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Clinical and computed tomography–radiologic outcome after bony glenoid augmentation in recurrent anterior shoulder instability without significant glenoid bone loss

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Background: The presence of a significant bony defect in anterior shoulder instability cases warrants glenoid reconstruction surgery typically by means of an autograft. Some surgeons use the same graft techniques even in the absence of a significant bony defect, thus augmenting the glenoid surface. The goal of this study is to investigate the clinical and computed tomography–radiologic outcome after glenoid augmentation surgery.

Methods: Between 2006 and 2011, 11 patients with recurrent anterior shoulder instability and glenoid bone loss of 5% or less were treated with an iliac crest autograft. Of the patients, 9 were available for follow-up at a mean of 34.6 months (range, 12 to 80 months), including apprehension testing, Western Ontario Shoulder Instability Index, Rowe score, Simple Shoulder Value, and 3-dimensional computed tomography examination.

Results: The mean Rowe score achieved was 85.0 points (range, 51 to 100 points); Simple Shoulder Value, 80.5 points (range, 30 to 100 points); and Western Ontario Shoulder Instability Index, 373.5 points (range, 61 to 878 points). Two patients reported a recurrence of instability, and one featured a positive apprehension test. The mean glenoid surface area was 96.5% (95% confidence interval [CI], 95.5% to 97.4%) preoperatively, increased after graft implantation to 119.5% (95% CI, 105.6% to 133.3%), and decreased to 102.8% (95% CI, 98.6% to 107.1%) at follow-up, concordant to an intact glenoid surface area. From preoperatively to follow-up, the mean increase in glenoid surface area was 6.4% (95% CI, 2.1% to 10.6%; $P = .008$); in concavity diameter, 2.0 mm (95% CI, −0.9 to 4.9 mm; $P = .168$); in concavity depth, 0.9 mm (95% CI, 0.3 to 1.5 mm; $P = .005$); and in concavity retroversion, 2.4° (95% CI, −1.2° to 6.1°; $P = .178$).

Conclusion: Because of anatomic bony remodeling processes, glenoid augmentation surgery seems to be subject to extensive graft osteolysis and, consequently, unsatisfactory clinical outcome in terms of stability in some cases.

Approval from the local ethical committee of Salzburg, Austria, was obtained for this study (415-EP/73/157-2012).

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

Keywords: Shoulder instability; glenoid augmentation; glenoid defect; J-bone graft; shoulder dislocation; glenoid remodeling

Bone loss at the anterior glenoid rim in patients with recurrent anterior shoulder instability warrants glenoid reconstruction surgery,[14] which is typically accomplished by means of either iliac crest bone graft transfer or coracoid process transfer. In general, for both procedures, excellent clinical outcomes have been reported.[1,7,13] Some surgeons perform autograft-based surgical stabilizations even in the absence of a significant glenoid defect, generating a nonanatomic bony glenoid augmentation rather than glenoid reconstruction[5] (Fig. 1).

In a study merely including glenoid reconstruction cases with significant defects, Moroder et al[9] observed that iliac crest bone grafts (J-bone grafts) are subject to a remodeling or load-dependent osteolysis process that anatomically reshapes the graft. No computed tomography (CT)–radiographic outcome studies focusing on glenoid augmentation by means of iliac crest graft transfer in cases without glenoid defect have yet been published; however, concern exists regarding excessive osteolysis in cases of nonanatomic glenoid augmentation. In a recent study including mostly augmentation cases (69%), Di Giacomo et al[5] reported 60% graft osteolysis on average after a coracoid transfer procedure (Latarjet). However, no differentiated quantitative assessment of graft osteolysis between reconstruction and augmentation cases was provided.

The goal of our study was to investigate the clinical outcome and bone graft changes over time after glenoid augmentation by means of an iliac crest bone graft transfer in recurrent anterior shoulder instability cases without significant bone loss.

Methods

Study population

As is standard at our institution, all patients with recurrent anterior shoulder instability receive preoperative CT scans of their shoulders with 3-dimensional (3D) reconstruction for detection of eventual glenoid bone loss. In this retrospective case series, the institution's shoulder database was searched for all patients with recurrent anterior shoulder instability treated at our institution between 2006 and 2011 by use of an iliac crest autograft transfer despite the absence of significant glenoid bone loss. Data on 11 patients with bony defects affecting 5% of the glenoid surface or less measured according to the Pico method[4] could be retrieved. The operation performed in all cases was the J-bone graft technique as described by Resch and colleagues.[2,9,11,12] Reasons for performing glenoid augmentation surgery instead of a capsulolabral repair were failed previous Bankart repairs in 4 cases and shoulder-demanding physical activity (either professional athlete or heavy manual worker) in 7 cases undergoing primary shoulder stabilization surgery. Six patients received postoperative 3D CT scans of the affected shoulder within 2 days after surgery to ensure correct graft positioning. Of the 11 patients included in this study, 9 were available for follow-up examination, during which the Western Ontario Shoulder Instability Index, Rowe score, and Simple Shoulder Value were obtained and apprehension testing and 3D CT imaging were performed. All obtained CT images were analyzed by the measurement methods described later to determine graft remodeling and change in glenoid morphology over time. The mean time to follow-up was 34.6 months, with a minimum of 12 months and a maximum of 80 months. Of the patients available for follow-up, 2 were women and 7 were men with a mean age of 36.7 years (range, 26 to 64 years). The mean number of dislocations that occurred before the glenoid augmentation surgery was 8.5 (range, 3 to 14), with the mean time interval from the first instability episode to surgery being 7.3 years (range, 2 to 16 years). Five patients had bilateral shoulder instability. Three patients had shoulder instability of atraumatic origin, and 6 patients had their first shoulder instability episode during a sports- or work-related incident. The mean Beighton score of the study participants, as a measure of generalized joint hyperlaxity, was 2.4, with a range from 0 to 6. None of the patients had an engaging Hill-Sachs lesion.

Surgical technique

With the patient in the beach-chair position, a deltopectoral approach is performed and the subscapularis is split horizontally between the middle and inferior thirds. The anterior glenoid rim is exposed after completion of a horizontal capsulotomy. A bicortical bone block is harvested from the iliac crest and cut into the shape of a ''J'' using an oscillating saw and a high-speed bur (Fig. 2). By use of a chisel, a vertical osteotomy is made 5 mm medially to the anterior glenoid rim at an angle of 20° to the glenoid surface in the transverse plane. The J-bone graft is inserted into the osteotomy, creating a press-fit fixation, and the graft's lateral surface is then shaped by use of a high-speed bur to create a flush transition to the glenoid cartilage. The capsule and subscapularis tendon are then adapted side to side. No Bankart repair or capsular plication is performed. Postoperatively, the patient's shoulder is immobilized in a sling for 3 weeks with subsequent increasing motion and strength exercises. Sports participation is allowed after 3 to 4 months in general, and shoulder-demanding athletic activity or contact sports can be performed after 6 months.