

How to Deal the Displaced Scapula Fracture

Anant Kumar Garg¹, Rajesh Kar², Nitin Kumar³, Sanjay Kumar⁴

¹Associate Professor, Department of Orthopaedic Surgery, Murshidabad Medical College & Hospital, Berhampore, West Bengal, India.

²Senior Resident, Department of Orthopaedic Surgery, Barasat Government Medical College and Hospital, Kolkata, West Bengal, India.

³Associate Professor, Department of Orthopaedic Surgery, Malda Medical College & Hospital, Kolkata, West Bengal, India.

⁴Professor, Department of Orthopaedic Surgery, Murshidabad Medical College & Hospital, Berhampore, West Bengal, India.

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Corresponding author: Dr. Anant Kumar Garg

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Abstract

Background: The aim of this study was to assess the functional outcomes of open reduction and internal fixation of displaced intra-articular and extra-articular scapula fractures.

Materials and Methods: This was a prospective study comprising 16 patients from 2014 to 2017 with displaced scapula fractures, out of which 6 were intra-articular and 10 were extra-articular, with 14 males and 2 females. All patients were operated using a modified judet approach. Intra-articular and extra-articular fractures were analyzed in separate groups.

Results: The mean follow-up period & patients average age was 3.6 years & 40.6 years for intra-articular group and 3.2 years & 32.1 years for extra-articular group respectively. None of the patients in our series was treated conservatively. The mean constant score for the intra-articular group was 85.5±11.3 (65-98) and for the extra-articular group was 84.8±8.5 (68-100) at the final follow-up. Individual comparison of the range of motions and strength in different positions with that of the contralateral non-injured shoulder also showed good outcome. Among the different parameters of Constant score, compared to contralateral normal shoulder, external rotation for the extra-articular group ($p<0.05$) and abduction for the intra-articular group ($p<0.05$) were the most affected, whereas pain, activities of daily living, strength and range of movements were the least affected ($p>0.05$).

Conclusions: Operative management seems to be a good treatment option for displaced scapula fractures, not only for intra-articular fractures but also for extra-articular fractures if it meets certain criteria. All parameters of constant score showed gradual improvement throughout the follow-up period.

Keywords: Scapula fracture; Glenoid fracture; Operative management; Functional outcome.

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Introduction

Scapula fractures account for 0.5% of all fractures, and extra-articular fractures account for between 62-98% of all

scapular fractures [1]. Fracture of the scapula (both intra-articular & extra-articular) has long been treated non-

operatively ever since the work of Robert Judet [2]. After Dr Judet, many authors questioned the traditional non-operative treatment. Nowadays, displaced scapula fracture management has become an interesting topic among the orthopaedic surgeons.

The operative indications of the displaced glenoid fossa are well established and accepted now [3,4,5,6]. The operative indications of extra-articular scapula fractures remain controversial. Though glenohumeral joint can compensate for severe deformities and loss of movements, several studies suggest that fractures with residual displacement lead to persistent discomfort, stiffness and functional disabilities [4,7-9]. Two studies showed long-term good functional outcome after operative intervention for displaced extra-articular scapula fracture if they meet certain operative criterias [5,6]. In this prospective study, we try to analyse the results of management of displaced scapula fractures (both intra-articular & extra-articular fractures) treated by operative intervention.

Materials and Methods

16 patients with displaced scapula fractures were included in this series with 14 males and 2 females who had been treated with ORIF between January 2014 and December 2017 at NRS Medical College and Hospital in the Department of Orthopaedic Surgery with an average follow up of 3.3 years (2 to 5.5 years). Fractures with associated brachial plexus injury and flail chest were excluded from this study. Open fractures were also excluded from this study. All 16 patients met at least one of the operative criterias [5,6,10]: (1) intra-articular gap or step-off of >4 mm and involvement of >25% of the glenoid surface (2) medial/lateral displacement (commonly referred to as "medialization") of ≥ 20 mm (3) angular deformity of $\geq 45^\circ$ in the semi-coronal plane measured on the scapular Y view (4) combined medial/lateral displacement of

≥ 15 mm and angulation of $\geq 30^\circ$ (5) a glenopolar angle of $\geq 22^\circ$ (6) a double lesion of the superior shoulder suspensory complex as described by Goss [11] with ≥ 10 mm of displacement of both lesions.

