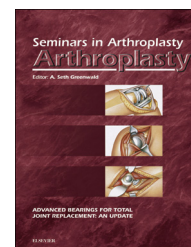


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Proximal humerus fractures should be treated with a reverse shoulder replacement

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ARTICLE INFO

Keywords:

hemiarthroplasty
reverse shoulder arthroplasty
proximal humerus fracture
shoulder arthroplasty

ABSTRACT

Historically, fractures of the proximal humerus not amenable to closed treatment or internal fixation have been treated with hemiarthroplasty. Clinical outcomes following hemiarthroplasty have been variable and difficult to predict. Results are often correlated with increasing age, tuberosity healing, and tuberosity position. Reverse shoulder arthroplasty has demonstrated effectiveness in elderly patients with rotator cuff arthropathy and has been increasingly employed for complex fractures in older patients. Several small trials have compared the reverse arthroplasty and hemiarthroplasty for acute fractures, and reverse shoulder arthroplasty has demonstrated more reproducible results in elderly patients.

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1. Introduction

The proximal humerus is the location for the third most commonly occurring fracture [1]. In 1970, Neer [2] illustrated the four-part classification system for proximal humerus fractures, and fractures displaced greater than 1 cm or angled 45° were considered displaced. In the following article, Neer [3] described the treatment of displaced three- and four-part proximal humerus fractures; and in four-part fractures, replacement with a prosthesis was noted to provide outcomes that were satisfactory and superior to closed or open reduction.

Currently, most minimally displaced fractures of the proximal humerus are treated nonoperatively [4]. Fractures with severe displacement, risk for osteonecrosis, substantial articular damage, risk of nonunion, or risk of implant failure are treated with arthroplasty; and in the past, hemiarthroplasty

was the gold standard [5,6]. Nevertheless, results of hemiarthroplasty for displaced proximal humerus fractures have been variable. The procedure is technically demanding, and clinical results are often correlated with healing and position of the tuberosities [7,8]. A small volume of operative cases has also been shown to decrease the clinical outcome results [8].

With the difficulty in obtaining consistent predictable outcomes, alternatives to hemiarthroplasty have been examined. Modern designs of reverse shoulder arthroplasty (RSA) began with Grammont et al. [9]. The procedure has been shown to be highly effective in low-demand elderly patients for the treatment of glenohumeral arthritis with rotator cuff deficiency [10–12]. The application of RSA to treat proximal humerus fractures allows less reliance on function of the tuberosities, and early studies have demonstrated good results [13–16]. Comparison trials have started to examine

All work was completed at Icahn School of Medicine at Mount Sinai, Department of Orthopaedic Surgery.

Evan L. Flatow, MD receives royalties from Zimmer and Innomed. Bradford O. Parsons, MD is a consultant for Zimmer and Arthrex. Paul J. Cagle, MD has nothing to disclose.

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<http://dx.doi.org/10.1053/j.sart.2014.02.003>

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the clinical outcome differences between RSA and hemiarthroplasty for proximal humerus fractures.

2. Hemiarthroplasty

Hemiarthroplasty has functioned as the standard for proximal humerus fractures not amendable to open reduction and internal fixation or closed treatment, but the results have not been as predictable. Antuna et al. [6] reported on the Mayo Clinic experience of hemiarthroplasty for proximal humerus fractures. They examined 57 patients with a minimum of 5 years of follow-up. Of the 57 patients, 30 were noted to have unsatisfactory outcomes by the Neer rating scale, and the range of motion was found to be variable and unpredictable. Boileau et al. [7] reviewed 66 patients undergoing hemiarthroplasty for fracture with an average follow-up of 27 months. Twenty-eight patients were unsatisfied; and at final follow-up, 33 patients had tuberosity malposition noted, which correlated with an unsatisfactory outcome. Kralinger et al. [8] examined 167 patients treated with hemiarthroplasty for fracture. Healing of the tuberosities significantly influenced subjective symptoms and Constant scores, and likelihood of tuberosity healing was inversely correlated with increasing age. Tuberosity successful healing was also more likely at institutions where more than 15 hemiarthroplasty procedures had been performed.

Despite the issues with tuberosity position and healing, hemiarthroplasty has been shown to improve pain. Olerud et al. [17] randomized patients with a displaced four-part proximal humerus fracture to either hemiarthroplasty or nonoperative treatment. Fifty-five patients with a follow-up of 24 months demonstrated treatment with hemiarthroplasty to produce an improvement in pain control, but there was not a difference in range of motion. The conclusion suggested a significant advantage for quality of life with hemiarthroplasty over nonoperative treatment.

Due to the unpredictability of the procedure, some studies have examined fracture-specific implants. These implants are generally designed to incorporate tuberosity fixation, bone grafting, and ingrowth materials. Krishnan et al. [18] retrospectively reviewed 112 patients with a fracture-specific hemiarthroplasty stems for proximal humerus fractures, and they compared those patients to 58 patients with a conventional prosthesis. American Shoulder and Elbow Surgeons (ASES) Score, active elevation, active external rotation, and tuberosity healing were superior with a fracture-specific stem, but superior fracture-specific stem results have not been consistent across all studies. Kontakis et al. [19] examined 28 patients with a proximal humerus fracture treated with a fracture specific stem. Improvement in Constant scores, forward elevation, abduction, and external rotation were correlated with the ability to obtain an anatomic tuberosity reconstruction, but the difference between the values was not significant for nonanatomic reconstruction. Loew et al. [20] examined 39 patients with three- or four-part proximal humerus fractures. Twenty-one patients were treated with an anatomic hemiarthroplasty and 18 patients were treated with a hemiarthroplasty stem designed for fracture. Results did not demonstrate a significant difference

in the clinical outcomes or the tuberosity healing between the different designs. Thus, studies have not consistently demonstrated a fracture-specific implant to be a superior answer to the unpredictability of tuberosity alignment and healing in hemiarthroplasty for fracture.

3. Reverse shoulder arthroplasty

RSA has demonstrated good results and improvement in pain control when utilized for proximal humerus fractures. Lenarz et al. [16] retrospectively reviewed 30 patients with three- or four-part proximal humerus fractures treated with RSA. Mean active forward elevation was 139°, and mean active external rotation was 27°. Overall, patients had an improvement in function and pain. RSA also offers the advantage of treating a displaced proximal humerus fracture with less reliance on tuberosity healing, and this may allow RSA to produce more predictable results. Klein et al. [13] performed a prospective analysis of 20 patients with a comminuted proximal humerus fracture treated with a RSA in which the tuberosities were resected in all cases. The mean age in their study was 75 years; and with their technique, patients demonstrated an average postoperative forward elevation of 122.7° and abduction of 112°. Levy and Badman [14] described a technique for using a wedge horseshoe graft for the tuberosities. Seven patients were examined, and all but one obtained tuberosity union. Mean active forward elevation was 117°, and mean active external rotation was 19°. In their series, no patient was unsatisfied with their outcome. Bufquin et al. [15] examined 43 patients with a mean age of 78 with three- or four-part proximal humerus fractures, and all patients were treated with a RSA. Anatomic reconstruction of the tuberosities was noted in only 17 patients, but there was not a



Figure 1 – Preoperative AP view of proximal humerus fracture with significant tuberosity and head displacement in an elderly patient.

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