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Chronic recurrent shoulder instability treated with a hemiarthroplasty, Glenojet allograft glenoid reconstruction, and anterior capsular reconstruction: a case report

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The morphology of the glenohumeral joint allows for significant mobility of the shoulder. Therefore, the glenohumeral joint is at risk for dislocation and subsequent injuries.[6] It is one of the most commonly dislocated joints in the body and has an estimated incidence of up to 1.7% with approximately 53% of patients being male.[15,17] Risk factors for recurrent shoulder instability include age, activity level, early return to sport, history of postoperative subluxation, prior nonunion, and significant bone loss.[4,3] Within the subset of patients experiencing chronic shoulder instability, some patients may experience this phenomenon due to recurrent shoulder dislocations related to seizure activity.[1]

Treating patients with shoulder instability due to recurrent seizures has been debated in the literature.[4,5,22] Procedures involving soft tissues, bony reconstruction, and arthroplasty have been mentioned; however, patients with seizure disorders are more difficult to treat due to significantly higher rates of shoulder dislocations compared to the general public.[4] We present a patient who experienced recurrent shoulder instability who was successfully treated with hemiarthroplasty, biceps tenodesis, a Glenojet procedure, and an anterior capsule reconstruction. To the authors' knowledge, this is the first case study using this specific treatment protocol for a patient with chronic shoulder instability due to recurrent tonic-clonic seizures.

Case report

A 36-year-old male with a past medical history of epilepsy and mood disorder presented to the outpatient clinic complaining of right shoulder pain related to chronic instability. The chronic instability was secondary to more than ten shoulder dislocations occurring after repeated tonic-clonic seizures. The patient has had a history of seizures since he was 13 years old. He continued to have breakthrough seizures and failed multiple anticonvulsants. When he first presented to the orthopedic surgery office, he was on Dilantin 300 mg twice daily which controlled his seizures the best, although he continued to have breakthrough seizures. No additional adjustments were made before his surgery and the patient stated he was compliant with his medications. His first dislocation occurred at age 18 and he stated his pain and functional limitations become more severe with each dislocation. He had significant pain with any attempted flexion and admits to locking, catching, and grinding of the right shoulder. He denied numbness or tingling in the right upper extremity. Initial x-ray imaging of the shoulder joint displayed mild degenerative changes of the acromioclavicular joint, advanced degenerative changes of the glenohumeral joint, a Hill-Sachs lesion of the humeral head, and an anterior bony Bankart fragment which was

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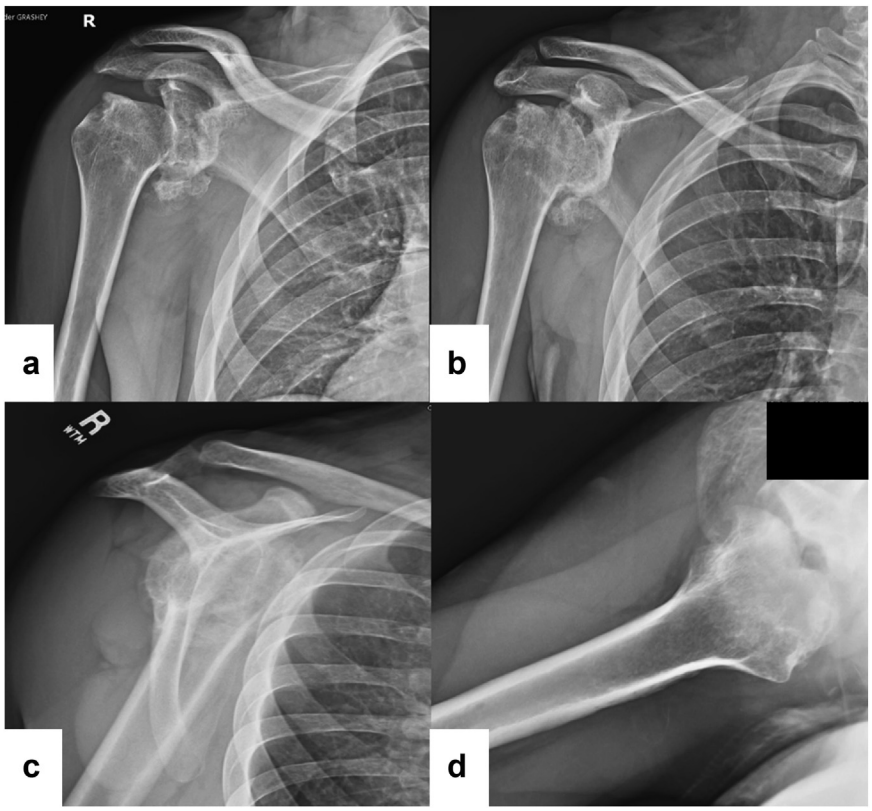

Figure 1 Preoperative Radiographs: (**a**) Grashey view (**b**) Anteroposterior with internal rotation view (**c**) Scapular Y view (**d**) Axillary view.

