Long-term outcome of open reduction and internal fixation of scapular fractures

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Background
Scapular fractures occur due to direct trauma to the upper-back area. The incidence of scapular fractures is rare, with 1% of all fractures and 3–5% of upper-limb fractures. Up to 88% of these fractures occur because of high-energy mechanisms, mostly coincidentally with rib fractures due to motor-vehicle crashes. Standard treatment of scapular fractures is still controversial. There was no consensus about the best indication for surgical management and therapeutic choice of the scapular fracture.
Patients and methods
This study is a retrospective review of 13 patients with comminuted scapular fracture type V. According to Ideberg classification, 11 males and two females with a mean age of 39.7 years (range, 25–62) were treated by open reduction and internal fixation using the modified Judet approach in the lateral position between March 2014 and April 2018.
Results
The time for surgery was 5.8 days (range, 2–15). All patients achieved radiological union in almost 12 weeks, ranging from 7 to 14 weeks. The average follow-up of the patients included in the study was 3 years.
Conclusion
Open reduction and internal fixation provide an excellent outcome in patients with comminuted intra-articular fracture scapula.

Keywords:
Fixation, fractures, judet, scapula

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Introduction

Fractures of the scapula are relatively uncommon injuries, making up 3–5% of all fractures of the shoulder girdle and less than 1% of all fractures [1,2] are usually the result of high-energy trauma, and over 50% of the patients have associated injuries [3]. Approximately 10% of scapular fractures involve the glenoid articular surface. Reported series of surgically treated intra-articular fractures are small series, for example, Cofield 10 patients [4], Mayo 27 patients [5], and Schandelmaier 22 patients [6]. These series show satisfactory results in greater than 80% of patients. The most widely accepted classification of these fractures is the anatomic classification, with the intra-articular glenoid fractures being further subclassified using the Ideberg *et al*. [7] classification modified by Goss [3].

The operative-treatment criteria for scapular fracture remain controversial. There are no universal parameters that can be found in the existing literature [8,9]. Cole and colleagues reported that operative-treatment indications include an intra-articular gap or step-off more than or equal to 4 mm, medialization greater than 20 mm observed in anteroposterior view, angular deformity for equal to or more than 45° on scapular Y view, lateral-border offset more than 15 mm with angular deformity more than 30°, GPA equal to or less than 22° and displaced double lesions in superior-shoulder suspensory complex [10–12]. It is important to evaluate the functional outcomes arising from the healing process of fractures.

Patients and methods

This study included 11 males and two females with a mean age of 39.7 years (range, 25–62) (Table 1). All patients who had a scapular fracture in the period between March 2014 and April 2018 were included. This study is a retrospective review of 13 patients with comminuted scapular fracture type V, according to the Ideberg *et al*. [7] classification modified by Goss [3]. Patients were treated by open reduction and internal fixation using a modified Judet approach to the scapula [13] Preoperative radiological images were evaluated. Intraoperative patients under general anesthesia

Table 1 Patients' age, sex, and time to surgery

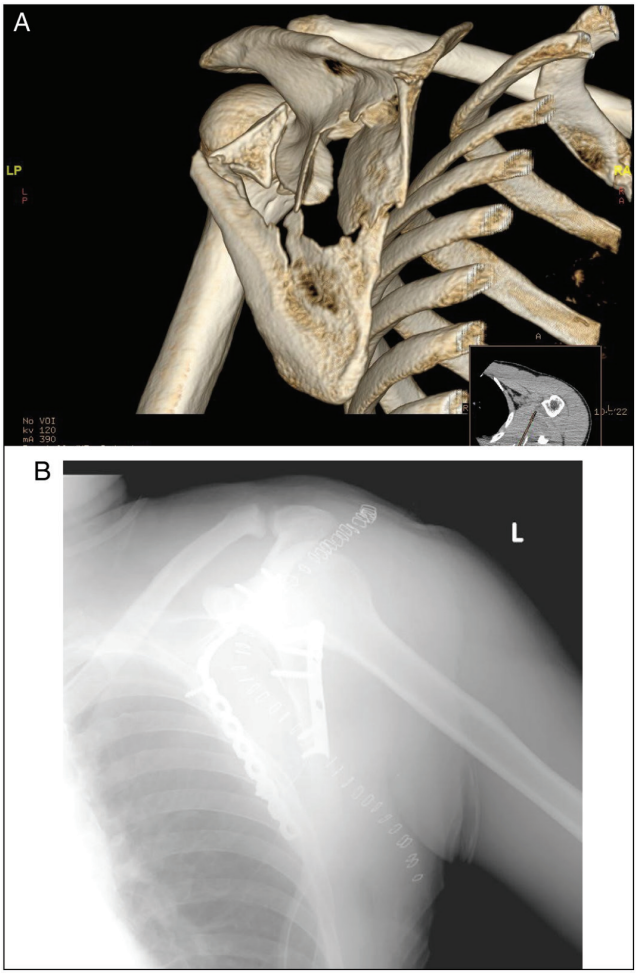
Patient no.	Age	Sex	Time for surgery (days)
1	62	Male	11
2	54	Female	8
3	35	Male	7
4	44	Male	2
5	46	Male	3
6	40	Male	2
7	29	Male	4
8	30	Male	6
9	50	Male	15
10	31	Female	5
11	33	Male	4
12	37	Male	9
13	25	Male	8

