

Which Scapula Fractures Should We Operate on and What Are the Functional Outcomes?

Hangi Skapula Kırıklarını Opere Etmeliyiz ve Fonksiyonel Sonuçları Nelerdir?

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ABSTRACT

Aim: In this study we reported the functional results and complications of patients with scapula fractures who underwent open reduction and internal fixation.

Methods: The study included 16 patients with scapula fractures who were treated with open reduction and internal fixation (ORIF) between September 2015 and March 2022. Radiologic examination (AP in the scapular plane, lateral and axillary radiography) and computed tomography (CT) scans were performed in all patients. Fractures were classified according to the revised (AO/OTA) classification system. The patients underwent deltopectoral and posterior approaches described by Judet. Functional outcomes were measured using Constant-Murley scores.

Results: Ten patients had a scapular neck fracture, or glenoid fossa fracture, five patients had a scapular trunk fracture affecting the glenohumeral joint, and one patient had a scapular process fracture. It was accompanied by clavicle shaft fracture in five patients. The mean follow-up period after injury was 42 months (6-92 months). The mean Constant-Murley score (CMS) for the shoulder with scapula fracture was 93.8 (± 8.93).

Conclusion: Open reduction and internal fixation of displaced scapular fractures is an effective treatment option in terms of union rate and functional outcome.

Key Words: Scapula Fracture, Constant-Murley Score, Judet Approaches

ÖZET

Amaç: Bu çalışmada, skapula kırığı nedeniyle, açık redüksiyon ve internal tespit yapılan hastaların fonksiyonel sonuçlarını ve komplikasyonları araştırdık.

Yöntem: Çalışma, Eylül 2015 ile mart 2022 arasında skapula kırığı olan açık redüksiyon ve internal tespit (ARIF) ile tedavi edilen 16 hasta değerlendirildi. Radyolojik inceleme skapular planda AP, lateral, aksiller grafi ve bilgisayarlı tomografi (BT) ile yapıldı. Kırıklar revize edilmiş (AO/OTA) sınıflandırma sistemine göre sınıflandırıldı. Hastalara cerrahi teknik olarak deltopektoral ve Judet tarafından tarif edilen posterior yaklaşım uygulandı. Fonksiyonel sonuçlar, Constant-Murley skorları kullanılarak değerlendirildi.

Bulgular: On hastada skapula boyun kırığı, glenoid fossa kırığı, beş hastada glenohumeral eklemi etkileyen skapular gövde kırığı ve bir hastada skapula proçes kırığı vardı. Ayrıca beş hastada klavikula cisim kırığı vardı. Takip süresi ortalama 42 ay (6-92 ay). Omuz Constant-Murley skoru (CMS) ortalama 93.8 (± 8.93)'di.

Sonuç: Yer değiştirmiş skapular kırıkların açık redüksiyonu ve internal fiksasyonu, kaynama oranı ve fonksiyonel sonuç açısından etkili bir tedavi seçeneğidir.

Anahtar Kelimeler: Skapula Kırığı, Constant-Murley Skoru, Judet Yaklaşımı

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Introduction

Fractures of the scapula are rare injuries due to the thick muscle cover and account for an average of 0.5% of all fractures [1]. In the past, the most common treatment options were immobilization and rehabilitation. Scapular fractures are usually caused by high-energy trauma; therefore, they are associated with other multiple injuries [2]. The majority of extra-articular scapular fractures can be treated conservatively. Indications for surgical treatment of scapular fractures are controversial. Surgical treatment is recommended for severe displacement fractures, especially those involving the lateral column. Surgical indications include intra-articular glenoid fractures with 2-10 mm displacement, glenoid neck fractures with more than 10-25 mm medial/lateral displacement, angulation deformity greater than 25-45°, shortening greater than 25 mm and glenopolar angle less than 22° and floating shoulder (more than 10 mm displacement with clavicle, acromion or coronoid process fracture or acromioclavicular dislocation) [3,4]. Insufficient bone stock, complex three-dimensional anatomy, and difficult surgical incisions create problems with open reduction and internal fixation [5]. Complications vary. Treatment of extra-articular scapula fractures is due to the paucity of information on treatment outcomes and relative unfamiliarity with the treatment of these injuries. Therefore, it has historically been non-operative. However, studies are showing that intra-articular fractures and some types of highly displaced fractures have better outcomes when treated operatively. These fractures require a well-designed diagnostic study and a properly implemented rehabilitation plan [6].

