



## Bilateral atraumatic acromial base fractures following reverse shoulder arthroplasty managed with open reduction and internal fixation: a case report

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Reverse total shoulder arthroplasties (rTSAs) have been widely and successfully used in patients with rotator cuff arthropathy, osteoarthritis, rheumatoid arthritis, and revision options for previous implants.<sup>4</sup> The success of the rTSA is largely dependent on medializing the center of rotation and re-tensioning of the deltoid.<sup>12</sup> In the native shoulder, the middle deltoid acts as the primary abductor. Re-tensioning of the deltoid creates a larger recruitment of the anterior and posterior deltoid to become abductors of the shoulder.<sup>12</sup> While recruitment of the anterior and posterior deltoid compensates for a deficient cuff to stabilize the implant, the demand on the deltoid is increased compared to native anatomy. Fractures of the acromion following rTSA are a rare, but well-documented complication, likely due to the increased workload placed on the deltoid.

Levy et al proposed a classification system for postoperative acromial fractures following reverse shoulder arthroplasty: type I involving the tip of the acromion, type II involving the lateral acromion, and type III involving the base of the acromion.<sup>8</sup> Management of type III fractures is particularly challenging as they involve a greater insertion of the deltoid. The incidence of acromial fracture after rTSA is estimated at 1–4%,<sup>2,16</sup> but the incidence of bilateral base of acromion fractures after rTSA is unknown. We report a case of bilateral atraumatic acromion fractures (left type II, right type III) following rTSA managed with open reduction and

internal fixation (ORIF). This report contributes evidence to the literature of bilateral acromion fractures following rTSA managed surgically.

### Case report

The patient is a 77-year-old right-hand dominant woman who was previously presented in *JSES International*<sup>6</sup> as a late presentation of atraumatic right acromial base fracture five years after undergoing right rTSA. Prior to her rTSA, the patient initially presented with 90 degrees of forward flexion, 25 degrees of external rotation, internal rotation to the ilium, 4/5 supraspinatus strength, and 4/5 external rotation strength. Following her rTSA, she rehabilitated well and reached 160 degrees of forward shoulder flexion with 40 degrees of external rotation and internal rotation to L1. The patient had no complaints of pain and 5/5 strength in forward elevation and abduction. She presented several years later after the atraumatic onset of pain while pulling a suitcase with her right arm extended. She reported that she suddenly externally rotated in response to uneven terrain and was found to have fractured her acromion (Fig. 1). She endorsed no prodromal symptoms.

She underwent ORIF of her Levy type III acromial base fracture and healed without complication (Fig. 2). At her six-week follow-up, she was without pain and had returned to her baseline function with right shoulder flexion 160 degrees, external rotation 30 degrees, and internal rotation L2. Radiographs of the right shoulder one year postoperatively demonstrated no new fractures or hardware failure (Fig. 3).

No institutional review board approval was required for this case report.

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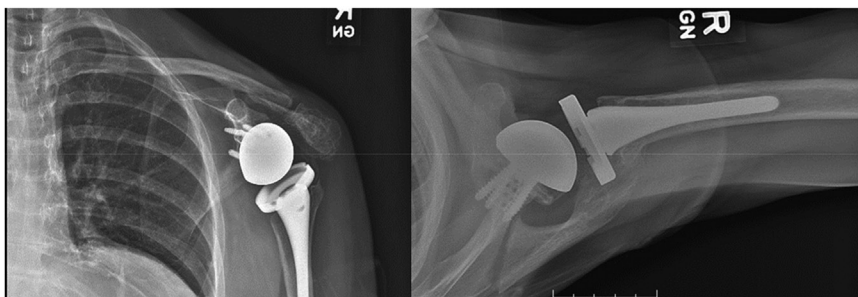


Figure 1 Radiographs of the right shoulder taken at the time of injury.

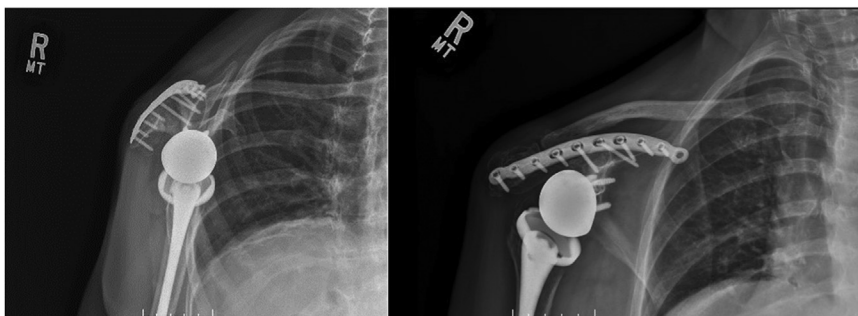


Figure 2 Radiographs of the right shoulder taken approximately 2 weeks postoperatively.

