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Glenoid component shift in position and subsequent ingrowth following loosening in reverse total shoulder arthroplasty: a case report

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Reverse total shoulder arthroplasty (rTSA) has become increasingly common, particularly as the indications have expanded and surgeons have become more proficient.[9,14] However, with the rise in rTSA, there has been an expected rise in the prevalence of complications, with recent studies reporting complications from 16%-25%.[3,8,14,24]

Glenoid component loosening with rTSA has been reported to occur 0.2%-4.3% of the time.[9,14,20,23] Glenoid component loosening is one of the most common complications following an rTSA and is one of the main reasons for a subsequent revision.[11] Risk factors thought to be associated with glenoid loosening include female gender and age younger than 70 years.[10,16]

Typically, the treatment for isolated glenoid loosening is a revision rTSA, though in cases where bone stock is severely compromised, hemiarthroplasty may be the only treatment option. There is currently limited literature demonstrating outcomes of nonoperative management of glenoid component loosening following rTSA, with only one case series looking at outcomes that looked at patient-reported outcomes following nonoperative management for glenoid baseplate failure.[6] We present a case report detailing nonoperative management in a patient with glenoid component loosening following a revision rTSA, where the glenoid component subsequently shifted in position and then went on to bone ingrowth—emphasizing the importance of correlating subjective symptoms and physical examination with imaging findings when deciding on the optimal treatment plan for certain patients following this complication.

Case report

A 67-year-old female presented with long-standing left-sided shoulder pain without a history of trauma and refractory to nonoperative management. She had a history of Ehlers-Danlos syndrome but no history of instability or dislocation. Physical examination revealed active forward elevation of 120°, active external rotation of 30°, and active internal rotation to the sacrum. Strength exam was noted to be 5 out of 5 throughout, except for external rotation, which is 4 out of 5. Imaging demonstrated signs of glenohumeral osteoarthritis (Fig. 1). The patient was indicated for and underwent anatomic total shoulder arthroplasty (aTSA) (Fig. 2).

Approximately 10 years after her left shoulder aTSA, the patient returned with increasing pain in her left shoulder after a fall. Her active external rotation had decreased to 30°, and active internal rotation was to her iliac crest. She also had 4 out of 5 strength with abduction, internal rotation, and 3 out of 5 strength with external rotation, and radiographic imaging demonstrated superior head migration with posterior subluxation. She was noted to have a rotator cuff tear on ultrasound. Two years later, her imaging was largely unchanged, and she elected to undergo conversion to rTSA (Fig. 3, *A* and *B*). The glenoid component was removed using previously described technique of splitting the polyethylene with a saw in 2 horizontal and 2 vertical cuts (Fig. 4, *A* and *B*).[21] A router bit ensured minimal bone resection with removal of the metal portion, all of which was completed without complication (Fig. 4, *C-E*).

Institutional review board approval was not required for this study.

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Figure 1 Preoperative radiograph demonstrating glenohumeral osteoarthritis without evidence of superior head migration.

Figure 2 Postoperative radiograph demonstrating an aTSA with appropriate placement. *aTSA*, anatomic total shoulder arthroplasty.

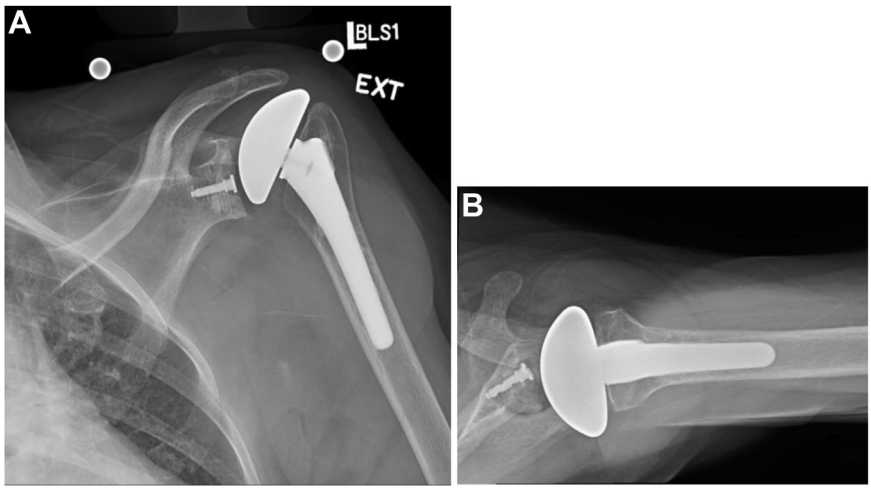

Figure 3 (**A**) demonstrates an anteroposterior view of the left glenohumeral joint with radiographic evidence of superior humeral head migration. (**B**) is a lateral view of the left shoulder with posterior subluxation of the humeral component.

