

Bilateral bony increased-offset reverse shoulder arthroplasty in rheumatoid arthritis shoulder with severe glenoid bone defect: A case report



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ABSTRACT

A 53-year-old woman presented with 10-year history of pain and limited range of motion in both shoulders. Radiographs of both shoulders showed severe shoulder osteoarthritis with glenoid bone defect. Very thin rotator cuff and superior migration of the humerus were also observed on computed tomography images. We performed bony increased-offset reverse total shoulder arthroplasty on her both shoulders. The patient had a good clinical outcome without any particular complication.

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Recently, reverse shoulder arthroplasty (RSA) has emerged as a substitutive treatment for rotator cuff tear arthropathy in place of total shoulder arthroplasty (TSA), and favorable results have been reported. Furthermore, Young et al¹ reported good results of RSA with cancellous or structural bone graft for glenoid bone defects due to rheumatoid arthritis (RA). However, in their cases, structural bone grafting was limited to type A2 glenoids according to the Lévigne classification system.² We report on a case in which we restored the neutral lateral offset of the glenoid using a structural bone graft harvested from the humeral head and a modified long-peg glenoid baseplate (bony increased-offset RSA; BIO-RSA) in a patient with bilateral severe glenoid erosion and poor bone stock (Lévigne classification type C2 or D2) due to RA, which resulted in a good clinical outcome.

Case report

A 53-year-old woman presented with a 10-year history of pain and limited range of motion (ROM) in both shoulders. She had been

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on RA medication for >20 years. Initial radiographs of both shoulders showed severe arthritic changes with glenoid erosion, and her shoulders were classified as type D2 (right) and type C2 (left) according to the Lévigne classification system (Fig. 1).

Preoperative computed tomography arthrography (CTA) images of both shoulders demonstrated narrowing of the glenohumeral joint spaces and acromiohumeral distances, subchondral sclerosis, and multiple bony erosions in the glenohumeral joints and acromions. Very thin rotator cuff and superior migration of the humerus were also observed on CTA (Fig. 2).

The preoperative active shoulder ROMs were measured as follows: forward elevation, 100°/110° (right/left shoulder, respectively); abduction and external rotation, 70°/70°; external rotation at side, 30°/20°; and internal rotation, L3/L4. The passive ROMs were measured as follows: forward elevation, 160°/160°; abduction and external rotation, 80°/80°; external rotation at side, 30°/20°; and internal rotation, L3/L4. The preoperative visual analogue scale scores were 10 and 6 for her right and left shoulder pain, respectively.

We decided to perform BIO-RSA with structural humeral head bone grafting on the glenoid bone deficiency to restore the medialized glenohumeral joint line to neutral, and the surgery was firstly performed on the more painful right shoulder.

The surgery was performed under general anesthesia with the patient in the 30° beach chair position using the deltopectoral

