Case Report: Porous Tantalum Augment Used To Address Significant Glenoid Deficiency in Revision Total Shoulder Arthroplasty

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Total shoulder arthroplasty can provide significant pain relief as well as improvement in function.[1] Glenoid component failure is a common mode of failure for unconstrained total shoulder arthroplasty.[2,3] Fixed posterior subluxation combined with excessive glenoid retroversion may result in premature loosening of the glenoid component due to asymmetric load distribution in the horizontal plane.[4] A clear consensus on the results of corrective measures to address fixed posterior subluxation is not available.[5-7] Multiple options to address bony deficiency at the time of glenoid component revision exist including allograft and autograft augmentation in a single or two stage revision.[2,8-11] In addition to the potential morbidity of these graft sources, nonunion, dissolution, and loss of fixation as mechanisms of failure of both grafts has also been reported [5,12-14]. While structural porous tantalum has been successfully utilized in other adult reconstruction applications, to our knowledge, the use of a porous tantalum augment to successfully address significant glenoid bone loss has not been previously reported.[15] We present a case of a failed glenoid component presenting with significant glenoid bone loss and fixed posterior subluxation managed with a porous tantalum augment at the time of revision arthroplasty. The patient was informed that data concerning his case would be submitted for publication and consented.

Case Report

A 61-year-old right hand dominant male was referred to our shoulder clinic with debilitating right shoulder pain of several years duration. He had three previous operations for this shoulder including an initial Putti-Platt procedure to address shoulder instability. The second operation was a total shoulder arthroplasty for debilitating arthritis. The total shoulder replacement provided good pain relief but very limited functional improvement for several years. With the recurrent progression of shoulder pain, the patient had several evaluations of his right shoulder and had a diagnostic shoulder arthroscopy with debridement revealing a grossly loose glenoid component. He was referred to our tertiary care shoulder clinic for definitive management. Preoperative radiographs (Fig. 1) revealed a posteriorly subluxated

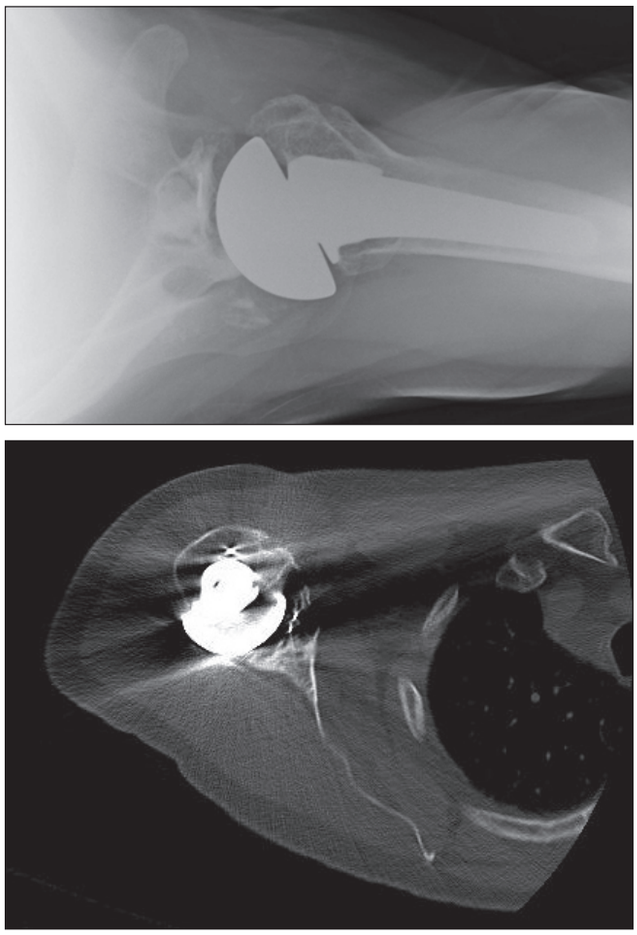

Figure 1a and 1b
Preoperative images (Axillary and CT scan) show posterior subluxation with significant asymmetrical posterior glenoid wear and failed glenoid component

total shoulder replacement with a failed glenoid component. The patient was also noted to have significant weakness of his subscapularis and supraspinatus on clinical examination. Subsequent EMG/NCV confirmed evidence of chronic severe demyelinative suprascapular neuropathy. After thoroughly reviewing the risks, benefits, and options of treatment, we discussed with the patient that revision options included conversion to a hemiarthroplasty with grafting and resurfacing of his glenoid, reimplantation of a glenoid component, or conversion to a reverse total shoulder arthroplasty. Given the constellation of clinical findings, including both soft tissue and bony deficiency combined with instability, and the