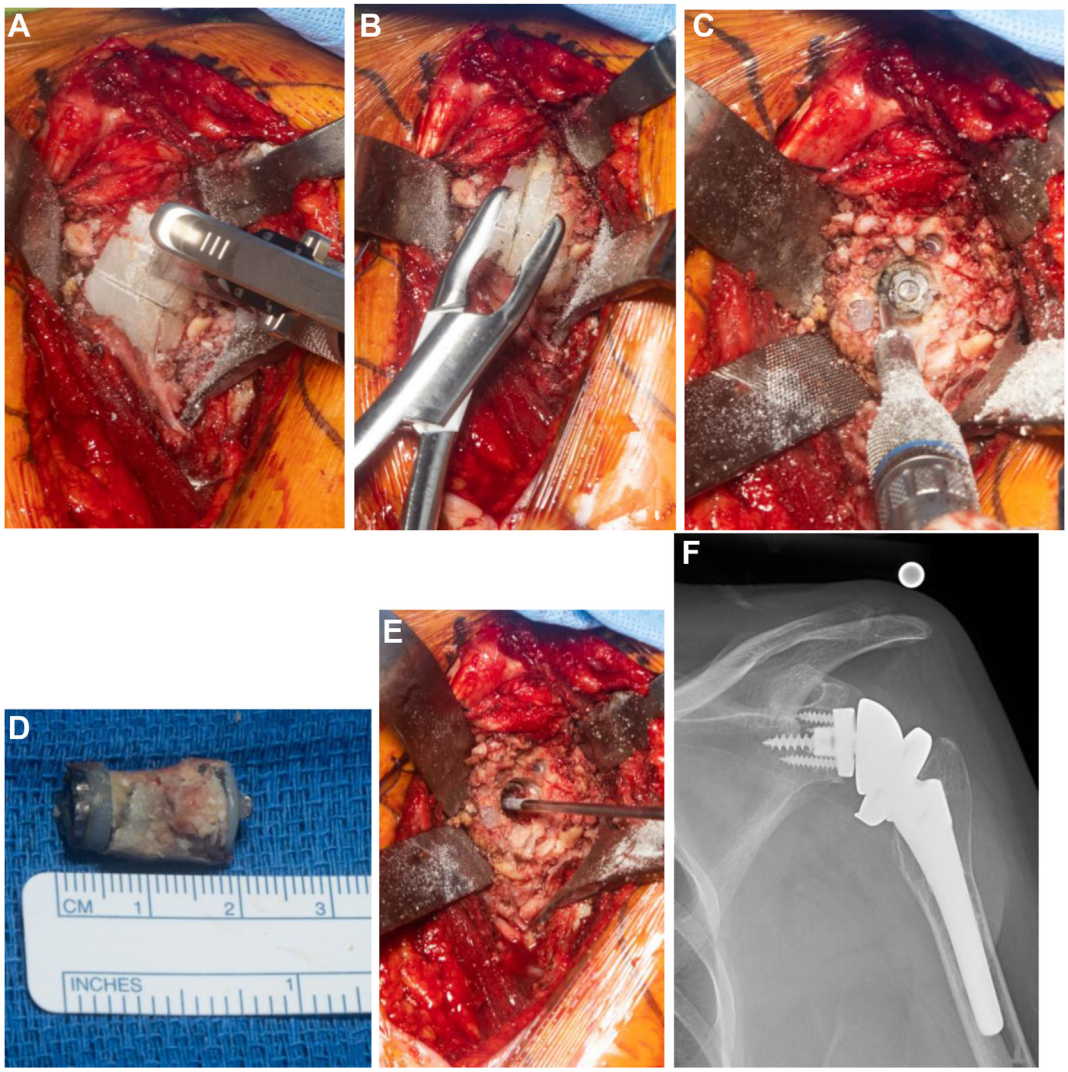

Figure 4 (**A** and **B**) demonstrating the technique of splitting the polyethylene with a saw in 2 horizontal and 2 vertical cuts. (**C-E**) demonstrate the router being utilized to ensure minimal bone resection with complete component removal. (**F**) is a postoperative radiograph 8 weeks after surgery demonstrating well-placed rTSA components. *rTSA*, reverse total shoulder arthroplasty.