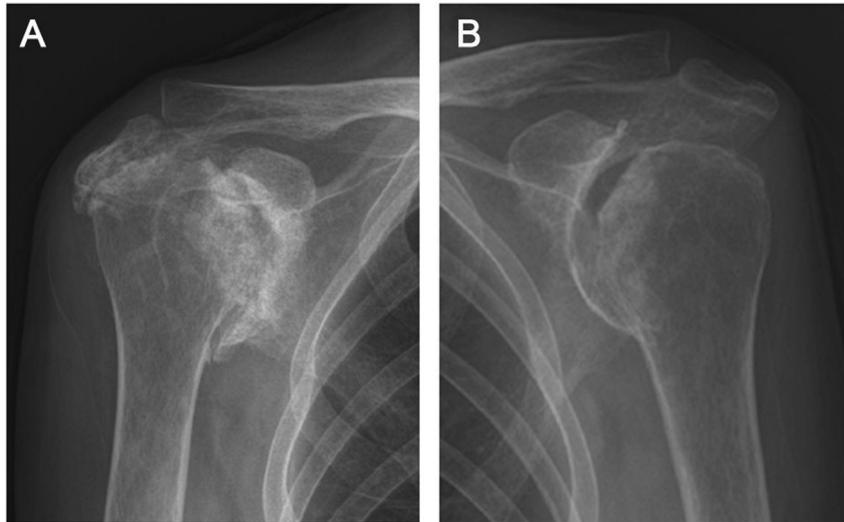


Fig. 1. Preoperative radiographs show severe arthritic changes with glenoid bone defects. The shoulders were classified as Lévigne type D2 (right) (A) and type C2 (left) (B), respectively.



Fig. 2. Preoperative computed tomography arthrography images demonstrate severe rotator cuff thinning, glenoid erosion and bone loss in right (A) and left shoulder (B).

approach. Almost all the procedure was carried out on the basis of Bolieau's techniques.³ We began with humeral osteotomy and graft harvesting. The humeral head was flattened until the subchondral bone was reached by using a graft reamer. Overreaming was avoided to preserve the hard subchondral bone. A cylinder of cancellous bone was obtained by using a bell saw. It was difficult to harvest sufficient structural humeral head bone because it was small and deformed. The harvested bone disc (8 mm in thickness) was inserted along the central peg. The cancellous portion of the bone disc was opposite the glenoid, and the subchondral portion of

the bone disc was in contact with the medial surface of the baseplate.

For the glenoid preparation, osteophytes were removed to confirm the glenoid's shape. A small reamer flattened the glenoid surface until the cancellous bleeding bone was reached. The central hole was then bored. The harvested bone disc was trimmed to fit the size of the reamed glenoid. Then the baseplate (25 mm in diameter)—with the harvested disc of bone graft—was inserted into the center hole. Two locking screws and two cortical screws were used to fix the baseplate. However, the two cortical screws

could not be fixed to the glenoid firmly regardless of their length, so the shortest cortical screws (16 mm) were used. Subsequently, the humeral step was performed using the standard surgical technique described for implantation the Aequalis reversed prosthesis (Tornier, Inc., Edina, MN, USA).⁴

The delayed rehabilitation protocol was adopted. Pendulum exercise started immediately, but any other motion was not permitted until 4 weeks postoperatively. After 4 weeks, passive ROM exercise started. After 8 weeks, active ROM exercise, except for heavy lifting, started. Three months later, radiographs and CT scans showed that the disc of the bone graft healed to the native glenoid. Then the same surgery was performed for the left shoulder at that time.

The patient had little pain in both shoulders and reported a visual analogue scale score of 1 at the final follow-up examination (25 months postoperatively). The outcome measurements for the patient included an American Shoulder and Elbow Surgeons Shoulder Score of 88, 90 and a Constant shoulder score of 82, 88. Additionally, the level of satisfaction postoperatively was >90%. There was no resorption or lysis of the grafted bone in the final radiographs of both shoulders at the two-year follow-up; however, scapular notching was observed in the right shoulder only (Fig. 3). The postoperative active ROMs were as follows: forward elevation, 170°/170°; abduction and external rotation, 80°/80°; external rotation at side, 30°/30°; and internal rotation, T12/T12 (Fig. 4). The patient was informed that the case would be submitted for publications and gave her consent.

Discussion

There is no consensus on which type of arthroplasty should be performed for RA shoulders. Resurfacing hemi-arthroplasty or stemmed hemi-arthroplasty also can be used in patients with RA.⁵

Barow et al compared RA patients treated hemi-arthroplasty and TSA, and found no clinically significant difference in outcomes. However, in patients with an intact rotator cuff, there was significantly better pain relief and a trend toward improved motion with TSA versus hemi-arthroplasty.⁶ In addition, in RA patients with severe glenoid damage, TSA or RSA are more theoretically appropriate procedures than hemi-arthroplasty. Thus, hemi-arthroplasty has somewhat limited indications in RA patients.