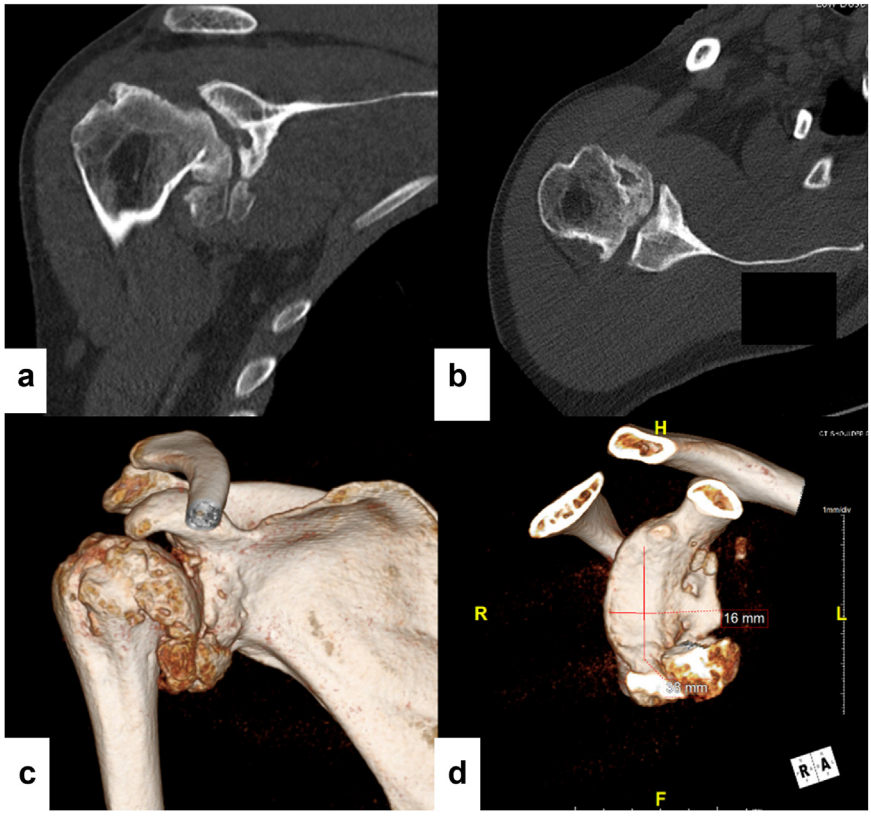

Figure 2 Preoperative CT scan: (**a**) Anteroposterior view (**b**) Axillary view (**c**) 3D anteroposterior view (**d**) 3D Sagittal view. *3D*, three-dimensional; *CT*, computed tomography.