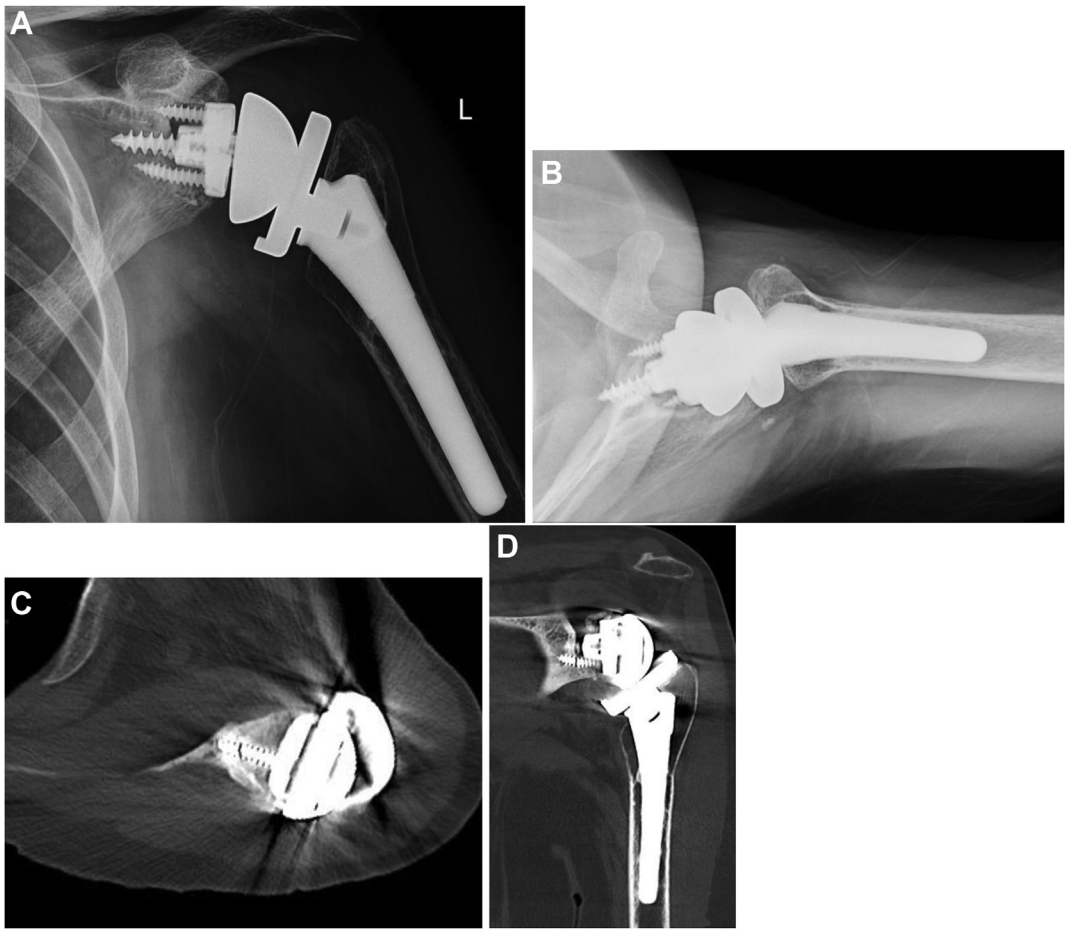

Figure 5 Imaging taken 10 months after the revision to rTSA. (**A** and **B**) are radiographs of the left shoulder in the AP and lateral planes demonstrate signs concerning for glenoid component loosening. (**C** and **D**) are CT imaging in the axial and coronal planes further indicating glenoid component loosening and hardware failure of a screw in the inferior glenoid. *rTSA*, reverse total shoulder arthroplasty; *CT*, computed tomography.

She was evaluated at 8 weeks postoperatively and was very pleased with her result (Fig. 4, *F*).

