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Simultaneous bilateral anterior shoulder fracture dislocations in the elderly: case report and focused clinical treatment algorithm

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Shoulder dislocations are among the most common musculoskeletal diagnoses treated in the emergency room. However, bilateral shoulder dislocations are rare. The first report in the literature of a bilateral anterior shoulder dislocation was made by Sargent in 1909.[7] In their review of the literature, Ballesteros noted a 47% incidence of associated fracture, 78% of which were greater tuberosity fractures. They further noted that 53% of greater tuberosity fractures were bilateral. Due to the symmetric appearance of bilateral upper extremities on presentation, up to 15.7% of these injuries are missed during the acute phase.[1] This infrequent injury pattern is most commonly secondary to trauma (50%) followed by seizures (33%). Multiple options exist to treat proximal humerus fractures that occur after dislocation, including arthroplasty, open reduction internal fixation (ORIF), or closed management. We present a case of an active 69-year-old female who sustained bilateral anterior shoulder dislocations with associated displaced bilateral greater tuberosity fractures treated with ORIF using multiple suture anchors in a double-row repair fashion. Here, we discuss the case, treatment algorithm, and outcome for this patient. To our knowledge, this is the first reported case of bilateral anterior shoulder dislocations with significantly displaced greater tuberosity fractures in an elderly patient treated with ORIF with bilateral suture-anchor fixation.

Case report

An otherwise healthy, active 69-year-old female presented to clinic 1 week after sustaining bilateral anterior shoulder fracture dislocations. She described a traumatic mechanism of injury in which both shoulders were in an extended, abducted, and externally rotated position while performing resistance exercise on a Pilates machine. She sustained bilateral anterior dislocations with significantly displaced fractures of the greater tuberosities (Fig. 1). Both glenohumeral joints were initially closed reduced at an outside hospital and patient was discharged in bilateral slings. Postreduction radiographs demonstrated significant retraction and medialization of the right greater tuberosity fragment and a posteriorly displaced left greater tuberosity (Fig. 2). Given the high prevalence of asymptomatic rotator cuff tears in patients aged more than 60 years,[9] we elected to proceed with bilateral shoulder magnetic resonance imaging (MRI) to evaluate the integrity of rotator cuff (RTC) and associated Goutallier stage (Fig. 3). MRI demonstrated intact RTC tendons and minimal fatty infiltration, indicating that ORIF remained a viable option for restoration of shoulder function in this active patient. Extensive discussion regarding treatment options including closed management, ORIF, and reverse total shoulder arthroplasty (rTSA) was had with the patient. Given the quality of her RTC, Goutallier stage, baseline activity level, and displacement of the fracture fragments, the decision was made to proceed with bilateral greater tuberosity ORIF.

Surgery was performed 2 weeks after initial injury. The patient was placed in a supine position and the fractures were accessed using a deltopectoral approach. Significant inflammation was noted within the bilateral long head biceps tendons. Biceps tenodesis was performed by securing the long head of the biceps tendon to the

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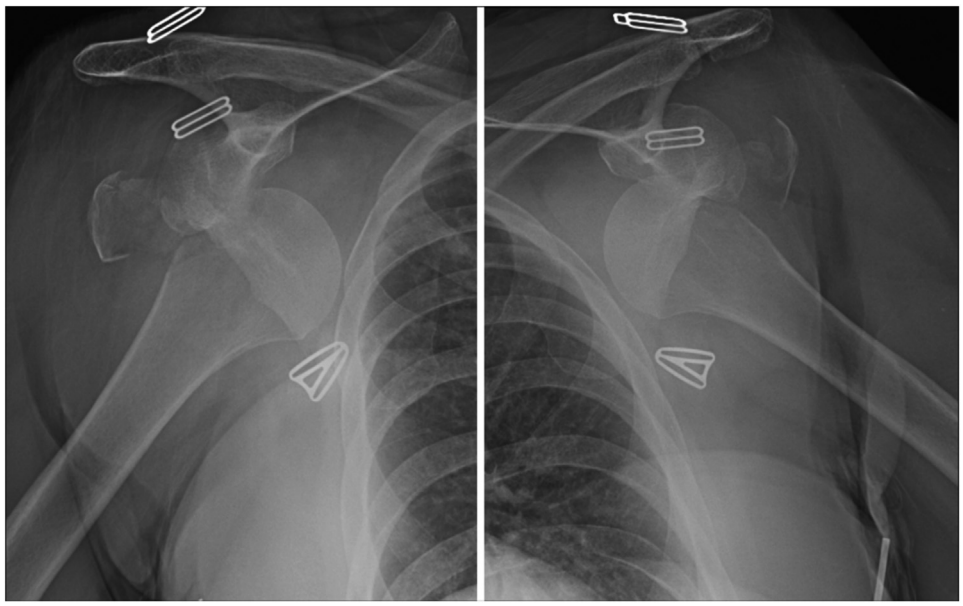

Figure 1 Injury radiographs of bilateral shoulders.

