Reverse Shoulder Arthroplasty in the Treatment of End-Stage Rheumatoid Arthritis of the Shoulder

Abstract

Background and purpose: Natural history of the rheumatoid shoulder will lead to upward migration, medialization and flattening of the humeral head causing loss of motion. Mechanically reversed shoulder Arthroplasty can prevent upward migration of humerus and restore shoulder motion. We evaluated pain relief and shoulder function after reversed Arthroplasty in RA; determined the rate of scapular notching; and determined the complication rate

Patients and Methods: We identified 76 reverse shoulder artroplasties with RA from consecutive RA patients having the surgery from 2007 to 2013. Mean follow-up was 27 months (range 12-84) and mean age at operation was 70 years (range49-90) all patients were evaluated preoperatively and at follow-up study by an independent observer (our physiotherapists). Level of pain, range of motion were recorded and radiographes taken and analyzed by an orthopaedic surgeon.

Results: Visual Analog Scale score for pain at motion decreased from 7.0 to 1.0 and score for pain at rest from 4.0 to 1.0. Some kind of complication developed to 11 (14%) patients. Notching occurred in 32% of shoulders but no loosening was seen.

Interpretation: Reverse shoulder Arthroplasty improved shoulder functions with a low incidence of complications in Rheumatoid Arthritis. We believe it should be used more often in patients with Rheumatoid Arthritis because the results with familiar total shoulders are disappointing in rheumatoid patients.

Keywords: Reverse shoulder Arthroplasty; Rheumatoid Arthritis; Shoulder Arthroplasty; Shoulder surgery; Shoulder arthroplasty; Level of evidence; Level IV; Therapeutic study

Research Article

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Introduction

Shoulder Arthroplasty is golden standard in treatment for radiologic end-stage glenohumeral osteoarthritis accompanied with pain and dysfunction of the shoulder. There are many available options for shoulder Arthroplasty, ranging from anatomic to more constrained non-anatomic reverse Arthroplasty (RSA) designs.

Rheumatoid arthritis (RA) of the shoulder affects both bony and soft-tissue structures around the glenohumeral joint and destroys the rotator cuff, and leads to loss of function, instability, and chronic incongruency of the joint. Lehtinen et al. [1] 2000 reported a natural history of 148 RA shoulders with a 15-year follow-up. The result was upward migration, medialization, and flattening of the humeral head. Accordingly, Rozing & Brad [2] and Kelly [3] detected a massive rotator cuff rupture at the time of surgery in 53%, and 30% of RA patients, respectively. Furthermore, in cases with RA and intact rotator cuff, Betts et al. [4] found a significant incongruence and postoperative upward migration of the humeral head in all cases of anatomic total shoulder Arthroplasty (TSA).

A shoulder with RA is eventually a shoulder with a massive rotator cuff tear, and therefore TSA may yield poor clinical results. However, an RSA may restore function and retain the joint congruency and alleviate the symptoms also in patients with RA. An RSA is typically recommended only for elderly patients with cuff tear arthropathy. The purpose of this study was to evaluate the short-term clinical and radiological results of RSA in patients with RA.

Patients and methods

The ethical committee of our institute approved the study. All RSA patients with RA during 2007 to 2013 were identified from the hospital records and were included in the study.

The indication for operative treatment was radiographic RA of the glenohumeral joint associated with severe refractory pain and disturbed function of the shoulder. The patients were clinically assessed for pain and shoulder function by an independent physiotherapist both preoperatively and at follow-up. Plain radiographs of the glenohumeral joint were obtained preoperatively and at follow-up, and evaluated by one of the authors. The severity of the arthritic changes in preoperative radiographs was estimated according to Larsen et al. [5]. Postoperative radiographic loosening of the humeral component was evaluated according to Sperling [6] and scapular notching according to Nerot [7].