She again followed up 10 months after surgery with continued pain after a recent fall. X-rays and computed tomography imaging did not demonstrate acromial or scapular spine fracture but instead a loose glenoid component, and operative intervention was planned with the patient (Fig. 5, *A-D*). She did maintain active forward elevation of 110°, external rotation of 30°, and internal rotation to sacrum with 4 out of 5 strength in all plans of motion. Aspiration was performed and negative for infection after 14 days of cultures. Using shared decision-making, the plan was made to have revision surgery in the upcoming months.

She returned for her preoperative appointment 5 months following this. Since her most recent visit, although there was no pain assessment scales to quantify her improvement, the patient noted her subjective pain had improved and her strength and motion was preserved objectively when compared to previous exams. Further imaging demonstrated some areas of spot welding and healing despite the new slightly retroverted position of the glenoid (Fig. 6, *A-E*). Given the fact that her subjective symptoms had improved, her range of motion had not significantly been affected, and her imaging demonstrated areas of bone healing around the glenoid screws and components, the decision was made to pursue nonoperative management. Six months following the decision to pursue nonoperative management, she had minimal pain and 110° of forward elevation, 20° of external rotation, and internal rotation to sacrum with 4 out of 5 strength at her follow-up visit. Imaging again demonstrated spot welding and no changes in alignment when compared to her previous imaging (Fig. 7, *A-C*).

Discussion

Glenoid component loosening is one of the most common complications following an rTSA. Kriechling et al reported a 2.7% rate of glenoid loosening in patients following rTSA, with migration occurring in 0.8% of patients.[14] A recent systematic review demonstrated an aseptic glenoid component loosening rate of 1.16% in overall cases, with a 3.64% rate of loosening in revision cases.[19] For revision rTSA cases addressing glenoid component loosening, Bartels et al showed a 17% glenoid mechanical failure rate.[1] In initial rTSA designs, long lever arms and inadequate glenoid baseplate fixation led to high rates of failure. The use of large-diameter locking screws and inferior tilt with the glenoid baseplate have significantly improved failure rates.[7,15] In addition, various studies have found accurate placement of the inferior screw in quality glenoid bone and caudal positioning to be protective regarding stability.[10,17] For the various options involving revision for glenoid loosening, the driving factor is determining the remaining glenoid bone stock, as component reimplantation

