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Original Article

Intra-articular scapular fractures: Outcomes after internal fixation

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ABSTRACT

Background: Although operative treatment may offer an appropriate management option for displaced glenoid fractures, there is sparse research assessing post-operative functional outcomes. This study assessed functional outcomes of patients after undergoing open reduction and internal fixation of displaced glenoid fractures.

Methods: Fifteen patients were treated with open reduction and internal fixation for displaced intra-articular fractures between 2005 and 2010. The indication for operative fixation was intra-articular displacement >4 mm. Post-operative functional outcomes were assessed via retrospective chart review. Evaluation included review of pre-operative imaging for fracture type, review of post-operative plain radiographs for fracture healing, Disabilities of the Arm Shoulder and Hand (DASH) and American Shoulder and Elbow Surgeon Assessment (ASES) scores at last follow-up.

Results: At a mean follow-up of 49 months (24–87 months) all patients had radiographic healing. The mean DASH score was 10 (range 0.83–29.17). Mean ASES score was 90 (range 41.7–100). No patients had evidence of hardware failure or infection.

Conclusions: Open reduction and internal fixation of displaced intra-articular glenoid fractures results in stable fixation and is associated with good functional outcome.

Level of evidence: Level IV. Case series.

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1. Introduction

Scapula fractures are rare injuries accounting for 1% of all fractures¹ and often occur in the setting of high-energy trauma.^{2,3} With typical high-energy mechanism of injury, scapula fractures often present with associated injuries (up to

88%) including fractures elsewhere in the shoulder girdle, thoracic/chest injury, head injury and spinal fracture.^{4–8}

While still controversial nonoperative treatment is the mainstay for most extra-articular scapular fractures.¹ Intra-articular glenoid fractures can lead to significant morbidity including chronic pain, instability, and early onset

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degenerative disease.⁴ For these reasons displaced intra-articular glenoid fractures have been managed surgically with good to excellent results.⁹⁻¹¹ To our knowledge there has only been one study¹¹ that has specifically assessed patient outcomes after ORIF of intra-articular glenoid fractures. The purpose of this analysis was to add to the body of research by assessing patient based functional outcomes after open reduction and internal fixation for displaced glenoid fractures.

2. Materials and methods

Institutional review board approval at the University of Southern California Health Sciences Campus was obtained prior beginning our investigation. Using a search of CPT code 23585 for open treatment of scapular fracture we were able to find forty-eight patients who undertook open reduction internal fixation of a scapula fracture at our private institution between the years of 2005 and 2010. Imaging was reviewed by

Fig. 1 – Ideberg classification of glenoid fractures into five types, with comminuted type VI of Goss added.

senior authors GFH and JMI and an attending musculoskeletal radiologist for each of these patients and twenty-five were found to have undergone internal fixation for displaced intra-articular glenoid fractures. Of these twenty-five patients only 15 (60%) met the inclusion criteria for this study primarily due to poor follow-up. Inclusion criteria was intra-articular glenoid cavity fracture with >4 mm gap or step-off or humeral head subluxation and at least 2 year follow-up.

Each of the 15 patients charts were reviewed for patient age, mechanism of injury, operative technique, DASH score and ASES score. Pre-operative imaging was reviewed and fractures were classified according to the Ideberg/Goss classification system (Fig. 1). Pre-operative imaging included XR and CT scan (Figs. 2 and 3) of the shoulder. Eight of the 15 patients (53%) had other bony injuries associated with the traumatic glenoid fracture all on the ipsilateral side (Fig. 4).

2.1. Surgical technique

The two senior authors (JMI and GFH) performed all of the operative cases studied. All patients received general endotracheal anesthesia and pre-operative antibiotics as well as prophylactic 24 h antibiotics post-operatively. Seven/15 patients were repaired via the posterior approach, 4 via anterior deltopectoral approach. Four of 15 had a combination posterior and deltopectoral approach to address both the glenoid fracture and coracoid fracture. Fluoroscopy was used to confirm reduction of fracture fragments as well as to assist with placement of the hardware. A combination of direct visualization and fluoroscopy was used to confirm hardware did not penetrate into the glenohumeral joint. All patients had drains placed which were removed post-operative day one or two.

2.1.1. Posterior approach

Pt was placed in lateral position with the affected side up. Incision was marked and made from posterior acromion along

Fig. 3 – Pre-op coronal CT.

the entire length of the scapular spine curving distally along the medial border of the scapula to the inferior angle. The deltoid muscle was identified and detached subperiosteally from the scapular spine then retracted inferiorly. Careful attention was given to bluntly separate the deltoid from the infraspinatus prior to detaching the deltoid. The infraspinatus and teres minor were then visualized and bluntly separated reflecting the infraspinatus superior and the teres minor inferior to reach the posterior glenohumeral joint and fracture fragments. For better exposure the infraspinatus was detached approximately 1 cm from the greater tuberosity and reflected medially off the spine of the scapula. In most cases the suprascapular nerve was identified and neurolysis was performed. Posterior capsulotomy was performed as needed. The fracture fragments were visualized and then reduced either manually with reduction clamps or with K-wire. Fractures were fixed with a variety of screws and plates from Synthes modular hand or craniofacial implants. When needed

Fig. 2 – Pre-op axial CT.