TSA in RA shoulder has been reported to result in good pain relief, improvements in shoulder function.⁷ However, severe destruction of the glenohumeral joint in advanced RA makes placing the glenoid component difficult because of glenoid bone deficiency. In addition, proximal humeral migration in TSA is associated with rotator cuff dysfunction.⁸ Twenty-seven percent of painful shoulders caused by RA are accompanied by full thickness rotator cuff tears.⁹ Lehtinen et al¹⁰ reported that most shoulders with RA progress to rotator cuff tear arthropathy by the 15-year follow-up. TSA in patients with advanced RA showed unsatisfactory results due to rotator cuff lesions. Therefore, RSA can be a substitute for TSA in patients with advanced RA because it has considered recently as a good treatment for rotator cuff tear arthropathy.

However, there is a risk of inferior scapular notching due to a medial shift of the center of rotation and prosthetic instability due to decreased soft tissue tension and glenohumeral impingement during RSA in advanced RA with severe glenoid bone defects.^{11,12} Metallic lateralization is achieved by increasing the offset of the glenosphere and/or baseplate and prevents scapular notching. However, it has a disadvantage of increasing the shear force applied to the glenoid component, which can potentially increase the risk of glenoid loosening or failure.¹² Especially, in RA shoulder with severe glenoid bone loss, metallic lateralization of glenoid component could not be used because of the risk. According to Boileau et al,³ BIO-RSA effectively creates a long-necked scapula,

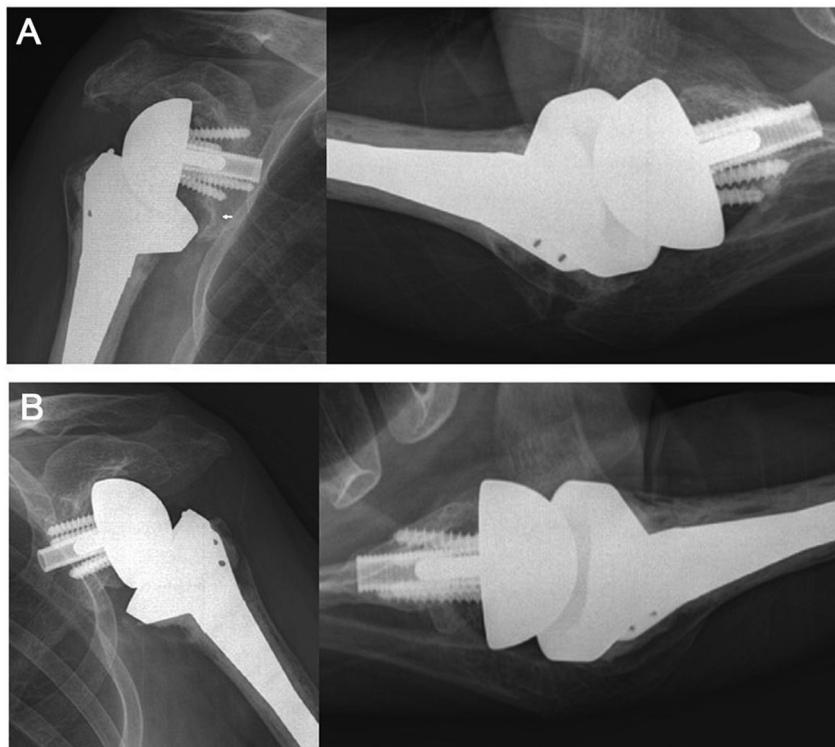


Fig. 3. Radiographs made two year postoperatively demonstrate healing of the graft. And there is no evidence of loosening of either the humeral or the glenoid component (A; right, B; left) but notching (arrow) of the inferior aspect of the scapular neck in right shoulder.

