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Single-stage bilateral reverse total shoulder arthroplasty for bilateral posterior shoulder fracture-dislocation following seizure: A case report

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ABSTRACT

INTRODUCTION: Posterior shoulder dislocations comprise a small percentage of shoulder dislocations. Even more uncommon are posterior shoulder fracture-dislocations, which are commonly associated with trauma, seizures, and electrical shock.

PRESENTATION OF CASE: We present the case of a 64-year-old right-hand dominant male who sustained bilateral shoulder posterior fracture-dislocations after a hypoglycemia-induced seizure. The patient was treated with bilateral reverse total shoulder arthroplasties in a single-stage. He recovered well and continues to have excellent function and range of motion at 4-year follow-up.

DISCUSSION: Treatment options for proximal humerus fracture-dislocations include open reduction internal fixation (ORIF), hemiarthroplasty, and reverse total shoulder arthroplasty (RTSA). The indications for reverse total shoulder arthroplasty continue to expand.

CONCLUSION: This is a rare case of bilateral posterior shoulder fracture-dislocations. In similar cases, simultaneous reverse total shoulder arthroplasties can be considered as a viable treatment option.

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1. Introduction

The vast majority (95–97%) of glenohumeral dislocations are anterior, with posterior dislocations accounting for 2–4% of glenohumeral dislocations [1]. Posterior dislocations are commonly associated with trauma, seizures, and electrical shock. The incidence of shoulder dislocation during a seizure is approximately 0.6%, and the most common etiologies of seizures in adults are primary epilepsy, substance abuse, diabetes/hypoglycemia, trauma, cerebrovascular disease, and tumors [2,3]. The majority of posterior dislocations occur in men between twenty and fifty-five years of age, with a 15% incidence of bilateral dislocation [1,2,4]. Posterior shoulder fracture-dislocations are more uncommon, and associated with an older patient population. Bilateral posterior shoulder fracture-dislocations are even more uncommon still and present a significant challenge to both patient and treatment provider.

We report the case of a 64-year old man who sustained bilateral posterior shoulder fracture dislocations following a seizure. This patient underwent bilateral reverse total shoulder arthroplasties in a single stage with good functional outcome and pain relief

at the most recent 4-year follow-up. This work has been reported according to the SCARE guidelines [5].

2. Case report

We present the case of a 64-year-old right-hand dominant male without significant medical history who sustained bilateral posterior shoulder fracture-dislocations following a hypoglycemia-induced seizure. The diagnosis was made at a local emergency department, where radiographs and advanced imaging were obtained (Figs. 1 and 2). He was placed in bilateral shoulder immobilizers and referred to our office for further management. The cause of the hypoglycemia was unknown.

Clinical examination revealed diffuse soft tissue swelling and tenderness to bilateral shoulders. Axillary nerve was function was found to be intact bilaterally. The fracture pattern classification in both shoulders was consistent with a four-part proximal humerus fracture with significant comminution (AO/OTA 11-C3). The anatomic neck fracture fragments were engaged with the posterior glenoid rim, bilaterally. The glenoid and remaining surrounding osseous structures were intact.

We had an extensive discussion with the patient with regard to his injury and discussed several treatment options including open reduction internal fixation (ORIF), hemiarthroplasty, and reverse total shoulder arthroplasty (RTSA). Concerns regarding ORIF included comminution of the tuberosities, and an anatomic

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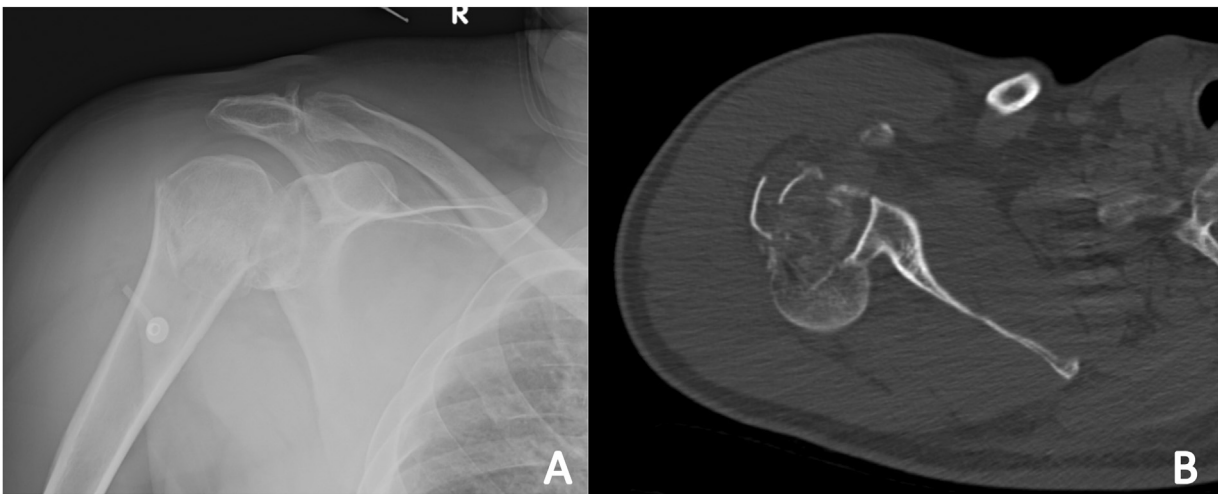