in lateral decubitus position, a straight incision starting from the posterolateral lip of the acromion extending to the tip of the scapula, then, after sharp dissection of the deltoid origin from the spine of the scapula and acromion, we went through the interval between infraspinatus and teres minor retracting the infraspinatus superiorly and teres minor inferiorly with care not to injure the suprascapular nerve or the axillary nerve, and then reduction of the fracture and fixation by interfragmentary screw (s) for the intra-articular fracture and lateral border±medial border by reconstruction plate or one-third tubular plate. Postoperatively, the patients were placed in a shoulder immobilizer for 6 weeks. An active range of motion below shoulder height was allowed. After 6 weeks, patients were allowed a full range of motion. The Disabilities of the Arm, Shoulder, and Hand (DASH) score was used to evaluate the functional outcomes.

Results

The time for surgery was 5.8 days (range, 2–15). All patients achieved radiological union in almost 12 weeks, ranging from 7 to 14 weeks. Fixation of the lateral and medial wall was done in five cases, besides the interfragmentary screw for the glenoid fracture (Fig. 1a, b), the other patient-only lateral wall with glenoid was fixed (Fig. 2a, b). The patient's average follow-up was 3 years (range, 27–43 months). By the end of the follow-up, all patients did not complain of any pain. The mean DASH score in our patients is 9.1 (range, 1.7–17.2). ROM and strength of the injured shoulder were measured and compared with the intact shoulder. As a percentage of the healthy-shoulder strength, the functional outcome of surgery in the injured shoulder started. Average range of motion of the operated shoulder produced 95% (forward flexion), 90% (abduction), and 75% (external rotation) of the same average range of motion of the other shoulder. Regarding the strength test, the percentage was 85% (forward flexion), 80% (abduction), and 70% (external rotation) of the average strength of the intact side.

Figure 1



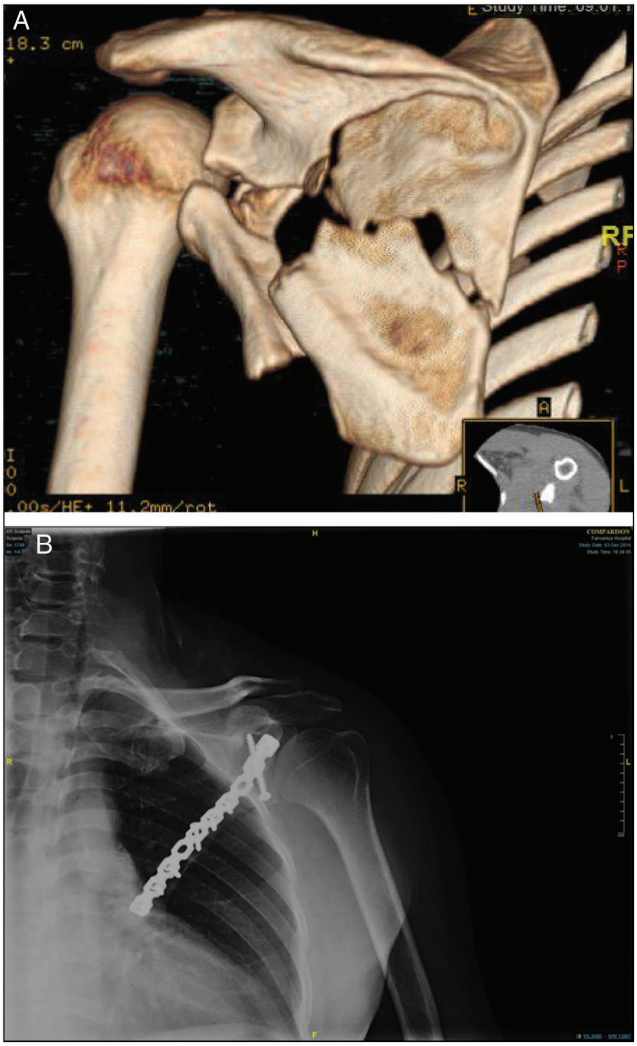
(a) Preoperative 3D CT scan of a 33-year-old male. (b) Postoperative radiograph. 3D, three dimensional; CT, computed tomography.