Three experienced shoulder surgeons performed the operations. The patients were under general anesthesia in a beach chair position, and the arm was draped free. Single-dose antibiotic prophylaxis (600mg clindamycin) was used. A deltopectoral or delta split approach was chosen, and Delta 3, Delta Xtend, (De Puy, Leeds UK) or Bigliani-Flatow Trabecular Metal (Zimmer, Warsaw, USA) implants were used according to surgeon's preference. The uncemented stems of the delta system are fluted stem design based on the GLOBAL® Shoulder Stem Design positioned in the anatomic version for optimal press-fit fixation with hydroxyapatite (HA) coated titanium, and they have also cemented mono block humeral implant with polished cobalt chromium alloy for cemented fixation. Bigliani-Flatov Trabecular Metal system has titanium stems with upper part Trabecular metal coating for uncemented or cemented use.

Post-operatively the arm was immobilized for three weeks after which slow physiotherapy rehabilitation was commenced.

A t-test was used to analyze the differences between the measured pre- and postoperative parameters. A p-value < 0.05 was considered significant. SPSS Statistics software version 21.0 (IBM SPSS Statistics 21) was used for statistical analyses.

Patient Demographics

A total of 82 RA patients with RSA during the studied period could be identified. There were 76 patients available for follow-up (66 females and ten males, drop-out rate 7%). The mean age of the patients before surgery was 71 years (49-90), and the mean follow-up time was 45 months (24-84). There were 4 Delta 3, 8 Delta Xtend (2 of the 12 Delta prosthesis were cemented), and 64 Bigliani-Flatow Trabecular Metal prosthesis (12 of the 64 Bigliani-Flatow TM prosthesis were cemented). There were 63 primary operations and 13 prosthetic revisions of which seven were performed with uncemented stems. Only four patients required a glenoid bone graft. The purpose of all the revisions was to replace failed hemi Arthroplasty to the reverse one. The rotator cuff was missing in all patients at the time of operation.

Clinical result

The mean patient-reported satisfaction at follow-up was 90%. VAS score for pain decreased from 7.0 to 1.0 ($p<0.001$), and from 4.5 to 0.4 ($p<0.001$), during motion, and at rest, respectively (Table 1). Active range of movement improved concerning flexion, abduction ($p<0.001$), extension ($p< 0.04$), external and internal rotation ($p< 0.001$). The ability to reach one's head with the hand increased from 12% preoperatively to 68% at follow-up ($p<0.001$) (Table1). Patients with different prosthesis designs were essentially similar concerning demographics and preoperative radiographic findings. There were no statistically significant differences in clinical parameters between the different prosthesis designs. The revised patients had lesser flexion, abduction, extension, external or internal rotation at follow-up compared to patients with a primary procedure. However, the differences were not statistically significant. There were neither statistically significant differences with pain VAS at follow-up between the revised and primarily operated patients. The clinical results are presented in Table 1.

Table 1: Results of reverse shoulder arthroplasty in patients with rheumatoid arthritis (N=76) expressed as mean values ± SD (range).

Variable	Preoperative	Postoperative	p-value
Pain at rest (VAS)	4.5±3.5(0-10)	0.4±1.3(0-7)	0.288
Pain at movement (VAS)	7.2±2.3(0-10)	1.1±2.0(0-8)	0.014
Flexion (dg)	65.7° ± 27.7°(15°-175°)	111.3°±30.8°(35°-165°)	0.001
Abduction (dg)	55.9°±22.2°(20°-165°)	106.5°±38.8°(25°-180°)	0.01
External rotation (dg)	35.3°±10.4°(10°-60°)	39.9°±10.6°(15°-60°)	0.007
Internal rotation (dg)	32.2°±15.9°(0°-67°)	24.3°±17.6°(0°-60°)	0.004

Radiographic results

The preoperative mean Larsen score was 4,3 (2-5). At follow-up, there were no radiographically detectable lucencies around the humeral components. Scapular notching was detected in 25 patients (32%), 19 (25%) grade1, 3 (4%) grade 2, 3 (4%) grade 3, and 0 (0%) grade 4 glenoids.