Fig. 1. (A) AP radiograph of the right shoulder demonstrating a comminuted proximal humerus fracture. (B) Axial CT image of the right shoulder demonstrating a comminuted posterior fracture-dislocation of the proximal humerus.

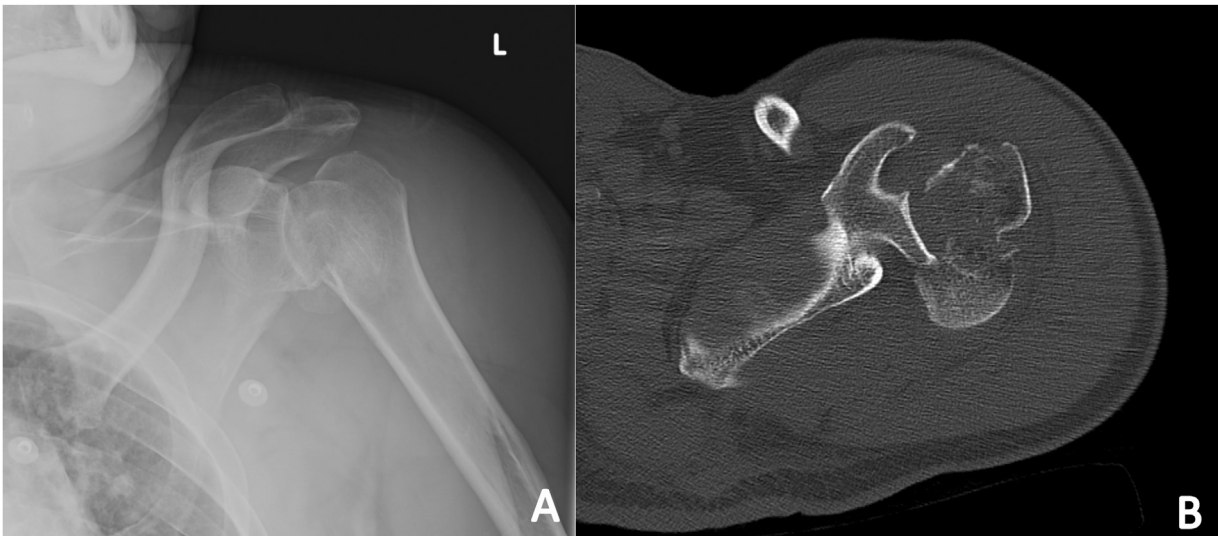


Fig. 2. (A) AP radiograph of the left shoulder demonstrating a comminuted proximal humerus fracture. (B) Axial CT image of the left shoulder demonstrating a comminuted posterior fracture-dislocation of the proximal humerus.

neck fracture with no metaphyseal extension resulting in limited bone available for secure fixation. Hemiarthroplasty versus RTSA were discussed as treatment options, however due to tuberosity comminution it was jointly decided that the reverse TSA would allow for the most predictable outcome and least chance of a failed surgery due to tuberosity resorption. The patient understood the risks associated with arthroplasty in the setting of a known seizure disorder. However, given no prior history of seizures, and no known risk factors such as diabetes for future episodes of hypoglycemia, the decision was made to proceed with bilateral arthroplasties.