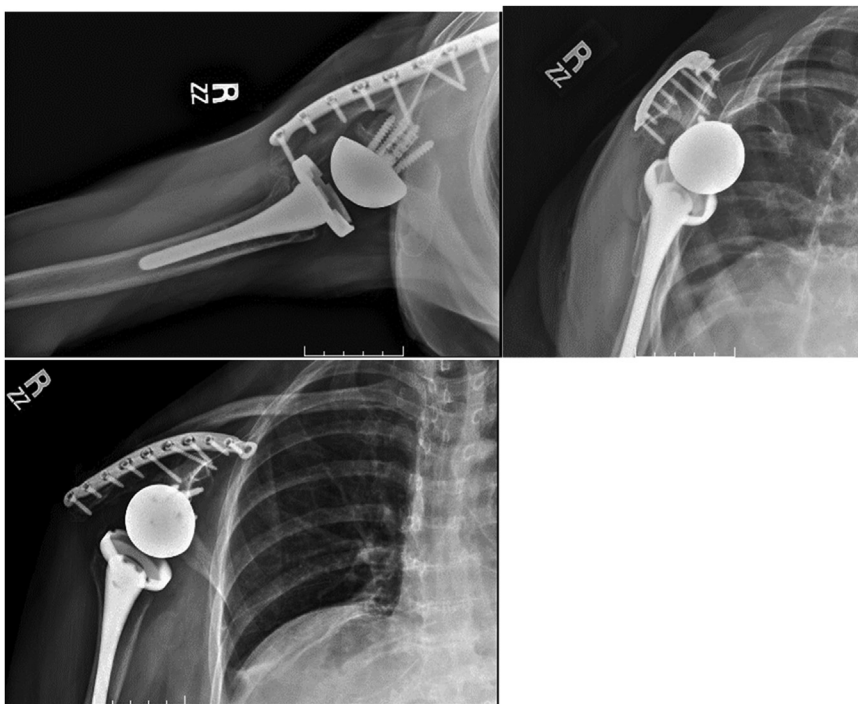
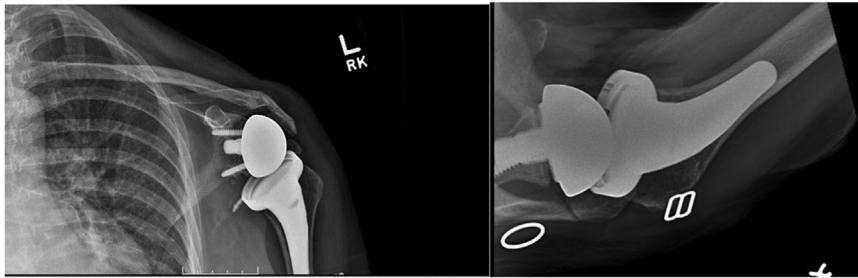


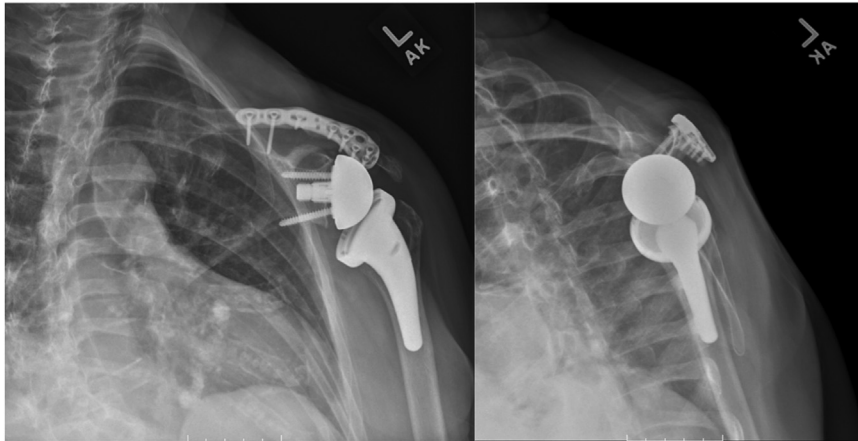
Figure 3 Radiographs of the right shoulder taken 1 year postoperatively.

In 2022, the patient underwent a left rTSA for rotator cuff arthropathy. Prior to her left rTSA she presented with 100 degrees forward flexion, 80 degrees abduction, and 5/5 strength. Following her left rTSA, she presented with 140 degrees forward flexion, 30 degrees external rotation, internal rotation to L5, and 5/5 strength. Six weeks following her left rTSA she had 5/5 strength and no