Complications

One (1%) patient had acromion fracture and luxation of the prosthesis after falling six years after the operation and required open reduction and plate osteosynthesis of the acromion. Three (4%) patients had a stress fracture of the acromion and were treated conservatively. A non-traumatic dislocation was noted in 2 (3%) patients, one and two years after the operation and both were treated with an open reduction and exchange of the polyethylene liner. One redislocated after one year, and a stem revision was performed. A traumatic periprosthetic humerus fracture occurred in one (1%) patient and was treated with open reduction and a plate osteosynthesis. A traumatic intraoperative fracture occurred in one revision case when removing a well-cemented humeral component [1%]. A deep infection occurred in 1(1%) patient three months postoperatively and was treated with a two-stage revision procedure. Iatrogenic ENMG positive nerve lesion of the supra scapular nerve occurred in 1 (1%) patient and was treated conservatively. The overall complications rate was 16%.

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Discussion

We present to our knowledge the largest consecutive series of 76 RA patients treated with RSA with a mean follow-up of 45 months. Satisfaction rate was 90% with the outcome, and there was a significant clinical improvement regarding pain reduction and function of the shoulder.

Previously Guery et Al. [8] in 2006 reported that reverse shoulder Arthroplasty is contraindicated in patients with rheumatoid arthritis. This suggestion was based primarily on concerns regarding the poor bone quality and the potentially increased risk of infection.

Woodruff et al. [9] reported 17 RA patients with RSA (Delta 3) with a mean follow-up of 87 months. Radiological loosening was detected around all of the uncemented, hydroxyapatite coated humeral stems (Delta III) and five of the glenoid components.

Yong et al. [10] in 2011 recommended the use of reverse shoulder Arthroplasty only with cemented humeral components in patients with rheumatoid arthritis. They showed in their series of 18 shoulders that reverse shoulder Arthroplasty could be performed safely and effectively in patients with rheumatoid arthritis. Ekelund & Nyberg [11] reported 27 RA patients with RSA (Delta 3 or Delta Xtend) with a mean follow-up of 56 months. In their series none of the cemented humeral components were loose. Our results are by Yong et al. [10] Ekelund & Nyberg [11]. In our study, no significant loosening was detected around the humeral components. However, contrary to the previous series 82% of the stems in our study were uncemented. Earlier studies have shown notching rates ranging from 0% to 96% in RSA [12]. Notching happens within the first few postoperative months and very few shoulders that have avoided notching by one year develop notching later [8,13,14]. Scapular notching at follow-up was noted in 32% of patients, similarly to the previous series.

Poor bone quality associated with rheumatoid arthritis raises concerns of intra-operative humeral fracture, especially with press-fit stems. In a systematic review by Gee et al. [15], the overall humeral fracture risk was 10,7% in patients with RSA. Zumstein et al. [16] reported 46 fractures in 782 RSA patients (mixed population), and a humeral fracture risk of 5.9%. In our series, we had one intra-operative periprosthetic humeral fracture (cemented stem), and two revision cases had had a previous periprosthetic humeral fracture (both uncemented stems).

Our overall complication rate (16%) was comparable to previous reports [17,11,18]. The progression of destructive changes of the glenohumeral joint in RA patients may be extremely rapid. Therefore, up-to-date radiographs should be obtained before planning for operative treatment in patients with RA. The mean preoperative Larsen score was 4 in our study. However, in severely destroyed joints (Larsen 5) the bone-stock may be insufficient for implantation of the glenoid component. In our series, only four shoulders required glenoid bone graft

There are several limitations to our study. The study is a retrospective with multiple variable factors and no comparison group. Our scoring system lacks the sub strength score and therefore is not entirely comparable with Constant score. Only plain radiographs were obtained, and we do not have imaging data on e.g. the condition of the rotator cuff musculature. The follow-up time may also be regarded as short, and complications including loosening and wear are probable to occur over a longer period.

Shoulder function reaching the level of the mouth and head is a necessity of daily living. In our cohort, most of the patients were satisfied with the outcome of RSA procedure. In conclusion, we observed a significant improvement of pain and function after RSA in patients with RA. The complications rate was relatively low, and no radiological loosening of the components was detected. An RSA is a feasible treatment option in patients with RA. Further studies are needed for the long-term survival of RSA in RA patients.

Conclusion

Earlier articles have not recommended to use reverse total shoulder in rheumatoid patients and if used the recommendation is to use cemented stems. However our article points out that the early results of reversed total shoulder Arthroplasty in rheumatoid patients is good even with uncemented stems.

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