The patient was taken to the operating room three days after injury. Surgery was performed in the beach chair position. The right shoulder was addressed first since the patient was right hand-dominant. A deltopectoral incision was used. The humeral shaft was found to be bayoneted anteriorly and the greater and lesser tuberosities were significantly comminuted. The humeral head was retrieved from the posterior and inferior aspect of the glenoid and was found to have segmental defects of the articular surface and was devoid of soft tissue attachments. A reverse total shoulder arthroplasty was performed (Fig. 3). Glenoid components included a 5 mm eccentric glenosphere (Integra LifeSciences, Plainsboro

Township, NJ, USA) with a 15-mm baseplate. Humeral components included a large body press-fit stem with a 3 mm non-retentive liner. #5 FiberWire (Arthrex, Naples, FL, USA) sutures were used to affix the tuberosities to the proximal body of the humeral stem and the humeral shaft. Three horizontal #5 FiberWire sutures were used to secure the greater tuberosity to the prosthesis and then to the lesser tuberosity via an “around the world” suture providing horizontal stability to the tuberosities. An additional two #5 FiberWire sutures were used to secure the tuberosities to the shaft with a figure of eight stitch providing vertical stability to the tuberosities. The humeral head was morselized and supplemented with Actifuse (Baxter, Deerfield, IL, USA) to bone graft the bed of the fracture. Following closure, the left shoulder was addressed in a similar manner. Findings were similar with regard to highly comminuted tuberosities, posterior inferior displaced anatomic neck fracture with articular injury, and glenoid cartilage loss. It was therefore decided to proceed with RTSA using similar components, tuberosity fixation, and bone grafting (Fig. 4). Following reduction both shoulders had excellent stability throughout the arc of motion.

The patient was immobilized for 4 weeks in a shoulder sling with abduction pillow to allow for tuberosity healing and bone

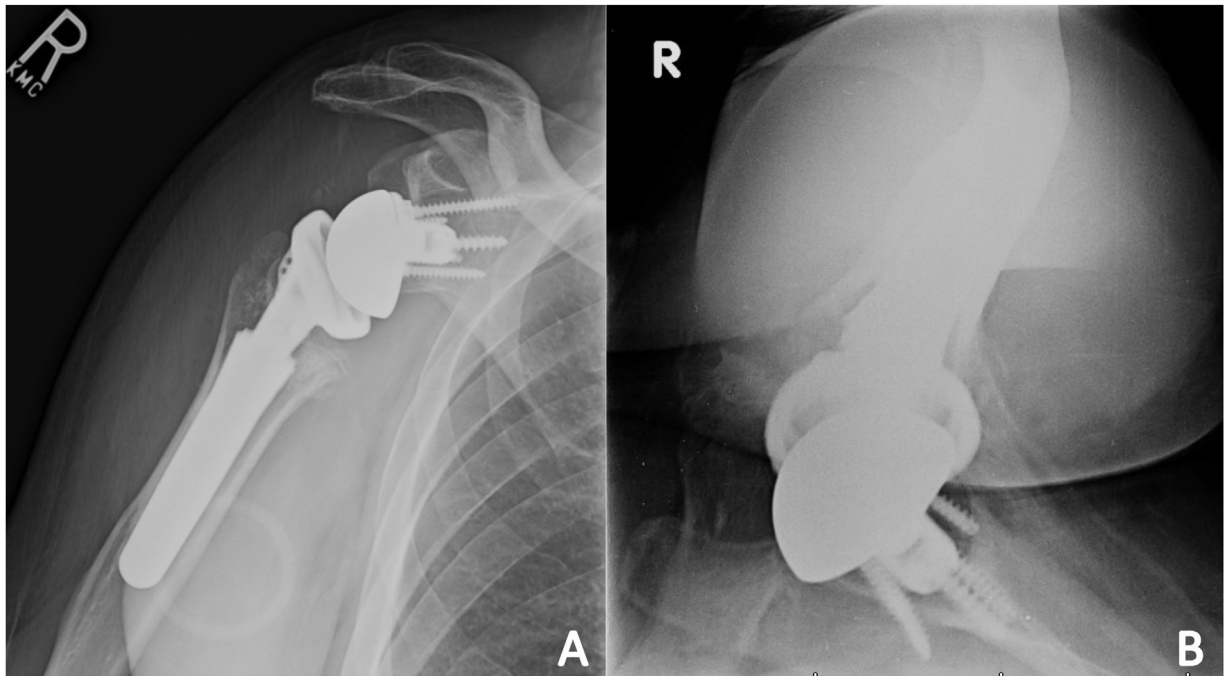


Fig. 3. (A) Post-operative AP radiograph of the right shoulder status post reverse total shoulder arthroplasty. (B) Post-operative axillary lateral radiograph of the right shoulder status post reverse total shoulder arthroplasty.