For all patients, standard pre-op assessment were x-rays (AP, Scapular Y views) and CT scan with 3D reconstruction views [12]. Fractures were classified according to the AO/OTA classification system [13]. All patients were operated in the prone position with modified Judet approach under general anaesthesia. During mobilization of the infraspinatus, great care taken to avoid neurovascular bundle injuries. After careful reduction, main fragments were fixed using 3.5mm reconstruction plate / 2.7mm reconstruction plate and / interfragmentary screw alone/in combination according to fracture configuration and finally checked with an image intensifier. Once fixation is achieved properly, the wound is closed in layers over a drain. Soft dressing is applied.

All patients were managed with proper rehabilitation protocol consisting of passive ROM exercises started from the immediate post-operative day, active-assisted ROM exercise started from 2nd postoperative week, full active ROM started from 4th post-operative week. Shoulder girdle exercise and strength training exercise started from 6th post-operative week. All restrictions were removed after 3 months of physiotherapy. All patients were assessed based on Constant score, VAS score, return to pre-trauma level activities. Clinical motions and strength of both injured and uninjured shoulder were measured and compared using paired t-test.

Results

16 patients (14 male & 2 female) with scapula fracture were operated, between 2014 - 2017. Of them, 6 fractures were intra-articular and 10 fractures were extra-

articular. Most of the patients were male in both intra-articular and extra-articular fracture group. The average follow-up period & pts' average age was 3.6 years (2-5.5 years) & 40.6 years for intra-

articular group and 3.2 years (2.5-5 years) & 32.1 years for extra-articular group respectively. The incidents of associated injuries were 43.75% (7/16). The patients' characteristics are summarized in Table 1.

Table 1: Demographic data

Male	6(100%)	8(80%)
Female	0(0%)	2(20%)
Step-off >4mm & >25% glenoid	3(50%)	0(0%)
Medialization	2(33%)	6(60%)
Glenopolar angle <22 degree	1(17%)	3(30%)
Angular deformity >44 degree	0(0%)	1(10%)
Road traffic accident	4(67%)	4(40%)
Fall from height	2(33%)	5(50%)
Heavy object direct impact	0(0%)	1(10%)

Road traffic accidents were the most common mechanism (67%) of injury for intra-articular fracture group and fall from height was the most common mechanism (50%) of injury for the extra-articular fracture group. The average interval between fracture and surgery was 12 days (7-24 days) for the intra-articular group &

18 days (8-32 days) for the extra-articular group, the mean operative time was 210minutes(170-280minutes) for the intra-articular group & 180 minutes (168-220 minutes) for the extra-articular group. The whole peri-operative parameters were summarized in Table 2.

Table 2: Perioperative data

Operative time(min)	210(170-280)	180(168-220)
Perioperative blood loss(ml)	520(250-1800)	450(150-1500)
Fluoroscopy shorts(number)	4(2-7)	6(4-9)
Duration of hospital stay(days)	26(18-38)	28(22-40)
Follow-up(years)	3.6(2-5.5)	3.2(2.5-5)
Interval between fracture and surgery(days)	12 (7-24)	18 (8-32)

There was no failure of instrumentations and no patients requiring revision surgery during the follow-up period. Union was achieved in all cases without further intervention with an overall average time of 6.2 months. The functional outcomes were recorded in terms of Constant score

and VAS scoring. The mean constant score for the intra-articular group was 85.5 ± 11.3 (65-98) with 2 excellent, 3 good & 1 poor result and for the extra-articular group was 84.8 ± 8.5 (68-100) with 3 excellent, 5 good, 1 fair & 1 poor result at the final follow-up (Fig. 1).

