood loss within the range of 110-130 ml, with each category representing a similar proportion of cases (20-25%). A smaller proportion of patients (20%) had blood loss of 140 ml. These findings indicate relatively controlled intraoperative bleeding during surgical interventions for scapula fractures. Surgical complications, particularly infections, were relatively infrequent, occurring in 10% of cases. The absence of complications in the majority (90%) of patients suggests overall favorable outcomes in terms of surgical management and postoperative recovery.

Table 1: Demographic data of the study

		No of patients (%)
Age (years)	16–25	5 (25%)
	26–35	6 (30%)
	36–45	7 (35%)
	46–60	2 (10%)
Sex	Male	16 (80%)
	Female	4 (20%)
Side	Right	9 (45%)
	Left	11 (55%)
Mechanism	RTA	17 (85%)
	Accidental fall	3 (15%)
Duration of surgery (mins)	90	4
	110	7
	120	9
Surgical blood loss (ml)	110	6
	120	4
	130	5
	140	5
Surgical complication	Infection	10%
	Nil	90%

DISCUSSION

Conservative treatment initially consists of pain control and immobilisation with a sling, followed by physical therapy. Passive-assisted exercises were started after pain control (usually after 14 days). Active-assisted exercises were usually started after 21 days, according to the patient's tolerance. Active exercises were usually initiated after 28 days. Schofer et al., in a retrospective cohort study of 51 patients with an average follow-up of 65 months, showed good functional outcomes after conservative treatment of scapula fractures.[1]

Cunningham et al., in a case series of 41 patients presenting association of floating shoulder and flail chest, compared 23 treated with operative stabilization and 18 treated nonoperatively. The authors found that restoration of the scapula-clavicular arch unloads the flail chest and may improve respiratory function and pain control, thereby decreasing the duration of mechanical ventilation days and intensive care unit length of stay.[2] Hu et al., in a retrospective cohort of 37 patients, reported favourable functional outcomes using distal humeral Y-type locking plates. No plate rupture or screw prolapse was observed during the 1-year follow-up.[3] Our fixation strategy usually combines stronger constructs (3.5- or 2.8-mm reconstruction plates, with 3.5 mm cortical screws).

In this study, we concentrated mainly on the lateral border of the scapula and periglenoid area; therefore, the posterior approach was preferred, with a delay in surgery of 60% after two weeks due to associated comorbidities. Perfect anatomical reduction was not possible in most patients. The age group ranged from to 20-65 years. The mean age was 36.5 years which including 16 males and 4 females. The follow-up period ranged from 3 to 20 months. 30% of the patients had multiple rib fractures and haemothorax which were managed with an intercostal drain.

Herrera et al. reported good outcomes in 22 patients despite delay in operative treatment (range, 21–57 days). Abduction, forward flexion, and external rotation in the injured limb were 94, 97, and 86% of

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the uninjured shoulder, respectively. The injured shoulder strength with a handheld dynamometer recorded an average abduction of 83%, forward flexion of 73%, and external rotation of 73%. None of the 22 patients developed postoperative complications such as infection, non-union, or failure of internal fixation.[4] Schroder et al. studied 61 patients treated within 20 days of trauma and were able to reproduce similar results. He reported that the injured shoulder's average ROM ranges between 96 and 99% of the uninjured shoulder, while the shoulder strength score is between 85 and 88% of the uninjured shoulder.[5]

In our study, the mean range of motion (ROM) in the injured shoulder was 114° abduction, 157° forward flexion, and 42° external rotation. These values are comparable to those reported by Herrera et al. and Schroder et al. (abduction 106°, 106°; forward flexion 152°, 154°; external rotation 61°, 66°). The percentage of ROM in the injured shoulder compared to the non-injured shoulder; is 90% of forward flexion, 80% of abduction, and 65% of external rotation.[4,5]

Schofer et al. reported a direct correlation between the reduced range of motion and the strength of the injured shoulder. He found that shoulder strength worsened as the limitation of motion in the respective plane increased.[1] Similarly, we noticed the same finding in our patients, where the external rotation strength of the injured shoulder was only 65% of that of the uninjured shoulder in response to the reduced external rotation ROM, that is, 70% of the uninjured shoulder.

Jones and Sietsema conducted a retrospective review of 31 surgically treated scapular fractures in 31 patients treated nonoperatively, matched by age, occupation, and sex. Although the outcomes were comparable between the two groups, the authors demonstrated a much greater severity of injury concerning medial/lateral displacement, shortening, and angulation in the operatively treated group.6 This may be a result of high-energy trauma being overrepresented in patients presenting to a level-I trauma centre. It may also be that high-energy trauma is more likely than other mechanisms to produce the force necessary to sufficiently displace the scapular fragments to meet our operative criteria.

In our study, functional outcomes were assessed using the Constant-Murley Score. The mean score was 74. Six patients (30%) had excellent outcomes, 8 patients (40%) had good outcomes, 4 patients (20%) had moderate outcomes, and 2 patients (10%) had poor outcomes. Perhaps more importantly, we believe that our measurements of the range of motion and strength of the contralateral extremity provide a useful internal control for comparing post-injury and post-treatment functional levels. The constant score corroborated the improvements in strength and range of motion over time, which we believe supports these results. Finally, this series represents a diverse range of patients and injuries. The results of our study suggest that severely displaced scapular body and glenoid neck fractures can be treated operatively, with predictably good functional outcomes and a low rate of complications.

CONCLUSION

Scapular fractures with specific surgical indications, such as mediolateral displacement, anteroposterior angulation, acromioclavicular joint disruption, and clavicle fracture (floating shoulder), are treated with open reduction and internal fixation using a reconstruction plate and 3.5 mm cortical screws. Surgical fixation provides fracture stability which allows early mobilisation of the shoulder joint, thereby reducing oedema and improving wound healing, early ambulation, and glenohumeral joint functional outcome of the patient.

Limitations

Although more precise anatomical plates are available, we used the reconstruction plate only, but we had excellent results with that, since we concentrated more on the periglenoid and lateral border of scapula fractures, all our patients underwent the posterior approach and not the classic judet approach. Surgery was delayed in a few patients with associated chest injuries. A few patients who did not undergo regular follow-up had inadequate rehabilitation.

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