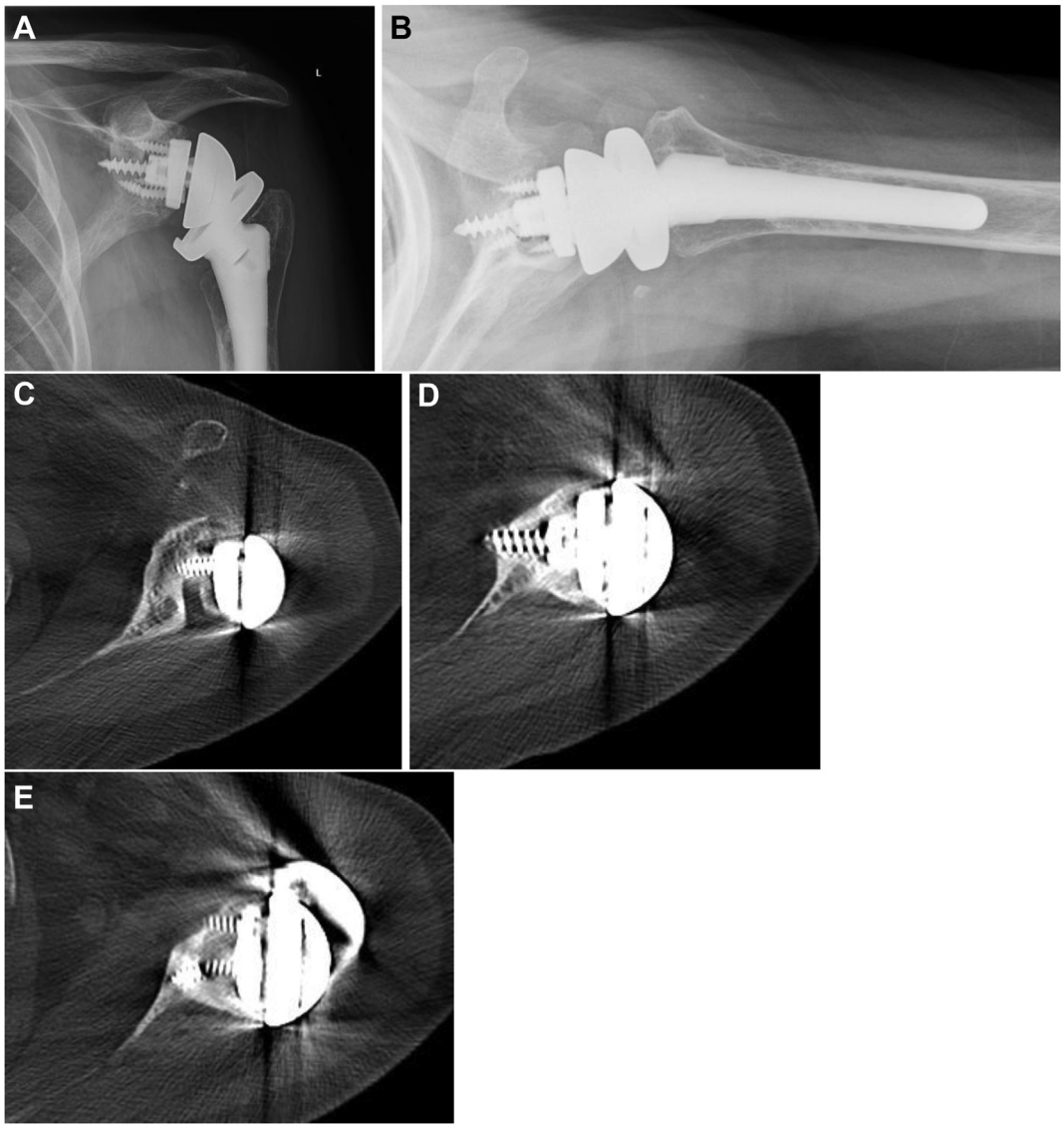

Figure 6 (**A** and **B**) are radiographs of the left shoulder with (**C-E**) being axial CT cuts, all of which demonstrate areas of spot welding. *CT*, computed tomography.

requires a sufficient bone stock.[5,10] If direct reimplantation is impacted by limited glenoid bone stock, a bone graft with a staged repair involving a temporary hemiarthroplasty prior to revision rTSA can be considered. Resection of the glenoid component with a conversion to a large-head hemiarthroplasty or complete resection arthroplasty are options but often come with less-than-optimal patient outcomes.[23]

For other complications following rTSA such as periprosthetic humeral fractures or scapular spine fractures, there is literature reporting the results of nonoperative management of these complications.[2,18,22] These studies emphasize the importance of considering a multitude of patient factors prior to deciding the optimal management of these complications. To our knowledge, there is limited literature regarding nonoperative management for glenoid component loosening or failure. Chen et al just recently published a case series with 18 patients following nonoperative management of glenoid baseplate failure and a minimum 2-year follow-up that demonstrated modest patient satisfaction scores.[6] This further accentuates the importance of accounting for all patient factors prior to determining if surgical intervention is the optimal treatment for some patients.

Our case demonstrates that baseplate integration may occur after loosening and shift in component position. From a biomechanical standpoint, this can possibly be explained through the process of osseointegration. After the patient's fall resulting in the initial loosening and shift in component positioning, the implant likely had 2 properties inherently important with re-establishing stability: direct contact with mineralized bone tissue and a high proportion of contact between the implant and bone tissue.[12] In addition, there needed to be a level of stability that is not excessive—to minimize risk of bone necrosis—while also ensuring there is enough stability to avoid excessive micromotion that would have led to further implant migration and subsequent failure.[12] On subsequent follow-up visits, there was radiographic evidence of bone healing and formation around the implant surface, indicating that the implant likely shifted into a new, stable position. Had she undergone surgery, the plan would have been for a revision glenoid component, though if she did not have enough bone stock remaining, she would have been converted to a hemiarthroplasty. Though she had initial symptoms and met all indications for surgical treatment, the time lapse and subsequent