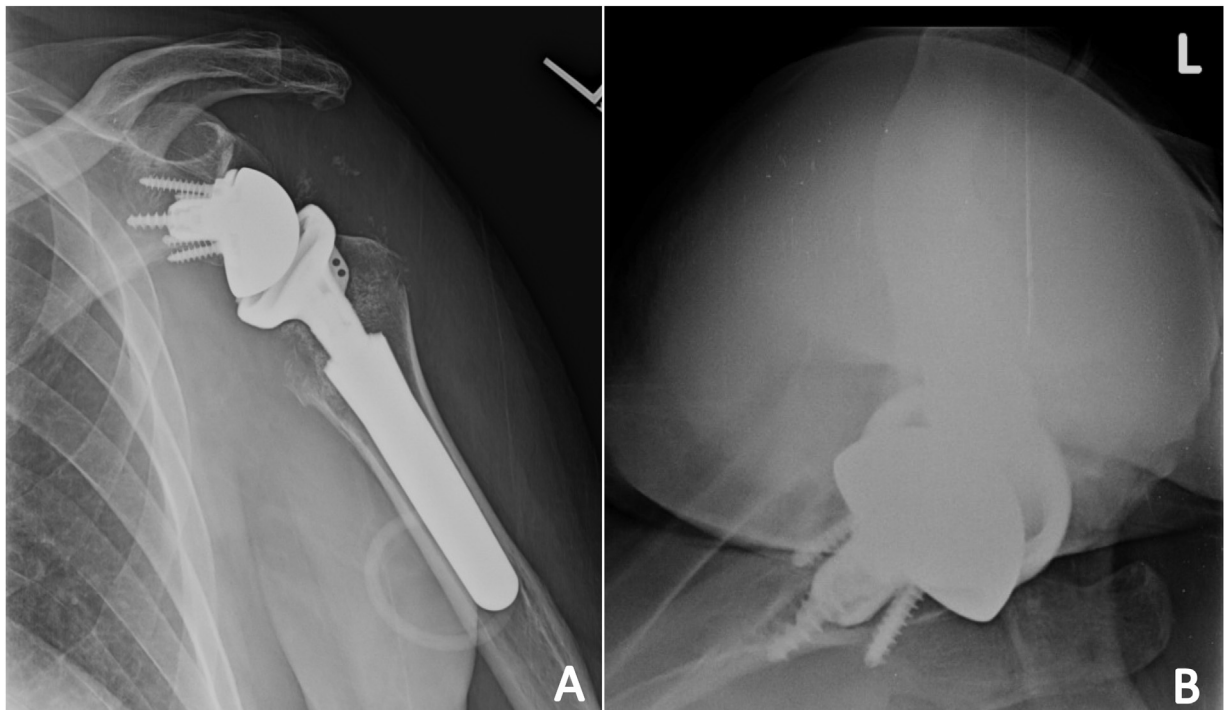


Fig. 4. (A) Post-operative AP radiograph of the left shoulder status post reverse total shoulder arthroplasty. (B) Post-operative axillary lateral radiograph of the left shoulder status post reverse total shoulder arthroplasty.

graft consolidation. At 2 weeks post-operatively, the patient was allowed to use his bilateral upper extremities for simple activities of daily living. At 4 weeks post-operatively the patient was started on a series of home-based closed chain exercises focusing on deltoid conditioning. At 2 months post-operatively, the patient's active range of motion was forward elevation to 120 degrees and externally rotation to 30 degrees. Strengthening was restricted until 3 months following surgery. No formal physical therapy was initi-

ated due to patient's success with home-based therapy. At 1-year follow-up, the patient continued to be pain free with radiographically healed tuberosities and full active motion (forward flexion of 180 degrees, external rotation of 30 degrees, and internal rotation to lower lumbar spine). At 18-months follow-up, the patient was involved in a motor vehicle collision resulting in a left nondisplaced fracture of the acromion. This was treated with several weeks of immobilization with a shoulder sling abduction pillow

followed by several sessions with physical therapy to review exercises for a home-based regimen, which was continued for 4 weeks. At 2-year follow-up, the patient endorsed no instability events and maintained a similar pain free arc of motion (forward flexion of 160 degrees, external rotation of 20 degrees, and internal rotation to buttock). This arc of motion was maintained at 4-year follow-up, and patient was able to continue his recreational activities including swimming. The patient's hypoglycemia was managed with dietary modifications and blood glucose monitoring with no further episodes of hypoglycemia or seizure.

