Short-term outcomes of reverse shoulder arthroplasty using Valut Reconstruction System for severe glenoid bone deficiency

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Introduction

In primary glenohumeral osteoarthritis (GHOA) or cuff tear arthropathy (CTA) with severe glenoid bone deficiency, it is challenging to achieve accurate placement and enough stability of the glenoid component. We have the surgical support tools for accurate implant placement such as preoperative planning software, intraoperative navigation, and patient-specific instrument guide. The Vault Reconstruction System (VRS; Zimmer Biomet), a novel custom-made patient-matched baseplate created from CT images, has been introduced recently. The purpose of this study was to evaluate the radiographic and clinical outcomes of reverse shoulder arthroplasty (RSA) using the VRS in patients with severe glenoid bone deficiency.

Methods

The subjects were 6 cases with 4 GHOA and 2 CTA shoulders with severe glenoid bone deficiency. All cases underwent RSA with the VRS, and the minimum follow-up duration was over one year. The evaluation items were as follows: glenoid morphology (Walch classification, Favard classification), pre- and postoperative glenoid version and glenoid inclination by CT scan as the radiographic outcome, and active range of motion, Japanese Orthopaedic Association (JOA) score, Constant score, and Shoulder 36 as the clinical outcome. Outcomes were compared using Wilcoxon signed-rank tests with $p < 0.05$ considered significance. This study was approved by the institutional review board and we got informed consents from all the included patients.

Results

The mean age at surgery was 82.3 years. The mean follow-up period was 15 months. This study included one Walch B2 and five B3 glenoids, and four Favard E1 and two E3 glenoids. Glenoid version improved 13.7 degrees retroversion to 2.4 degrees anteversion, and glenoid inclination improved 8.7 degrees to -2.2 degrees. Active range of motion was 56.7 degrees of flexion, 51.7 degrees of abduction, and 6.7 degrees of external rotation preoperatively, and significantly improved to 120.0 degrees, 86.7 degrees, and 16.7 degrees respectively at final follow-up. As for clinical outcomes from preoperative to final follow-up, the JOA score improved from 39 to 60, the Constant score improved from 19.3 to 64.1, and Shoulder 36 improved from 10.2 to 19.7. All implants were radiographically stable without loosening, and there were no complications.

	Preoperative	Final follow-up	*p* value
Glenoid version	-13.7 ± 7.3	2.4 ± 3.3	< 0.01
Glenoid inclination	8.7 ± 7.3	-2.2 ± 2.3	< 0.01
Flexion	56.7 ± 19.5	130.0 ± 27.2	< 0.01
Abduction	51.7 ± 20.3	111.7 ± 33.4	< 0.01
External rotation	6.7 ± 8.0	21.7 ± 10.7	< 0.05
JOA score	39.0 ± 6.8	81.8 ± 8.3	< 0.01
Constant score	19.3 ± 8.5	65.8 ± 9.2	< 0.01
Shoulder 36	10.2 ± 3.9	18.7 ± 2.8	< 0.01

Discussion

RSA using the VRS is a novel surgical technique that can obtain accurate baseplate implant placement and good clinical outcomes in patients with severe glenoid bone deficiency. The disadvantages of this technique are high medical costs and the time required to create the VRS. The limitations of this study were short-term follow-up, the small sample size, and no control group. We should determine mid- and long-term outcomes and compare the outcomes with other standard techniques such as bone graft.

Significance

This study provides the novel surgical technique for the osteoarthritic shoulder with severe glenoid bone deficiency.

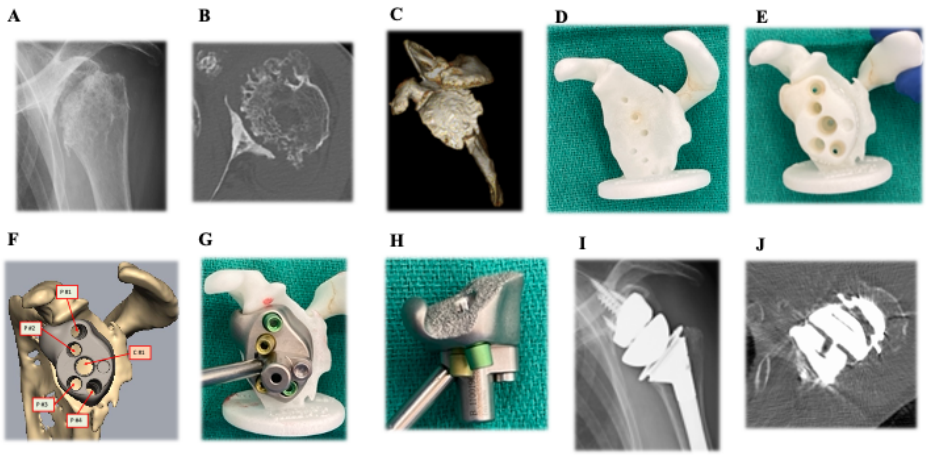

Figure 1 RSA with the VRS. (A) Preoperative X-ray AP view. (B) Preoperative CT axial image; Walch B3 glenoid. (C) 3D reconstruction image produced from CT scan. (D) 3D scapula bone model produced by 3D printer. (E) Prototype of VRS implant. (F) Proposal notification for screw insertion. (G) The final VRS implant with scapula bone model. (H) The VRS implant (the right side is anterior edge). (I) Postoperative X-ray AP view. (J) Postoperative CT axial image.