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Arthroscopic reduction and fixation of large solitary and multifragmented anterior glenoid rim fractures

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Background: The optimal treatment of large anterior glenoid rim fractures is still a matter of debate. The purpose of this study was to evaluate the clinical and radiologic results of an arthroscopic reduction and fixation of acute displaced large solitary or multifragmented anterior glenoid rim fractures using anchors or bioabsorbable compression screws.

Methods: Twenty-three consecutive patients (7 women, 16 men; mean age, 47.9 [15-74] years) were treated. The patients were followed up clinically (range of motion, instability testing, and shoulder outcome scores) and with conventional radiographs (true anterior-posterior, axillary, and Bernageau views).

Results: With a minimum follow-up of 24 months, 21 patients could be evaluated. The average Constant score was 84.5 points, the Rowe score was 90.8 points, the Melbourne Instability Shoulder Score was 96.2 points, the Western Ontario Shoulder Instability Index was 89.2%, and the subjective shoulder value averaged 92.1%. No patient had suffered recurrent instability. The radiologic evaluation revealed signs of osteoarthritis in 7 cases, which was pre-existing in 1 patient. Patients with osteoarthritis were on average 10 years older at the time of surgery compared with patients without osteoarthritis. A postoperative step-off of the glenoid was detected in 7 cases and averaged 2 (1-3) mm. We could not find a correlation between the step-off and the presence of osteoarthritis.

Conclusion: Arthroscopic reconstruction of acute large solitary and multifragmented fractures of the glenoid rim shows good and excellent clinical results. In the majority of cases, an anatomic reduction and healing of the glenoid fracture can be achieved. The rate of osteoarthritis needs further investigation.

Level of evidence: Level IV, Case Series, Treatment Study.

Keywords: Anterior glenoid rim fracture; arthroscopic reconstruction; screw fixation

Fractures of the anterior glenoid rim are known to occur after shoulder dislocation.[1] It is generally accepted that large fractures of the glenoid can result in persisting instability and may lead to osteoarthritis of the glenohumeral joint.[13,22] Griffith et al[11] found a prevalence of glenoid fractures of 16% in patients with a first-time

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shoulder dislocation and 38% in patients with a recurrent shoulder dislocation. This high rate of glenoid rim fractures results in the need for adequate diagnostics in every case of shoulder dislocation. Currently, there is no clear consensus for the optimal treatment of large glenoid rim fractures. However, indications for operative treatment represent a decentered humeral head and a significant dislocation of the fragment itself.[10,17]

A variety of arthroscopic procedures for the treatment of anterior glenoid rim fractures have been introduced in the last 2 decades. Cameron[6] was the first to describe the technique of an arthroscopic reduction and internal fixation using a 3.5-mm cancellous screw. Later, Tauber et al[40] reported on 10 cases of large glenoid rim fractures using 2.7-mm cannulated titanium screws, and Bauer at al[2] presented an arthroscopic transglenoidal refixation of the fragment using sutures. Sugaya et al[37] introduced a unique suture anchor technique for the refixation of large glenoid fractures, and recently Millett et al[24,25,36] performed a double-row bony Bankart bridge fixation technique and reported the results of 15 patients.

The small number of patients reported in the literature and the need for a precise analysis of the varying fracture types observed in our practice make further investigation necessary. Therefore, the purpose of this study was to evaluate the clinical and radiologic results of an arthroscopic reduction and internal fixation using anchors and bioabsorbable compression screws of acute large and displaced solitary or multifragmented anterior glenoid fractures.

Materials and methods

In this retrospective case series, we treated 23 consecutive patients with an acute large solitary or multifragmented anterior glenoid rim fracture through an arthroscopic approach. All procedures were performed by a single surgeon (M.S.).

There were 7 women and 16 men with a mean age of 47.9 (range, 15-74) years at the time of surgery. The average time from injury to surgical treatment was 12.4 (0-17) days. The most common reason for the time interval between trauma and intervention of >14 days was a delayed appearance of the patient in our outpatient department. An indirect trauma mechanism with a fall on the extended arm or an abduction/external rotation trauma was present in 13 patients. One patient had a severe car accident with multiple concomitant injuries. In 19 patients (82.6%), the initial trauma was accompanied by a shoulder dislocation. The dominant shoulder was affected in 13 patients. None of the patients reported any history of shoulder dislocation or previous shoulder surgery.

We calculated the size of the glenoid lesion according to Itoi et al.[14] The calculation was performed by an on-face 3-dimensional computed tomography (CT) scan of the glenoid with a circle drawn with a diameter of the outer fitting circle of the glenoid (A). A 45° rotated line to the anterior-posterior line of the glenoid was drawn in a best-fitting way through the fracture gap. A line orthogonal to the 45° inclined line was used to measure the distance from the outer circle to the fracture line (B). The exact value results from the calculation A × 96.5% − B/A × 100 according to Tauber et al,[40] who already used this measurement for acute anterior glenoid fractures.

Table I Classification of glenoid defects

Type I	
Acute fragment-type lesion	Ia. Osteochondral avulsion lesion
	Ib. Solitary glenoid rim fracture
	Ic. Multifragmented glenoid rim fracture
Type II	
Chronic fragment-type lesion	Malunited (extra-anatomically consolidated) or nonunited bone fragment lesion
Type III	
Chronic glenoid bone loss without fragment	IIIa. <25% bone loss of the glenoid surface
	IIIb. >25% bone loss of the glenoid surface

Classification

A recently published classification for anterior glenoid rim defects was used in this study. It is based on the Bigliani classification and distinguishes between acute and chronic defects. In addition, it incorporates the fragment and erosion type of defects published by Sugaya et al[3,31,38,39] (Table I). Acute fragment-type lesions are graded type I, with type Ia resembling a small osteochondral avulsion lesion, type Ib representing a large solitary glenoid rim fracture, and type Ic being a multifragmented anterior glenoid rim fracture. Extra-anatomically consolidated (malunited) or nonunited bone fragments are classified as chronic fragment-type lesions (type II). Type III lesions are characterized by a glenoidal bone loss without bone fragment.[31] The chronic bone loss is further separated into type IIIa with a bone loss <25% and type IIIb with a bone loss >25% of the glenoid surface.

Inclusion and exclusion criteria

We included patients with an acute fragment-type lesion with a large solitary (type Ib) or multifragmented (type Ic) glenoid fracture into this study. All resulting glenoid defects were >21% of the glenoid length, with an average of 27.5% (21.5%-36.5%) according to the calculation by Itoi et al.[14] Exclusion criteria were smaller osteochondral avulsion lesions (type Ia), chronic fragment-type lesions (type II), and glenoid bone loss (type III).