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patient's goals we also discussed with him that although we would be prepared for each of these options intraoperatively, he may have the best chance at meaningful pain relief and limited function with a reverse total shoulder replacement. Graft options including the possible use of a porous tantalum augment and iliac crest autologous graft to address the glenoid deficiency were also discussed with the patient. Given his debilitating pain and previous operations, he preferred to avoid iliac crest graft if possible and wished to proceed with a revision procedure. During the approach, the subscapularis was intact but significantly attenuated. A lesser tuberosity osteotomy was performed along with a sub-coracoid and deep surface release of the subscapularis to preserve as much function and length of the subscapularis as possible. The subscapularis lesser tuberosity osteotomy was securely repaired at the end of the procedure. Intraoperatively, after removal of the glenoid component and loose cement mantle, the patient was noted to have a large cavitary defect with associated loss of the posterior wall resulting in significant posterior glenoid version. Enough native bone remained for excellent purchase of the long-stem (25mm) baseplate for the reverse prosthesis. Reconstruction of the posterior defect with a 5mm porous tantalum augment (Zimmer) allowed us to create a stable base with neutral version to accept the glenoid baseplate for the reverse prosthesis. The tantalum augment was a modular implant designed for total knee revision arthroplasty. The augment is manufactured with a central hole to allow incorporation to the tibia base plate during revision total knee arthroplasty. This augment was contoured intraoperatively, utilizing a high speed metal cutting wheel, to fill the posterior defect creating a neutral glenoid face for the reverse baseplate. The augment was incorporated and stabilized with the posterior compression screw in the baseplate. In this fashion, the augment was compressed to the native glenoid bone and baseplate to minimize micro-motion at the baseplate tantalum interface. The locking screws were then placed routinely resulting in excellent capture of the scapula and seating of the baseplate in native bone. A 42-mm glenosphere component was placed without difficulty. The press fit humeral stem was then removed via a cortical window which was stabilized with cerclage wires. A long stem reverse humeral component that extended at least 2.5 diameters distal to the osteotomy was cemented into the humeral shaft with excellent stability. The patient had an uneventful postoperative course, noting immediate resolution of shoulder pain. At 12 months postop his active FF = 130 degrees, abduction = 130 degrees, ER (90) = 60 degrees, IR (90) = 40 degrees. Despite excellent restoration of external rotation and deltoid strength, his subscapularis strength only returned to Grade +4/5 at 12 months after surgery. Postoperative radiographs (Figure 2) demonstrate correction of glenoid version to neutral with well fixed reverse prosthesis and porous tantalum augment. Preoperative Constant Score was 5 and Postoperative Constant Score (12 months) was 64.

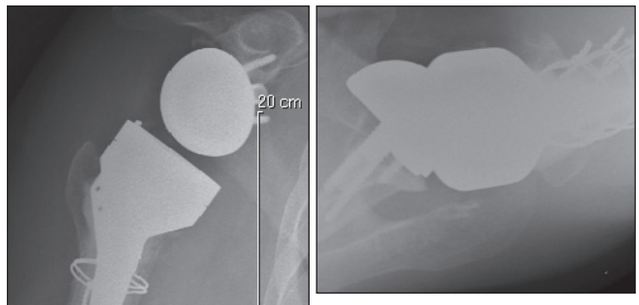

Figure 2a and 2b
Postoperative images (AP and Axillary) show restoration of neutral glenoid version with the posterior porous tantalum augment in place.

Discussion

Revision total shoulder arthroplasty is a technically demanding procedure. As the rate of total shoulder arthroplasty continues to increase, a greater number of revision procedures can be expected. Reasons for failure of primary total shoulder replacement are numerous. The causes for failure may be broadly categorized into soft tissue deficiencies, osseous deficiencies, component wear, and infection. The results of revision also can vary significantly based on the etiology[2]. The problem of fixed posterior subluxation combined with significant glenoid bone deficiency is particularly difficult both in the primary and revision setting. Although the indications for the Reverse Total Shoulder Replacement are evolving and long term results are forthcoming, instability of the center of rotation as seen in rotator cuff deficiency is a well accepted indication. Our patient presented with a particularly difficult problem - recurrent posterior instability, glenoid bone loss, failed total shoulder arthroplasty, and rotator cuff compromise. Porous tantalum has a long history of use in orthopedics particularly to address bone deficiency in hip and knee arthroplasty. The biomechanics, biocompatibility, and osteoconductivity of porous tantalum have also been favorable[15-20]. Aside from the risks of morbidity associated with use of allograft and autograft, the success of incorporation of these grafts has also been questioned. As the demand for shoulder replacements continues to increase, the ability to reliably address revision of failed implants will also continue to be in demand. Although, we present the utilization of porous tantalum augmentation to address glenoid bone defects as an option to consider taken as an extension of its success in hip and knee reconstruction, we also fully recognize the preliminary nature of our report, and continue to recommend

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and primarily utilize autologous bone graft whenever possible. Longer follow-up and further studies are required before a modular system as seen in revision knee arthroplasty is possible for shoulder arthroplasty.

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