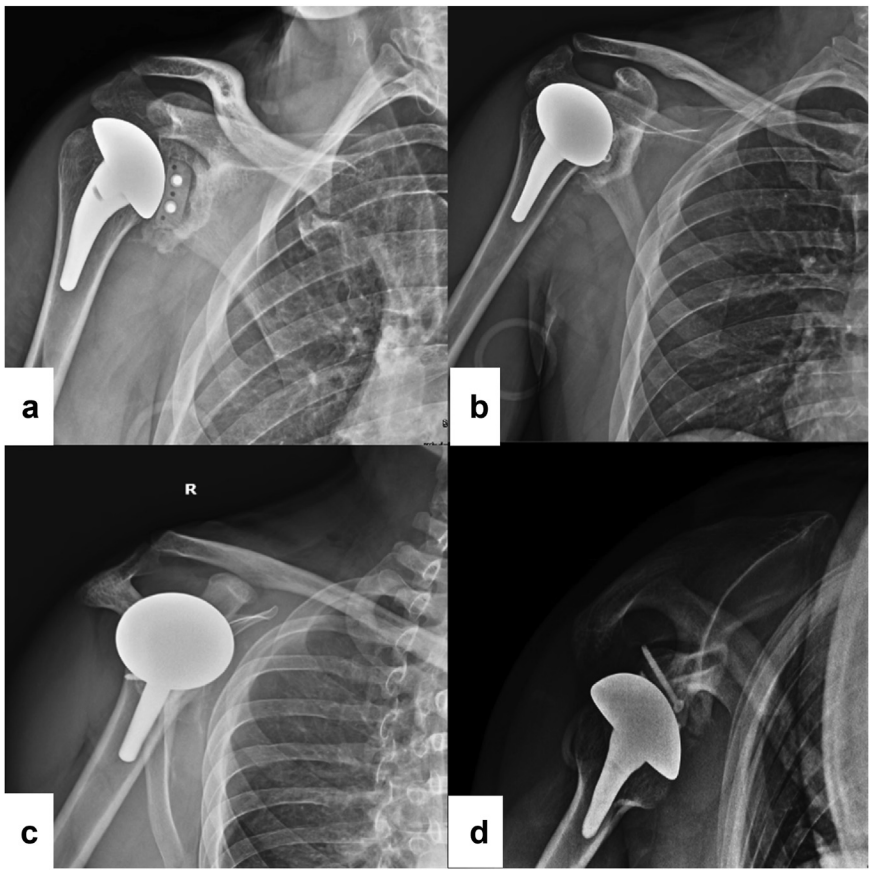

Figure 3 Postoperative radiographs: (**a**) Grashey view (**b**) Anteroposterior with internal rotation view (**c**) Scapular Y view (**d**) Axillary view.

medialized and malunited (Fig. 1). A computed tomography scan with three-dimensional reconstruction was also performed to confirm radiographic results and demonstrated an anteriorly subluxed humeral head and an impaction fracture of the medial humeral head with approximately ten millimeters of depression of the subchondral bone plate (Fig. 2). His rotator cuff musculature and the long head of the biceps tendon were intact.

After a several-month trial of conservative management with activity modification, oral anti-inflammatories, physical therapy, and corticosteroid injections, his pain continued to worsen. He continued to experience functional limitations from the severity and progression of his glenohumeral arthritis. A long discussion about the risks of surgical management of his shoulder pain included the distinct possibility of an epileptic seizure causing another dislocation and failure of the shoulder reconstruction. The patient fully understood the risks and we decided to move forward with a hemiarthroplasty, anterior glenoid reconstruction with allograft, and anterior capsular reconstruction (ACR). Postoperative radiographs are shown below (Fig. 3).

The patient was placed in the beach chair position and an anterior deltopectoral approach was performed on the right shoulder. A subscapularis tenotomy was performed and due to some tearing with the long head of the biceps, a biceps tenodesis was performed. The shoulder was subsequently dislocated. There were extensive degenerative changes appreciated at the glenohumeral joint with significant remodeling of the humeral head. There were also significant degenerative changes to the glenoid with complete remodeling on the anterior aspect. There was a large bony Bankart fragment which was free floating in the axillary pouch and was subsequently removed. A cutting guide was used for the humeral head, and a size 1 canal finder was used for initial broaching of the humeral shaft. The glenoid was then prepared for the Glenojet allograft bone grafting procedure. The Anika Therapeutics (Bedford, Massachusetts) Glenojet anterior glenoid allograft implant was placed according to manufacturer protocol.[24,23] Two fiber tape sutures were passed through the allograft bone in the predrilled holes which were then later used for the ACR. The glenoid allograft was secured to the anterior inferior glenoid with two 3.5 by 32 millimeter partially threaded screws. Following fixation, no step-off was appreciated along the glenoid surface. As expected, given his history of recurrent anterior dislocations, the patient's anterior capsule was found to be completely deficient. To provide as much anterior stability as possible an ACR was performed with a 3-millimeter thick Arthroflex dermal allograft patch (Arthrex, Naples, FL, USA). Two vertical mattress sutures were passed through the graft using the suture that had been previously passed through the Glenojet. We then proceeded and a hemiarthroplasty was performed. Prior to final implantation of the humeral stem transosseous tunnels were drilled and sutures were passed for the ACR and subscapularis repair. Fixation of the ACR and meticulous subscapularis repair were completed to the lesser tuberosity once the final hemiarthroplasty stem was inserted. Intraoperative photos are included below (Fig. 4).

