Custom Reverse Total Shoulder Arthroplasty

Brian T Grisez1, Mark A Goodman2 and Brock A Lindsey1*

1Department of Orthopaedics, West Virginia University, Morgantown, WV, USA
2Department of Orthopaedic Surgery, University of Pittsburgh Medical Center, Pittsburgh, PA, USA

Abstract

Reverse total shoulder arthroplasty (rTSA) initially faltered because of glenoid component failure. Modern design utilizes a large glenosphere component and relies upon a functional deltoid for arm elevation. We report novel use of rTSA to revise a chronically dislocating TSA. The patient underwent proximal humeral resection for chondrosarcoma, requiring sacrifice of the deltoid and all proximal insertions including the latissimus dorsi. Two years post-operatively, he had good stability, no pain, and was using his arm more than he had in years. rTSA is a salvage option for failed TSA, even with absent deltoid function and lack of a latissimus.

Keywords: Reverse total shoulder arthroplasty; Proximal humeral neoplasm; Shoulder arthroplasty dislocation

Introduction

Reverse total shoulder arthroplasty (rTSA) has gained significant popularity in the past decade. Although introduced in the 1970s, it initially failed to gain popularity because of unacceptable failure rates of the glenoid component. However, the modern rTSA design by Grammont, which utilizes a large glenosphere component, has become the treatment of choice for severe cuff-ear arthropathy and is the only indication approved by the Food and Drug Administration (FDA) [1,2]. Because of its success, its uses have been expanded to treat other shoulder pathology including proximal humeral neoplasms, non-union fractures, and also as a salvage procedure for failed conventional arthroplasty [3-6]. We report a novel use of the reverse total shoulder arthroplasty in a patient who underwent multiple revisions of an unconventional arthroplasty with a constrained proximal humeral component. His initial indication for replacement was a proximal humeral resection for a bony neoplasm, which required sacrifice of the deltoid muscle and removal of latissimus insertion. Because the design relies upon a functional deltoid to permit arm elevation, it is typically contraindicated when there is severe neurologic impairment or absence of the muscle [1].

Case Report

A 63-year-old man presented in 2004 for an elective rotator cuff repair of his right shoulder. About this time, he began to have pain in his left shoulder which was worse at night and often awakened him from sleep. Examination did not reveal any specific pathology; he had full range of motion (ROM) and exceptional strength in the entire arm, including the shoulder. A radiograph of the arm revealed a mass suspicious for a bony neoplasm. In January 2005, the patient underwent limb-sparing surgery requiring removal of the proximal half of his humerus, as well as the majority of the deltoid muscle. A hemiarthroplasty was also performed to salvage function of the arm. The patient had a revision in February 2008 because of chronic dislocation of his hemiarthroplasty; the hemiarthroplasty was converted to a total shoulder arthroplasty with a constrained proximal humeral component. Unfortunately, the patient had recurrent anterior dislocations (Figure 1), limited ROM in the joint, and pain. On examination, the implant could be palpated just deep to the skin. Three treatment options were considered: 1) non-operative management; 2) complete explant of all hardware, which would leave him with a flail shoulder; and 3) replacing the constrained implant with a custom reverse prosthesis. After extensive discussion and collaboration with Biomet, Inc. (Warsaw, IN), a custom reverse total shoulder prosthesis was designed. The patient underwent surgery in August 2012 (Figure 2); his hospital course was unremarkable. At the 10-week follow-up, he reported some burning pain over his lateral shoulder at about the level of the prosthetic stem-humeral junction, which radiated into his forearm. It was felt that his pain was secondary to a brachial plexus traction neuropathy due to a lengthening of the arm with the new prosthetic components and lack of deltoid for active reduction of his shoulder joint. The patient was started on Pregabalin 75 mg three times a day and given a sling to use when performing physical activity like walking. At his two-year follow-up, he was using his left arm more than he had in years. His active ROM of his left shoulder included 20° of abduction, 5° of forward flexion, and 30° of internal rotation with a functional range of motion.

Figure 1: The anterior-posterior (AP) radiograph identifies a custom constrained-type total shoulder arthroplasty with evidence of dislocation and superior anterior displacement of the humeral component.

*Corresponding author: Brock A Lindsey, Department of Orthopaedics, West Virginia University, PO Box 9196, Morgantown, WV 26509-9196, USA, Tel: 3042931317; Fax: 3042937070; E-mail: blindsey@hsc.wvu.edu

Received April 25, 2017; Accepted May 23, 2017; Published May 25, 2017


Copyright: © 2017 Grisez BT, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.
extension (Figures 3 and 4). Range of motion of his left elbow included full extension and 150° of flexion with normal hand function. He had had no symptoms of brachial plexopathy, was off all medication, and reported no episodes of instability or pain.

Discussion

Although severe impairment of deltoid function is a relative contraindication to rTSA, we present a case where such an implant was used in a patient who had no deltoid muscle or active latissimus. Currently accepted indications for rTSA include rotator cuff tear arthropathy (CTA), proximal humeral neoplasms, non-union fractures, and as revision procedure for failed traditional replacement or hemiarthroplasty [3-6].
surgery. To our knowledge, there is no other literature describing use of rTSA and concurrent repair of a deficient deltoid.

The reported complication rate after rTSA varies from 19% to 68% and the most frequent complications include neuropathy, infection, scapular notching, dislocation, fractures, and baseplate failure [15]. Post-operative neuropathy, as seen in our patient, may be the result of intraoperative traction or manipulation, retractor placement, or lengthening of the arm secondary to the humeral stem implant [15,16].

Clinically significant neurologic injury has been reported in 1% to 4% of all patients undergoing rTSA [17]. Inherent to the operative technique, the humerus is externally rotated, abducted, and retracted posteriorly to allow for appropriate glenoid exposure, which may place stress on the brachial plexus resulting in neuropathy [1]. Revision may be an additional factor causing neurologic injury compared to primary rTSA because of dissection in distorted anatomy and difficulty with component removal. Interestingly, neuropathic pain developed as a delayed complication, rather than immediately in the post-operative period. This complication was likely due to arm lengthening during activity secondary to unopposed forces of gravity but was not apparent early on because of the use of the shoulder immobilizer.

Conclusion

The goal of surgery was to relieve pain, improve elbow/hand function, and prevent dislocation. Active abduction and elevation were severely limited but the patient reported more use of his arm without instability compared to before surgery. An rTSA should be considered for salvage even without any functional deltoid or latissimus function.

References