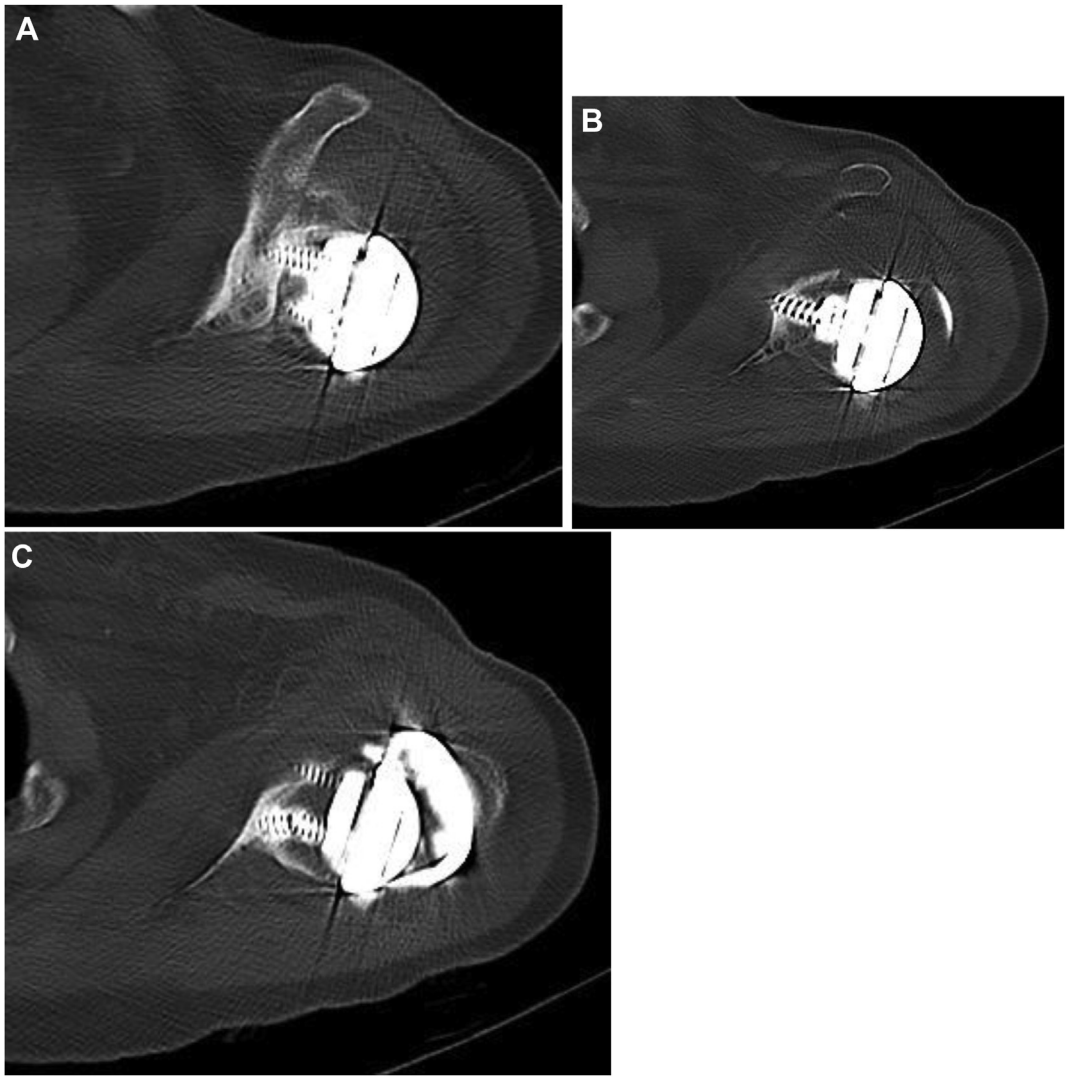

Figure 7 (**A-C**) show imaging that show additional evidence of spot welding and further healing without significant changes in alignment when compared to previous imaging from 6 months prior.

improvement in symptoms as well as correlating healing on imaging findings shows that these patients may be able to have improvement with time. Just as with lateral acromial spine fractures in rTSA and subscapularis failures in aTSA, early severe symptoms may gradually resolve over a few months despite not addressing the pathology surgically.[4,13] This experience demonstrates the importance of shared decision-making and discussion with the patient as well as continued and frequent follow-up for patients who have complications.

Conclusion

Postoperative glenoid implant loosening presents a complex challenge in the management of patients following an rTSA. Oftentimes, revision operative intervention is taken to manage this difficult complication. For some patients, consideration of the patient's subjective symptoms and objective physical examination findings should be considered and correlated with imaging findings when considering optimal management. Though operative treatment is often the preferred option, our case demonstrates that nonoperative management may be a viable alternative to immediate revision surgical intervention with positive patient outcomes in some patients.

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