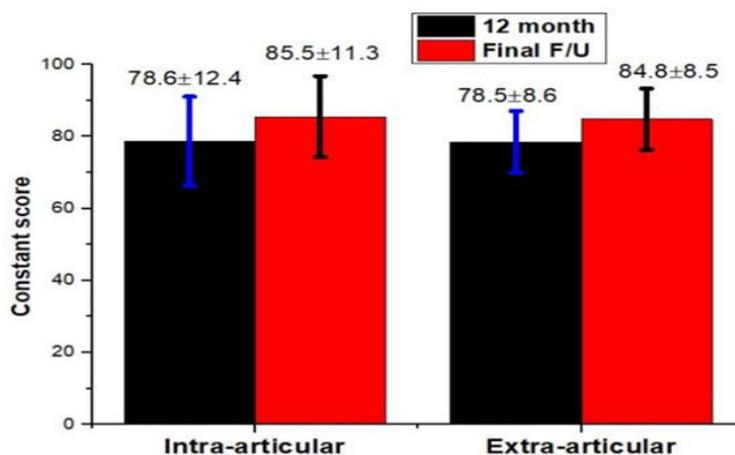


Figure 1: Mean Constant score for Intra-articular & Extra-articular fracture group at 12th month and at final follow-up.

All patients show gradual improvement of the constant score over time. Five out of six (83.3%) intra-articular fracture patients and nine out of ten (90%) extra-articular fracture patients returned to their pre-trauma day to day working life. The average VAS score significantly dropped to 1(0-3) at the final follow up for both the group. In the intra-articular group, the mean active range of motion (and standard deviation) in degrees (injured/uninjured) was 158 ± 3.85/171 ± 3.45 for abduction, 68 ± 7.18/75 ± 4.86 for external rotation, and 142 ± 4.86/148 ± 3.77 for forward

flexion (Fig. 2-A). The respective values in the extra-articular group were 162 ± 5.64/170 ± 3.45, 61 ± 7.11/77 ± 4.05 and 143 ± 6.81/152 ± 3.43 (Fig. 2-B). The mean strength in pounds (1 lb = 0.45 kg) (injured/uninjured) was 12 ± 1.67/14 ± 1.55 in abduction, 16 ± 1.78/17 ± 1.41 in external rotation, and 18 ± 2.45/21 ± 2.68 in forward flexion in the intra-articular group (Fig. 2-C) and 12 ± 2/13 ± 1.8, 15.6 ± 2.9/17 ± 2.3, and 20 ± 2/22 ± 1.7 respectively, in the extra-articular group (Fig. 2-D).

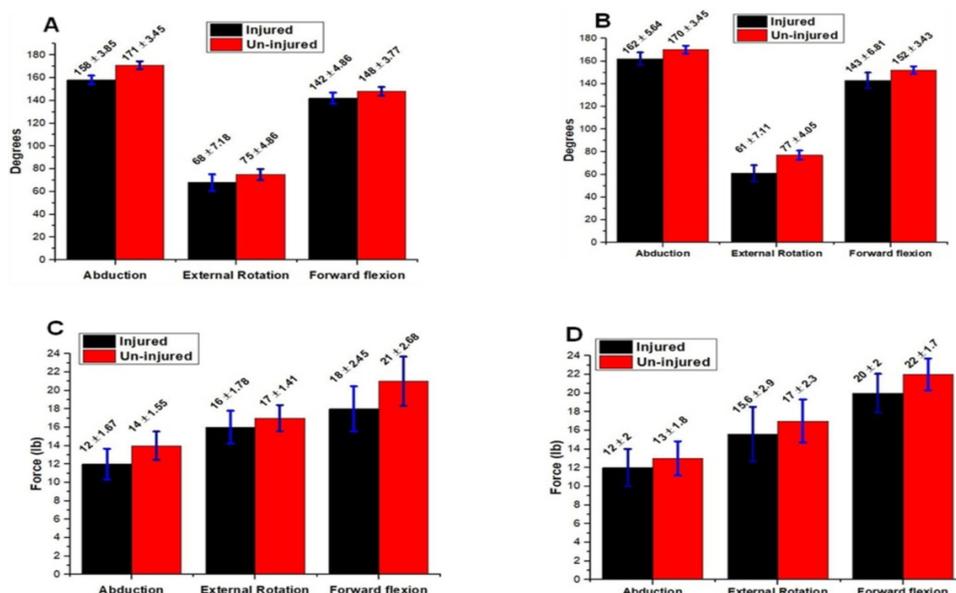


Figure 2: Comparison between ROM & Strength of operated vs non-operated shoulder for Intra-articular (A=ROM & C=strength) & Extra-articular (B=ROM & D= strength) fracture group at final follow-up.