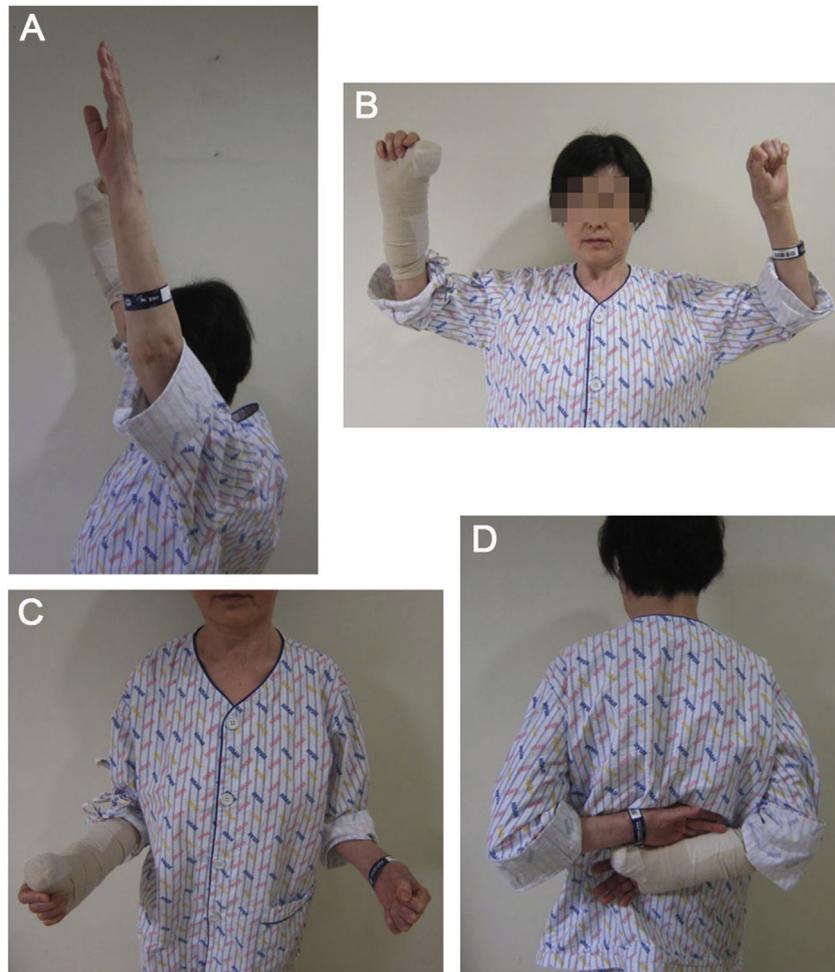


Fig. 4. Photographs of the patient at 25 months postoperatively show forward elevation, 170°/170° (A); abduction and external rotation, 80°/80° (B); external rotation at side, 30°/30° (C); internal rotation, T12/T12 (D); Notice, the first interphalangeal joint fusion was performed on the right hand due to RA deformity.

providing the benefits of lateralization, which has several advantages such as decreasing inferior scapular notching and improving shoulder rotation, prosthetic stability, and cosmetic shoulder contour. This surgical technique also minimizes torque on the glenoid component in contrast with metallic lateralization.

We followed several precautions during the operation. Firstly, we had to thoroughly remove the osteophytes to confirm the anatomical center of the glenoid, because it was important to accurately place the central peg on the center of the glenoid for initial stabilization of the glenoid component. Secondly, gentle and minimal reaming of the glenoid was required to avoid fracture of the fragile glenoid and to preserve sufficient bone stock. Lastly, postoperative rehabilitation started slowly, because the harvested bone from the humeral head was weak.

In conclusion, performing BIO-RSA in a patient with a thin rotator cuff and severe central glenoid bone defect due to RA restored the neutral lateral offset of the glenoid and resulted in a good clinical outcome. Therefore, we think that BIO-RSA is an effective substitute treatment in shoulders with advanced RA if the above-mentioned precautions are carefully considered.

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