This study aims to describe the surgical technique after open reduction and internal fixation in patients with scapular fractures and to report the functional results and complications on a patient basis.

Materials and Methods

The study includes 16 patients with scapula fractures who were treated with open reduction and internal fixation (ORIF) between September 2015 and March 2022. The clinical and demographic findings of the patients were obtained from the hospital records with the decision of the ethics committee. Patients' age, gender, side, anesthesia type, waiting time to start the operation, operation time, patient satisfaction with anesthesia and surgery were examined from medical records. Our surgical indication criteria are the following: medial/lateral displacement greater than 20 mm, shortening more than 25 mm, angular deformity greater than 40°, intra-articular deviation greater than 4 mm, fracture of the clavicle, coracoid or displaced acromion greater than 10 mm. All patients underwent radiological examination (AP in the scapular plane, lateral and axillary radiography) and computed to-

mography (CT) scans. Fractures were classified according to the revised (AO/OTA) classification system. The patients underwent deltopectoral and posterior approaches described by Judet. Functional outcomes were measured using Constant-Murley scores (Figure 1,2,3).

Statistical Analysis

Normal distribution analysis was evaluated using 5 parameters (skewness-kurtosis, histogram, Standard Deviation/MEAN, histogram, and Q-Q plots). The frequency of demographic data was expressed as numbers and percentages. Data are shown as median (minimum-maximum). Spearman's Rho correlation analysis was performed between clinical aspects. Biserial correlation analysis was performed between the fracture site and clinical angles. Frequency analysis between patient classifications and CMS values was evaluated using the Fisher's exact test (minimum expected value < 5). The SPSS 28.00 package program was used in the statistical analysis of the study.

Results

The mean age of the patients included in the study was 42.50±13.25 (95% CI: 35.18-49.31). The mean follow-up time after injury was 42 months (6-92 months). Sixteen patients with scapular neck fractures and glenoid fossa fractures in nine patients, scapular body fractures affecting the glenohumeral joint in five patients, and scapula process fracture in one patient were included in the study. Clavicle shaft fracture was accompanied in five patients. The injury mechanism was considered high-energy in all patients. Nine patients had more than one injury. Associated injuries in these multiple injured patients include rib fractures (n=3), pelvis fractures (n=1), thoracic vertebral fractures (n=1), pneumothorax (n=2), and ipsilateral clavicle fractures (n=5).

Union problem was seen in one patient and infraspinatus muscle atrophy was seen in two patients and no other complications were observed. Frequency analysis of the data is available in Table 1.

MLD (Medial Lateral Displacement) median value is 17.15 (0-32.60), 25% and 75% percentile values are 12.55 and 23.92, respectively.

GPA (Glenopolar Angle) median value is 34.35 (0-64.50), and 25% and 75% percentile values are 20.20 and 46.85, respectively.

AD (Angular Deformity) sagittal median value is 30.7 (0-63.00), 25% and 75% percentile values are 8.32 and 38.92, respectively,

APD (Anterior posterior displacement) median value is 13.85 (0-28.20) and 25% and 75% percentile values are 7.25 and 16.15, respectively (Table 2).