Detailed follow up records are depicted in Figure 3-6.



Figure 3: (a,b,c) X-ray and CT of a 46 year old male with AO F1/OTA 14 C-3 type fracture.(d)4 month post-operative x-ray.(e,f,g) 4th year f/u x-ray and clinical images respectively. (h,i) 5.5 th year f/u x-ray and clinical image.x-ray shows early osteoarthritic changes.

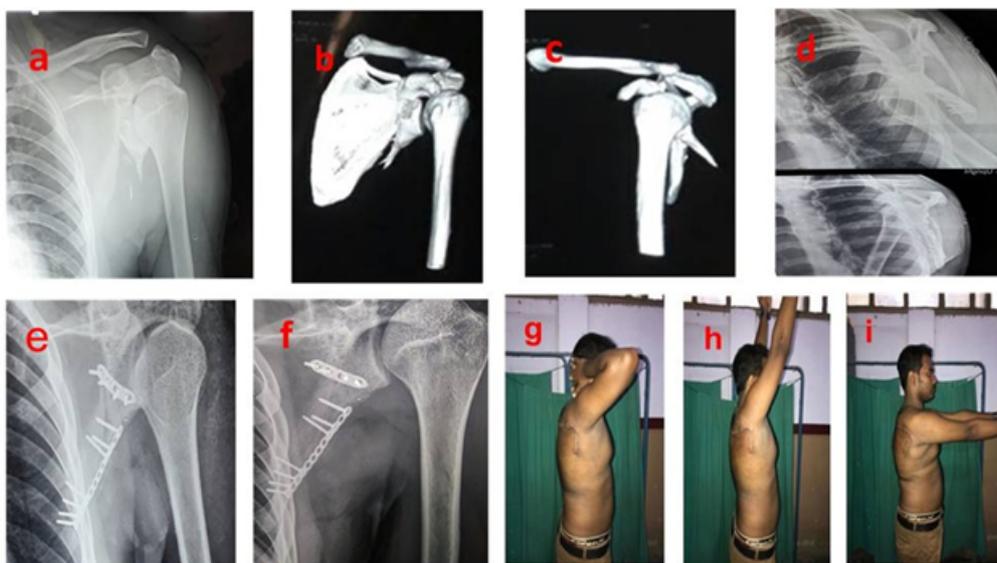


Figure 4: (a,b,c) X-ray and CT of a 25 year male patient with AO type F0/OTA 14C1 type Extra-articular glenoid neck fracture with inferior extension, (d,e) 4th post-op month xrays. (f) 4th post operative year x-ray, (g,h,i) 4^{yr} follow up clinical image

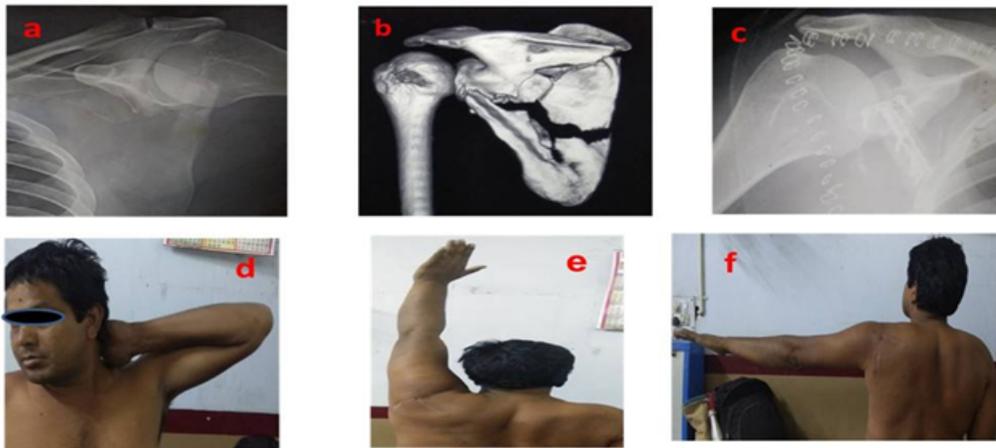


Figure 5: (a,b) X-ray and CT of a 47 years male with AO type F0/OTA 14 C1 type fracture. (c) post-operative x-ray. (d,e,f) 2nd year f/u clinical images.



