J Shoulder Elbow Surg (2017) ■■, ■■–■■

ELSEVIER

Journal of Shoulder and Elbow Surgery

www.elsevier.com/locate/ymse

ORIGINAL ARTICLE

Use of a shorter humeral stem in revision reverse shoulder arthroplasty

Eric R. Wagner, MD, Joseph M. Statz, MD, Matthew T. Houdek, MD, Robert H. Cofield, MD, Joaquin Sánchez-Sotelo, MD, PhD, John W. Sperling, MD, MBA*

Department of Orthopedic Surgery, Mayo Clinic, Rochester, MN, USA

Background: The purpose of this study was to examine the outcomes of revision reverse arthroplasty using short bone-preserving humeral components in revising a long-stemmed component.

Methods: During a 7-year period, 39 patients who underwent revision reverse shoulder arthroplasty using the long to short humeral component technique were included. The mean age was 72 years. Prior implants used in the primary setting included anatomic (n = 26), hemiarthroplasty (n = 11), and reverse (n = 2).

Results: At a follow-up of 3 years (2-5), 5 shoulders (13%) required revision surgery, including 1 for a periprosthetic humerus fracture and 4 for glenoid component loosening. The survival free of revision for any reason and revision for humeral disease was 84% and 94%, respectively. One patient experienced a nondisplaced greater tuberosity fracture at 18 months postoperatively that healed without operative intervention. There were no dislocations or infections. Overall, patients experienced excellent overall improvements in their pain levels and shoulder motion ($P < .001$), with a postoperative 91% satisfaction rate as well as postoperative American Shoulder and Elbow Surgeons score of 68 and Simple Shoulder Test score of 6.7. At most recent radiographic follow-up, 1 (5%) patient had grade 3 humeral lucency.

Conclusions: Preserving bone stock through conversion to a shorter reverse humeral stem in the revision setting is a reasonable option with good short- to intermediate-term results and low rates of humeral complications. Using the shorter stem components provides adequate stability and high rates of humeral component ingrowth.

Level of evidence: Level IV; Case Series; Treatment Study

Keywords: Revision; reverse; arthroplasty; long; short; humeral; component

Since its introduction in the United States in the early 2000s, the incidence of and indications for reverse total shoulder arthroplasty (RSA) have expanded rapidly with good outcomes.[35] In addition to its expansion in the primary setting, the indications for the reverse prosthesis have continued to expand in revision shoulder arthroplasty. Recent reports have demonstrated promising results when the reverse prosthesis is used to revise a primary hemiarthroplasty, total shoulder arthroplasty, or RSA.[1,3,6,9,11-13,21-23,25,26,28,31]

Approval for this study was provided by the Mayo Clinic Institutional Review Board: 12-007498. Each author certifies that his or her institution approved the human protocol for this investigation and that all investigations were conducted in conformity with ethical principles of research.

Investigation performed at the Department of Orthopedic Surgery, Mayo Clinic, Rochester, MN, USA.

*Reprint requests: John W. Sperling, MD, MBA, Department of Orthopedic Surgery, Mayo Clinic, 200 First Street SW, Rochester, MN 55905, USA.

E-mail address: sperling.john@mayo.edu (J.W. Sperling).

1058-2746/$ - see front matter © 2017 Journal of Shoulder and Elbow Surgery Board of Trustees. All rights reserved.
http://dx.doi.org/10.1016/j.jse.2017.01.016

Similar to recent innovations within total hip arthroplasty, there has been increasing interest in short, metaphyseal-fitting humeral prostheses in anatomic shoulder arthroplasty and RSA. Specifically in RSA, short humeral prostheses have been shown to have good outcomes with little or no radiographic signs or clinical loosening.[14,16,19,22,30] In the primary setting, one of the theorized benefits of these implants is preservation of bone stock if revision surgery is required.