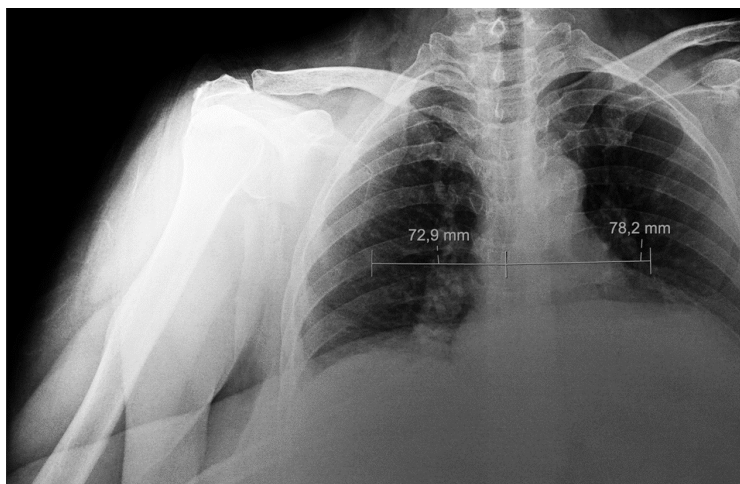


Figure 1. This is an AP radiograph of a 49-year-old female patient who has a scapula fracture.



Figure 2. Comminuted fracture of the scapular body, extra-articular with a neck fracture, 3D CT reconstruction, posterior view in the same patient



Figure 3. Post-op AP radiograph of the same patient 3 months later

Table 1. Frequency analysis of the data

		Number(n=16)	Percent (%)
Gender	Male	13	81.3
	Female	3	18.7
Classification	A3	5	31.3
	B1	1	6.3
	C1	1	6.3
	C2	1	6.3
	C3	8	50
Extra-articular	No	2	12.5
	Yes	14	87.5
Intra-articular	No	6	37.5
	Yes	10	32.5
Neck	No	12	75
	Yes	4	25
Body	No	2	12.5
	Yes	14	87.5
Clavicula Shaft	No	11	68.8
	Yes	5	31.2
Floating Shoulder	No	15	93.8
	Yes	1	6.2
Union	No	0	0
	Yes	16	100
	poor	1	6.3
	good	3	18.8
	fair	2	12.5
CMS	very good	10	62.5

Table 2. Clinically significant angle values

	Minimum	%25 percentiles	Median	75% percentile	Maximum
MLD	0	12.55	17.15	23.92	32.6
GPA	0	20.2	34.35	46.85	64.5
AD sagittal	0	8.32	30.7	38.92	63
AP displacement	0	7.25	13.85	16.15	28.2

Medial Lateral Displacement (MLD)
 Glenopolar Angle (GPA)
 Angular Deformity (AD)
 Anterior posterior displacement (APD)

There is a moderate positive correlation between MLD value and AD sagittal values ($0.5 < r < 0.7$, $p < 0.05$)

There is a high positive correlation between MLD value and AP placement values ($0.7 < r < 0.9$, $p < 0.001$).

There is a high positive correlation between AD sagittal and AP displacement values ($0.7 < r < 0.9$, $p < 0.01$).

A double-point correlation was made between the presence of fracture direction and clinical values. There is a moderate positive correlation ($0.5 < r < 0.7$, $p < 0.5$) between the presence of extra-articular fracture and the increase in the AD sagittal angle.

There is a moderate correlation between the incidence of extra-articular fractures and the increase in the AD sagittal angle.

There is a moderate positive correlation between the presence of neck fracture and increased GPA angle ($0.5 < r < 0.7$, $p < 0.1$).

There is a moderate positive correlation between neck fracture and increased GPA angle in the cases. There is a moderate positive correlation ($0.5 < r < 0.7$, $p < 0.5$) between the presence of body fracture and the increase in the AD sagittal angle.

There is a moderate correlation between the occurrence of fracture in the cases and the increase in the AD sagittal angle (Table 3).

Cross-tabulation was made according to CMS classification. In this test, where Fischer's Exact test (minimum expected value < 5) was applied, the same letters show that they belong to the same group, and different letters show that they belong to a different group.