From our experience, the subscapularis split approach is doable; however, a full subscapularis tenotomy makes the glenoid exposure much easier. Additionally, if there is gross instability with loss of the anterior capsule, as seen in epileptic patients with chronic instability, an ACR is needed, and dermal allograft is our graft of choice. If performing the surgical case strictly for glenoid bone loss

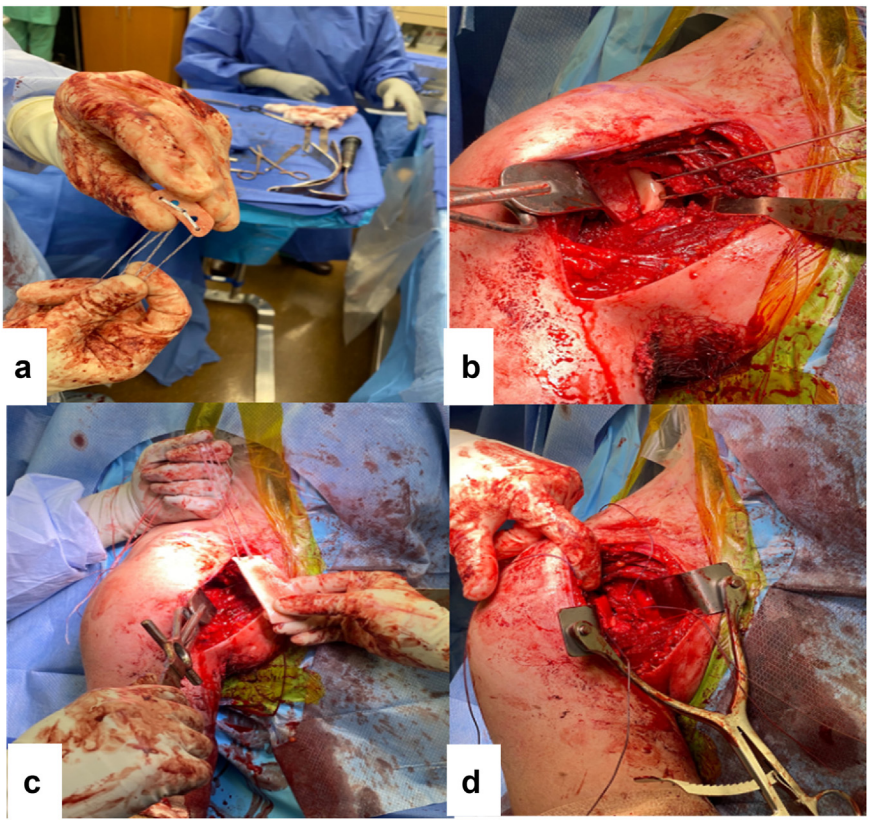

Figure 4 Intraoperative clinical photos: (**a**) Glenojet allograft bone block with sutures for anterior capsular reconstruction (**b**) Glenojet allograft wired in place restoring anterior glenoid deficiency (**c**) Arthroflex dermal allograft patch (**d**) Anterior capsular reconstruction prior to subscapularis repair.

in the setting of a more acute event without chronic instability, an ACR is not necessary. Lastly, a conjoint tendon transfer to the bone block allograft is imperative. This is done by suturing the tendon to the implanted graft through the subscapularis split at the end of the procedure to achieve the desired sling effect.

After a benign hospital course, the patient was discharged on postoperative day 2. His preoperative range of motion was limited with 120 degrees of forward flexion, 90 degrees of abduction, external rotation of 10 degrees, and internal rotation of 10 degrees. At his 1-week follow-up, the patient was doing well, and his postoperative pain was improving. He was encouraged to perform pendulum exercises and passive forward flexion not to exceed 90 degrees and not to exceed 30 degrees of external rotation. The patient was seen again at 6 weeks, 3 months, 6 months, and 1 year. At the 6-week postoperative mark, we wrote him a script for physical therapy to begin gentle strengthening exercises. At the 3-month postoperative mark, all restrictions were removed, and he was encouraged to continue strengthening exercises.

Pain control was achieved early in the course. Range of motion and strengthening improved at each visit. At the 6-month postoperative visit, the patient was able to flex their shoulder to 110 degrees actively and achieved full flexion passively. At the 1-year postoperative visit, he presented with continuously improved range of motion. He was able to perform approximately 130 degrees of shoulder flexion and 85 degrees of abduction. He had full range of motion on internal rotation with a slightly decreased amount of external rotation compared to the contralateral side. It should be noted that throughout the postoperative course, the patient seized several times, each time without shoulder dislocation.