Figure 6: (a,b,c) X-ray and CT of a 45 year male with AO type F1/OTA 14C3 type fracture. (d) 5 year post op xray. (e,f,g,h) 5th yr f/u clinical images.

Compared to contralateral normal shoulder, among the different parameters of Constant score, external rotation for the extra-articular group ($p < 0.05$) and abduction for the intra-articular group ($p < 0.05$) were the mostly affected, probably due to injury to infraspinatus and supraspinatus by the fracture fragments itself at the time of trauma though we could not assess the exact reason, whereas pain, activities of daily living, strength and range of movements except external rotation & abduction were the least affected overall ($p > 0.05$). Poor outcome predictors were age, neuronal injury and severe polytrauma leading to delayed operative intervention. Two cases with poor results had been associated with

suprascapular and axillary nerve injury, though they showed gradual improvement over the follow-up period. Two patients had superficial wound infection, which resolved with regular antiseptic dressing and prolonged antibiotic therapy for 3 to 4 weeks resulting in an ugly looking scar. One of six intra-articular fractures (over 45 years of age) develops early osteoarthritic changes on x-ray without any clinical deterioration at final follow-up.

Discussion

The relative infrequency of scapular fractures probably explains the limited attention it has received in literature. Though the pathophysiology is not well

understood till date, but day by day, a better understanding of the fracture pattern, mechanism of injury, residual deformities and disabilities is being brought to light. Interest in these types of scapular fractures among orthopaedic surgeons is on the rise. Literatures showed good to excellent outcomes after operative management, though they lack long term follow up. One literature shows excellent functional outcome with a five to ten years follow-up [14]. They also show that there is subtle and continued functional improvement of the same operated patients over time. So, long term follow-up has immense importance. In this study, we followed up our patients upto 5.5 years which showed encouraging outcome. All parameters of constant scores, even external rotation and abduction, showed continued improvement over time reflected by constant score. Interestingly two patients with both injured suprascapular and axillary nerve also showed a slow but gradual improvement of strength, external rotation and abduction & improved constant score at final follow-up than 12th month follow-up.

Though surgical intervention for displaced intra-articular fractures is well recommended nowadays, surgical interventions of displaced extra-articular fractures still remain controversial despite many literatures showing poor outcome after conservative management of certain fracture patterns, particularly those with a glenopolar angle of $<20^\circ$ [15,16,17]. At 2016, Schroder et al reported good functional outcomes with ORIF of 61 extra-articular scapula fractures with a 2.75 year follow-up. In this study, we found overall good 2 to 5.5 years functional outcomes in terms of Constant Score, time taken to return to work, VAS scale. Individual comparison of the range of motions and strength in different positions with that of the contralateral non-injured shoulder also showed good outcome. Overall, 87.5% of patients returned to their work. No patients require

secondary surgery and only one wound complications. [18] The limitations of this study include the lack of non-operative control group, relatively small number of patients and lack of long term follow-up. Additionally, we recognize that including both intra-articular and extra-articular neck and body fracture patterns in the study may increase heterogeneity.

Conclusion

In conclusion, operative treatment for displaced scapula fractures is a viable option if it meets certain criterias. In this study of a single-centre series, we documented upto 5.5 years the quantitative clinical measurements and functional outcomes following operative management of displaced glenoid fossa, scapular neck and body fractures. It seems reasonable to individualize treatment based on associated injury patterns, the feasibility of surgery, presence of instability between fracture fragments or at the joint and presence of gross displacement of the fragments. CT scan with 3D reconstruction has its immense importance in all displaced fractures to read the exact pattern of fracture and to plan the management protocol. One should not focus on the fracture alone. The associated injuries should also be taken into consideration during decision making. The current study shows that if we maintain the principles of fracture fixation, we can reproduce a good to excellent functional outcomes in the majority of patients for both displaced intra-articular and extra-articular scapula fractures.

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