Discussion

Scapula fractures can interfere with shoulder function because of malalignment, rotator-cuff dysfunction, and scapulothoracic dyskinesia [14]. Conservative treatment for scapular fractures typically results in a reduced range of motion and functional outcome. Recently, open reduction and internal fixation are better recognized as a treatment option for patients with scapular fractures [15]. Most surgical indications are based on the surgeon's preferences. Scapular-fracture studies rarely reported radiographic-fracture characteristics, such as displacement and angular deformity, when evaluating the results of surgical and conservative treatment. This makes interpreting the conclusions of their research difficult [16].

This study evaluated the long-term outcomes of open reduction and internal fixation of comminuted

Figure 2



(a) Preoperative 3D CT scan of 40 years. (b) End of follow-up radiograph. 3D, three dimensional; CT, computed tomography.

scapular fractures in adult patients using a modified Judet approach. The radiological union was achieved by all patients on average in 12 weeks. At the last follow-up, there was no pain or decrease in range of motion reported by any of the patients, except one patient who underwent manipulation under anesthesia.

After conservative treatment of scapular fractures, Schofer *et al*. [17] reported 79 points of the mean Constant–Murley score on the injured side for 50 patients. According to Bozkurt *et al.* [18], the average Constant–Murley score for 18 patients with scapular neck fractures was 78.8 points after conservative treatment. The Constant–Murley score after conservative treatment for 13 patients with a scapula fracture was 90. According to van Noort and van Kampen [19] study, Rajfer *et al.* [20] evaluated the long-term functional outcomes of nonoperatively treated highly displaced scapular body and neck fractures and reported a DASH score of 8.9.

In our study, the average follow-up of the average DASH score at the latest follow-up was 9.1, which was excellent. Schroder *et al*. [16] evaluated the functional results following operative management of scapular fractures and reported a 100% union rate and a mean DASH score of 12.1 points. Vidović *et al*. [15] evaluated the outcomes and complications of treating 14 patients with scapular fractures by open reduction and internal fixation via the Judet approach, with a mean follow-up of 44 months. The mean Constant–Murley score was 93.45, with a reliable union rate. After surgical treatment of scapular neck and body fractures, Porcellini *et al.* [21] reported a mean Constant–Murley score of 82.8 for eight patients undergoing a modified Judet approach, and a mean score of 75.8 for six patients undergoing a classic Judet approach.

In this study, we used the modified Judet approach. The classic Judet approach is often associated with infraspinatus atrophy postoperatively since infraspinatus muscle must be reflected laterally to expose the infraglenoid fossa and the posterior part of the scapular neck [13].

The limitations of this study include the absence of a control group and the small number of patients, which is also present in Cofield who presented 10 patients [4], Mayo presented 27 patients [5], and Schandelmaier presented 22 patients [6]. Future studies with a larger cohort of patients would be more appropriate to evaluate the functional outcomes following operative treatment of comminuted scapular fractures.

Conclusion

Comminuted scapular fractures can be treated effectively with open reduction and internal fixation, which results in a high union rate and excellent functional outcomes.

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Conflicts of interest

No conflict of interest.

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