Discussion

Management of chronic instability due to recurrent shoulder dislocations continues to pose a dilemma to treating surgeons. Patients with seizure disorders are particularly difficult to treat due to the high chance of recurrent dislocation, adding to the complexity of any type of surgical intervention. Management of this condition in epileptic patients should involve a multidisciplinary team approach involving a neurologist to monitor the patient's seizure activity. This population consists primarily of young, active, healthy males. Nonoperative treatment is a viable option for isolated dislocation events, and includes immobilization in combination with physical therapy.[7] It should be noted that nonoperative management has a high rate of failure compared to surgery.[14] Conservative management is a poor choice due to capsular and rotator cuff insufficiency, large joint surface defects, and significant bone loss.[26] When dislocations and instability are untreated for prolonged periods, additional pathologies including soft tissue contractures, osteoporosis, and recurrence of instability and dislocations increases. Additionally, patients with seizure disorders have greater amounts of bony pathology compared to patients without seizure disorders.[1]

Large humeral head deficits, as seen in our patient, are commonly treated with hemiarthroplasty in younger patients. A retrospective study by Hackett et al reviewed 359 patients who underwent a hemiarthroplasty procedure to determine the most common reasons for failure. They found that cuff failure, persistent fracture, tuberosity malunion, and glenoid erosion were leading causes for revision surgery.[12] Although total shoulder arthroplasty provides better scores for pain and mobility compared to hemiarthroplasty, this procedure is not commonly recommended in

younger patients with epilepsy and deformity as the one seen in our patient due to the risk of glenoid loosening and potential need for revision surgery.[9,26] Additionally, reverse total shoulder arthroplasties can be considered; however, the high rates of complications and questions around the long-term implant longevity makes this procedure a potentially poor choice in younger populations. The most common complications include periprosthetic infection, shoulder dislocation, periprosthetic fractures, neurologic injury, scapular notching, and associated acromion or scapular spine fractures.[16] Glenohumeral arthrodesis has been suggested as a treatment option for recurrent shoulder instability in epileptic patients. Six patients, mean age of 31, underwent shoulder arthrodesis and demonstrated improved Oxford shoulder instability scores by eleven points.[25] However, extensive counseling about functional deficits and muscle atrophy of the shoulder needs to be thoroughly discussed prior to conducting a glenohumeral arthrodesis.

Additional treatment options for shoulder instability include Latarjet or other bone graft glenoid reconstruction procedures.[1] The Latarjet procedure, which involves transferring the coracoid to the anterior aspect of the glenoid, is a commonly used technique in patients with anterior shoulder instability and bone loss. Ersen et al evaluated the effectiveness of the Latarjet procedure in epileptic patients. They found the Latarjet to be effective in restoring some level of joint stability in epileptics, they also found postoperative stability to be comparable to nonepileptics, thereby demonstrating the potency of this procedure.[10] However, this procedure has a complication rate as high as 30% of cases with a reoperation rate of 7% as discussed in a study by Griesser et al.[11] The use of the Glenojet, a preshaped predrilled allograft, has been gaining in popularity. Because this allograft is preshared and predrilled, this decreases the overall operation time, and the graft preparation is simple.[23] Indications for using this bone block allograft include anterior glenohumeral instability with greater than 20% of glenoid bone loss and may be used as a revision procedure in patients with prior soft tissue or bone treatment. Contraindications include infection, voluntary anterior instability or multidirectional instability, and comorbidities that may interfere with the healing of the allograft.[19]

Anterior shoulder capsule and subscapularis integrity are important to anterior glenohumeral stability and biomechanics.[19] Traditionally, the use of pectoralis major and latissimus dorsi tendon transfers were formed to address this challenge.[20] The use of hamstring, iliotibial band, and tibialis anterior tendon grafts have also been described in anterior shoulder stabilization procedures.[2,8,13,27] Another option is the use of dermal allograft for reconstruction of the anterior capsule.[21] Benefits of this technique include the potential for faster recovery, better cosmetic outcomes, lower risk of neurovascular injury, and no harvest site morbidity.[19] Additionally, a study conducted by Lee et al showed significant improvement in patients' Quick Disabilities of the Arm, Shoulder, and Hand scores after two years for patients who underwent ACR with dermal allograft.[18]

Conclusion

Shoulder instability secondary to epilepsy-induced tonic-clonic seizures can be difficult to treat and there is no clear consensus regarding the optimal surgical management of these patients. Our patient exhibited great functional outcomes without recurrent shoulder dislocations following an anterior glenoid reconstruction with allograft Glenojet bone graft, ACR with dermal allograft, and hemiarthroplasty. Our patient is nearly two years out from surgery and is doing well without subsequent instability despite recurrent postoperative seizure activity.

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