Discussion

Surgical treatment of patients with scapula fractures has recently been better recognized as a treatment option with a predictable outcome. Conservative treatment, used predominantly in the past, has often resulted in reduced range of motion and functional outcomes. Displaced fractures of the scapula can alter shoulder girdle function due to malalignment, dysfunction of the rotator cuff, arthrosis, impingement, and scapulothoracic dyskinesia.

Esenkaya et al. in a prospective study in which anatomic plate osteosynthesis was performed in nine patients with a mean follow-up period of 39.8 (12-77) months and Miller Type 2 or 4 scapula fractures, the results were evaluated using the Herscovici score, and it was found to be a safe method allowing an early range of motion [7]. Similar results were found in our study.

Anavian et al. thirty-three patients with displaced intra-articular glenoid fractures were treated surgically. Five patients had extra-articular involvement of the scapula. A posterior approach was used in 21 patients, an anterior approach in seven patients, and a combined approach in five patients. Functional results including Arm, Shoulder, and Hand Disabilities (DASH) and Short Form-36 (SF-36) scores, shoulder motion and strength, and return to work and/or activities were achieved in thirty patients (91%). Surgical treatment of complex, displaced intra-articular glenoid fractures with or without scapular neck and body involvement has been shown to have good functional outcomes and a low complication rate [8]. They observed brachial plexus damage in one patient and suprascapular nerve damage in 8 patients. In our study, there were two suprascapular nerve lesions.

Table 3. Correlation between the presence of fracture and clinical angles

		MLD	GPA	AD sagittal	AP displacement
Extra-articular	r	0.472	0.185	0.513	0.472
	p	0.065	0.494	0.042	0.065
Intra-articular	r	-0.225	-0.084	-0.112	-0.042
	p	0.403	0.757	0.679	0.877
Neck	r	-0.298	0.689	0	-0.125
	p	0.262	0.003	1	0.643
Body	r	0.472	0.185	0.513	0.472
	p	0.065	0.494	0.042	0.065

61 patients with extra-articular fractures of the scapula were surgically treated within 20 days of injury. 49 of 61 patients (80%) were followed for ≥ 1 year (mean 33 months) after surgery. After follow-up, 100% union was observed, and mean Arm, Shoulder, and Hand Disabilities (DASH) score was 12.1 points (0-54 points). Complications and/or secondary surgery were performed in eight patients (16%). Displaced scapular body and glenoid neck fractures treated with ARIF had good functional outcomes [9].

Of the 250 patients operated for scapula fracture, 16 geriatric patients aged 65 and older were identified. Dash, Short Form Health Questionnaire versions 1 and 2 (SF-36), Range of Motion (ROM), and strength at the last follow-up of 1 year or longer were evaluated. Minor perioperative complications were seen in three patients (transient delirium in 2 patients, and urinary tract infection in 1 patient). One patient required subsequent removal of the intra-articular screw and one patient required resection of the heterotopic ossification and the implant was requested to be removed. The mean ROM ranged from 78% to 96%, and the mean strength ranged from 76% to 92%. Displaced in patients aged 65 and over operative treatment for fractures has been reported to be safe and yield good functional results [10]. No heterotopic ossification case or minor perioperative complications, urinary tract infection (delirium) were observed in our study.

Strengths and limitations of the study: When compared with the literature, there was no significant difference between the results of surgical treatment applied in such fractures and the results we found. However, the limitation of this study is the lack of a sufficient number of patients, and the follow-up period is relatively short. However, scapula fractures are rare and are mostly treated conservatively. Indications for surgical treatment are limited. On the other hand, there is no clear comparative evidence on the outcomes of fractures treated by surgical and non-surgical methods [11,12]. Therefore, there are few studies on the results of surgical treatment of scapula fractures. The results of our study may contribute to national data and/or systematic reviews and meta-analyses [13] or clinical practice guidelines [14], at least together with other studies on the subject from our country.

Conclusion

Open reduction and internal fixation of displaced scapular fractures is an effective treatment option in terms of union rate and functional outcome.

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