3. Discussion

The treatment of glenohumeral fracture-dislocations is primarily dictated by the presence and severity of concomitant injuries, fracture morphology, and patient related factors. The algorithm for treatment of complex proximal humerus fractures has evolved over the last five decades and includes methods such as hemiarthroplasty, proximal humeral locking plates, and more recently, RTSA.

Hemiarthroplasty was classically considered a surgical option until more recent innovations in fracture fixation and arthroplasty [6]. Hemiarthroplasty and anatomic total shoulder implant designs aim to restore the native center of rotation of the shoulder. This can create a high-strain environment at the fracture site secondary to pull from the rotator cuff muscles resulting in nonunion, tuberosity resorption, instability, and pseudoparalysis [7]. There is also evidence that there is a high incidence of rotator cuff injury in older populations after shoulder dislocation, leading to instability and early failure with hemiarthroplasty [8–10]. Outcomes of hemiarthroplasty in the presence of arthritic changes on the glenoid lead to poor satisfaction rates [11]. In a study by Sperling, fifteen-year follow-up of hemiarthroplasty and total shoulder arthroplasty in patients fifty years or younger showed that glenoid erosion was present in 72% of hemiarthroplasties with 60% of patients unsatisfied, resulting in high revision rates secondary to painful glenoid arthritis [12].

The use of locked plating for complex proximal humerus fractures has similar biomechanical disadvantages in the setting of osteoporotic bone. Common complications include avascular necrosis, perforation, loss of fixation, fracture subsidence, screw cut out, and tuberosity displacement [13,14]. Patient age, comorbidities, bone quality, fracture morphology, and rotator cuff integrity must be taken into consideration to determine the likelihood of each of these complications to determine if locked plating is appropriate.

There is one prior report of simultaneous bilateral RTSA for proximal humerus fractures, however the patient was more elderly with 1-year follow-up, and we found no reports for bilateral fracture-dislocations of the shoulder in the literature [15]. Indications for reverse total shoulder arthroplasty continue to expand from rotator cuff arthropathy and pseudoparalysis to include complex proximal humerus fractures that are not amenable to surgical fixation. Multiple studies have examined hemiarthroplasty versus RTSA outcomes in the setting of complex proximal humerus fractures [16–20]. A comparative study by Cuff et al. on the treatment of acute proximal humerus fractures in elderly patients compared 26 consecutive patients who underwent hemiarthroplasty to 27 consecutive patients who underwent RTSA, noting higher final outcomes scores, patient reported satisfaction, incidence of radiographic healing of tuberosities, and forward elevation in the RTSA group. 13% of the hemiarthroplasty group underwent revision to RTSA due to failed tuberosity healing and secondary shoulder pseudoparalysis [16]. Sebastia-Forcada et al. showed similar results in a blinded, randomized, controlled, prospective study with

improved functional outcome scores, greater shoulder elevation, higher tuberosity healing, and lower revision rate with RTSA [2].

Some of the unproven theoretical benefits of a reverse TSA over hemiarthroplasty for shoulder fracture dislocations may be that medialization takes tension off the tuberosity repair and the semi-constrained design of the polyethylene lined eliminates translation which provides a more stable environment for tuberosity healing.

4. Conclusion

Patients with comminuted bilateral proximal humerus fracture dislocations present a complex problem that requires a thoughtful approach. We performed simultaneous bilateral RTSA on a patient with bilateral posterior glenohumeral fracture dislocations following a seizure secondary to hypoglycemia. The patient achieved pain free function of bilateral upper extremities, maintained at 4-year follow-up. As was the case here, each patient should be evaluated based on the mechanism of injury, age, comorbidities, fracture morphology, risk for osteonecrosis, tuberosity bone stock, glenoid arthritis, and patient goals. With this in mind, bilateral simultaneous RTSA can be considered a viable option for patients with this complex injury.

Declaration of Competing Interest

Reza Omid receives royalties from Medacta and Integra and has consultant agreements with Wright/Tornier, Medacta, and Integra. All the other authors and their immediate families have not received any financial payments or other benefits from any commercial entity related to the subject of this article.

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Ethical approval

Ethical approval was not required and no patient identifying information was included in the report.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

Ali Azad: writing of the original draft, collected case details, conducted literature search

Joseph Antonios: writing and editing of the report, submission
Hyunwoo Paco Kang: collected case details, conducted literature search

Reza Omid: performed the reported surgeries, surgical management, and editing of the report

Registration of research studies

Not applicable.

Guarantor

Dr. Reza Omid.

Provenance and peer review

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