If these shorter stems truly preserve metaphyseal bone stock, it is reasonable to extrapolate this logic to the revision setting, particularly in the revision of a long-stemmed humeral prosthesis even in the setting of deficient diaphyseal bone stock. Using a shorter stem would allow the surgeon to perform a revision RSA without the need to sacrifice more metaphyseal bone from an already compromised humerus, thus avoiding the need for a very long humeral stem or megaprosthesis. Furthermore, in patients with cemented primary humeral components, it avoids the need to remove distal cement and the associated thermal risk to the radial nerve. Other theoretical advantages involve a lower fracture risk, avoidance of interfering with any future elbow arthroplasties, and preservation of humeral blood supply by avoiding extensive surgical dissections. Currently, there is a paucity of studies in the literature regarding the outcomes of revision RSA using these short-stemmed humeral implants after primary shoulder arthroplasty with a regular or long-stemmed humeral component. Given this lack of information, we sought to investigate these outcomes. The specific purpose of this study was to examine the outcomes of revision RSA using short, bone-preserving humeral components for failed primary shoulder arthroplasty that used a long-stemmed humeral component in the primary setting.

Patients and methods

We used our institutional prospectively collected total joint registry.[5] Briefly, the total joint registry prospectively collects information pertaining to patients, surgeries, and surgical outcomes after total joint arthroplasty. Follow-up intervals beyond the preoperative consultation include 3 months, 1 year, 2 years, 5 years, and 10 years and then every subsequent 5 years.[20] We used the electronic medical record to capture anything not captured by this registry.

Patient demographics

From January 1, 2005, through December 31, 2012, 39 procedures involved revision of a regular or long-stem primary anatomic (n = 26), hemiarthroplasty (n = 11), or reverse (n = 2) to a reverse prosthesis with a short metaphyseal-fitting humeral stem (long to short technique) with >2 years of follow-up (Fig. 1) by 3 fellowship-trained shoulder surgeons. Although there were initially 47 patients who underwent this technique, 8 patients were excluded because they were lost to follow-up (<2-year clinical follow-up because of death [n = 5] or failure to return to the 2-year appointment [n = 3]). Demographics are summarized in Table I. The primary indications for revision surgery were instability or subluxation (n = 23), glenoid loosening (n = 10), and combined instability and glenoid loosening (n = 6). Indications for a shorter humeral stem do not include a prior infected total shoulder arthroplasty or humeral stem loosening.

Surgical details

There were 3 different implant systems of metaphyseal-fitting humeral components, including 1 Encore Reverse Shoulder Prosthesis (DJO Surgical, Austin, TX, USA), 2 Delta III and 1 Delta Xtend (DePuy Orthopaedics, Warsaw, IN, USA), and 35 Comprehensive Reverse Shoulder (Zimmer/Biomet, Warsaw, IN, USA). The implants were implanted in an average 26° (range, 15°-30°) of retroversion. No humeral components required augmentation with bone graft. All 14 of the cemented primary humeral components were recemented in the revision procedure using a cement-within-cement technique (Fig. 1). Eleven glenoid components required

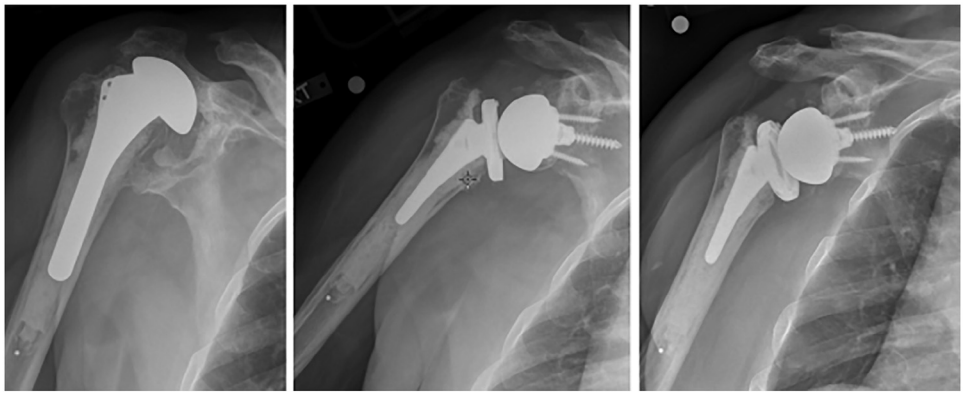

Figure 1 A 69-year-old man with osteoarthritis who developed a chronic rotator cuff tear associated with humeral head escape and glenoid loosening after anatomic shoulder arthroplasty. He underwent revision reverse shoulder arthroplasty to a short humeral stem using the cement-within-cement technique and remained stable 2.5 years postoperatively.