Fig. 4 – Post-op coronal CT.

the deltoid was reattached with suture anchors and/or transosseous sutures into the scapular spine.

2.1.2. Anterior approach

The patient was placed in supine position with head of bed elevated 30–45°. Standard deltopectoral approach was used to address glenoid fractures and coracoid fractures. To gain access to the joint the rotator interval was sharply incised and the subscapularis was taken down off the lesser tuberosity leaving small cuff of tendon for suture repair. The glenohumeral joint was visualized, fracture fragments were visualized and reduced then fixed with lag screw and neutralization plate or bridge plating as indicated. If present the coracoid fracture was visualized, reduced and fixed with K-wires.

2.2. Demographic data

Of the 25 patients found via initial search of CPT codes only 15 had adequate follow-up to include in this study. Ten patients were males. All of the patients were under age 60 at time of injury/surgery, with a mean age of 51 and a standard deviation of 9.52. Three patients sustained an Ideberg type 1 fracture, one patient a type 2, one patient type 3 and nine patients were type 5. Of note the Ideberg type I fractures were all greater than 5 mm, rim fractures that did not lead to glenohumeral instability were excluded from this study. Displacement seen on pre-operative CT imaging was a minimum of 4 mm in all patients. Mechanism of injury was traumatic in all patients: seven bicycle accidents, one ATV flip, one metrolink crash, two motorcycle crashes, one fall from a trailer, one ground level fall and one skiing injury. Eight patients sustained concomitant ipsilateral upper extremity injuries including three ipsilateral coracoid fractures, three ipsilateral clavicle fractures and two patients with ipsilateral coracoid and clavicle fractures.

3. Results

At a mean follow-up of 49 months (24–87 months) all patients had radiographic healing. At final follow-up the functional results were a mean DASH score of 10 (range 0.83–29.17), normative mean is 10.1.¹² Given this was a retrospective study pre-operative DASH scores were not taken. Mean ASES scores at final follow-up was 90 (range 41.7–100). One patient self-reported a superficial skin infection that was not seen in follow-up clinic and one patient reported repeat hospitalization for renal failure one day after discharge. The renal failure did not appear to impact this patient's functional outcome as DASH score was 5.83 and ASES was 100.

4. Discussion

The rarity of scapula fractures and the fact that most can be treated non-operatively¹ have lead to sparse research assessing functional outcome of patients who have undergone operative treatment. Many authors agree that displaced intra-articular glenoid fractures would benefit from operative

fixation though there is poor consensus regarding operative criteria. Indications include “displacement”, >/4–5 mm displacement, humerus subluxation or humeral head dislocation.^{1,2,5–7,9–11,13–17}

The recent study by Anavian et al¹¹ reported results after operative treatment on 33 patients with >/4 mm displacement of glenoid fossa fractures with or without extra-articular scapular fractures. They found a 30% strength deficit compared to the uninvolved shoulder. This strength deficit did not correlate with patients perceived function and overall patients had good functional outcome as measured by DASH and SF-36 scores.

We assessed functional outcome of 15 patients treated operatively for intra-articular glenoid fractures using DASH and ASES scores, both of which have been validated.^{12,18,19} The inclusion criteria for the study was displacement >4 mm and or shoulder instability, excluding small glenoid rim or chip fractures. Patients reported good functional outcome with minimal evidence of surgical complication.

There are limitations to this study due to the fact that it is a retrospective analysis, which limits the power of our conclusions. Due to the transient nature of the much of the trauma patient population long-term patient follow-up is difficult. This leaves the investigators limited to what is available in the patients' charts. The sample size of 15 patients did not allow for comparisons of types of intra-articular glenoid fractures. Associated injuries might have an influence on limitation in function or pain independent of glenoid fracture. For example one patient in our study had a Type 5A glenoid fracture and associated clavicle and acromion fractures. The clavicle and acromion fractures were minimally displaced and treated non-operatively which might account for her lower functional scores (DASH 23.7/ASES 41.67).

5. Conclusion

This study assessed self-reported functional outcomes of patients treated operatively for intra-articular glenoid fractures with and without scapular neck, body and other associated fractures of the shoulder girdle. We found that patients had minimal functional impairment as demonstrated by the ASES scores and scored similar to the normal population when looking at DASH scores. In conclusion, operative fixation of displaced glenoid fractures leads to stable fixation with good to excellent functional outcomes and low rate of complications.

Disclaimer

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Conflicts of interest

All authors have none to declare.

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