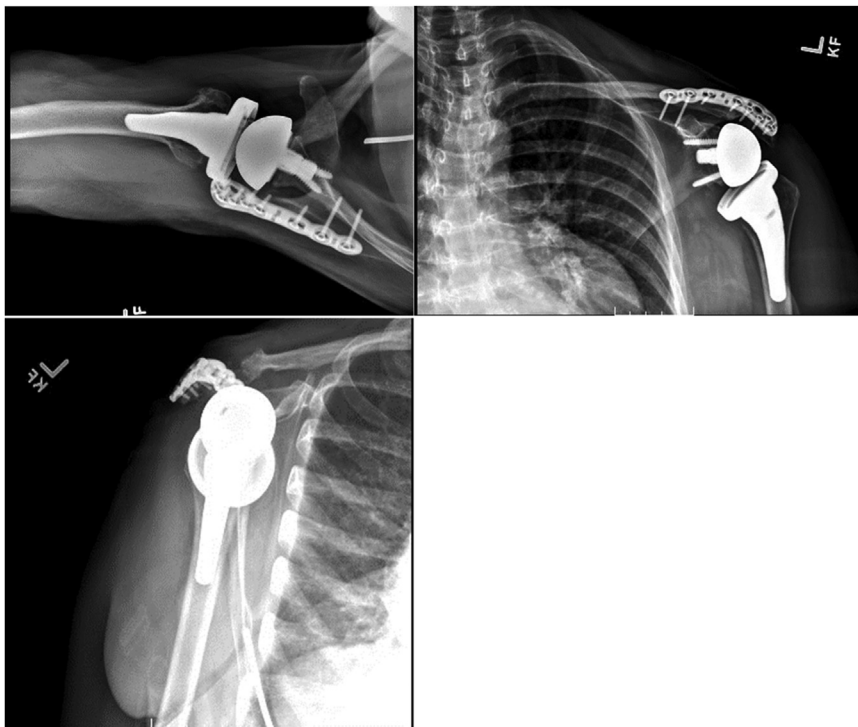
complaints of pain. Five months following her left rTSA, the patient was folding clothes and felt sudden pain. At the patient's initial visit following her injury, she presented with abduction of 40 degrees, active forward elevation of 45 degrees, passive forward elevation of 90 degrees limited by pain, 35 degrees external rotation, and internal rotation to the ilium. Forward elevation, internal rotation,



**Figure 4** Radiographs of the left shoulder taken at the time of injury.



**Figure 5** Radiographs of the left shoulder taken approximately 6 weeks postoperatively.



**Figure 6** Radiographs of the left shoulder taken 6 months postoperatively.

and external rotation strength were 4/5. Radiographs demonstrated a type II displaced acromion fracture (Fig. 4). No cross-sectional imaging was obtained at this time. She chose to undergo ORIF of the displaced fragment.

Approximately eight days following diagnosis, the patient underwent ORIF of the left acromion using a precontoured clavicle plate, using the same procedure as her right acromial ORIF. During the two-week follow-up, the patient's progress was positive as she remained pain-free and adhered to postoperative instructions. Wound healing showed no signs of infection. Radiographs taken at this time indicated that the fracture was anatomically reduced, with no evidence of hardware loosening or failure. Subsequently, the patient began elbow, wrist, and hand range of motion exercises. During her six-week visit, she displayed continual improvement. Physical examination revealed that her left shoulder had returned to its baseline function with 120 degrees of forward flexion, 20 degrees of external rotation, and internal rotation to L5. She experienced no pain and was instructed to stop using the sling while maintaining weight-bearing below 20 pounds until 12 weeks. At the twelve-week visit, the patient once again reported no complaints and was cleared for full activity (Fig. 5). Approximately seven months after ORIF, the patient remained pain-free, and her forward flexion improved to 130 degrees, with 30 degrees of external rotation (Fig. 6).

## Discussion

Current literature does not provide a consensus on the management of Levy type II and III fractures following rTSA. Conservative management of both type II and type III fractures has a high likelihood of displacement with persistent pain.<sup>15</sup> Nonunion rates of conservative treatment have been reported from 50 to 75 percent.<sup>14</sup> Crosby et al reported resolution of pain with surgical management of both type II and type III acromion fractures.<sup>3</sup> The goal of fixation is to apply compression at the fracture site and neutralize distracting forces of the deltoid.<sup>9</sup> Multiple constructs for ORIF exist, including tension band, dual locked plating, precontoured clavicle plate, and mesh plating.<sup>1,9,11</sup> A combination of constructs, such as tension band with cortical lag screw placement has also been reported.<sup>5</sup> While successful outcomes have been achieved, no definitive conclusions can be drawn due to small sample sizes.

The incidence and prevalence of bilateral acromion fractures following bilateral rTSA is unknown. There have been three reported cases of atraumatic bilateral acromion fractures.<sup>7,10,13</sup> Kim et al reported bilateral type II acromial fractures occurring simultaneously after staged rTSA. Surgical fixation was selected for this patient, and at the two-year follow-up, the fracture was completely healed with return to baseline function. Stevens et al report bilateral scapular fractures following rTSA; however, the patient declined surgical fixation.<sup>13</sup> Nicolay et al also reported bilateral acromion fractures that were managed conservatively, but this patient had a poor outcome.<sup>10</sup>

Our patient underwent ORIF for both fractures with the use of clavicular plates for her right Levy III and left Levy II acromial fractures. Postoperatively, the patient returned to her baseline function without subsequent complication. Our case contributes to the sparse evidence of surgical fixation for Levy II and III fractures after rTSA.

## Conclusion

Bilateral atraumatic acromion fractures after rTSA are rare. Our case demonstrates a satisfactory outcome following surgical management of atraumatic Levy type II and III fractures with single clavicle plate ORIF.

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