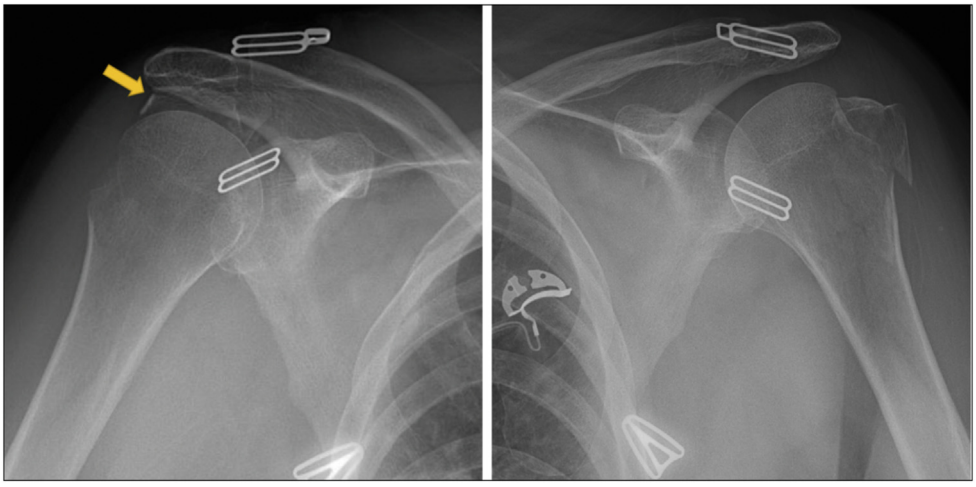

Figure 2 Postreduction radiographs. Significant medial and proximal displacement of the right greater tuberosity ( ).

cranial border of the pectoralis major tendon using #2 Fiberwire (Arthrex, Naples, FL, USA) in figure-of-8 fashion prior to amputation of the tendon at its origin on the supraglenoid tubercle. The greater tuberosity fracture donor site was identified and débrided down to bleeding cancellous bone. Number 5 Fiberwire (Arthrex, Naples, FL, USA) was passed in an anterior-to-posterior fashion through the osteotendinous junction of the RTC to aid in manipulation and reduction of the fragments. A standard double-row repair technique was then performed with 4.75-mm suture anchors and preloaded suture tape (Arthrex Speedbridge; Arthrex, Naples, FL, USA) with the medial row anchors placed just lateral to the articular margin, proximal to the fracture footprint, and the lateral row placed on the lateral proximal humerus approximately 1 cm distal to the distal end of the tuberosity footprint. The greater tuberosity fragment was first reduced using the cancellous footprint and cortical read to assess the quality of reduction. A smooth 1.6-mm Kirschner wire was then placed lateral to medial to maintain provisional reduction of the fragment. The medial row suture anchors were then placed, with the suture tape passed inside-out at the osteotendinous junction of the RTC. The suture tape was then tensioned, and lateral row suture anchors were placed to complete a knotless repair. Intraoperative range of motion examination demonstrated satisfactory fixation with the proximal humerus, RTC, and greater tuberosity moving as a single unit. Final postoperative radiographs are seen in Fig. 4A. The wound was irrigated with normal saline, and multilayered closure was then performed.

Postoperatively, the patient was made coffee-cup weight bearing bilaterally with bilateral shoulder slings for comfort. Shoulder immobilizers were not used. She was discharged home with assistance from her spouse from the hospital on postoperative day 2. Codman exercises were initiated 2 weeks postoperatively. Active assist and overhead passive range of motion exercises were started at 4 weeks postoperatively in addition to physical therapy. A standard rotator cuff repair protocol was employed with physical therapy. At 4 weeks postoperatively, she had passive forward flection to 100° and passive external rotation to 30° bilaterally. At 3 months, she had achieved active forward flexion to 120° and 40° external rotation bilaterally. At 6 months postoperatively, patient

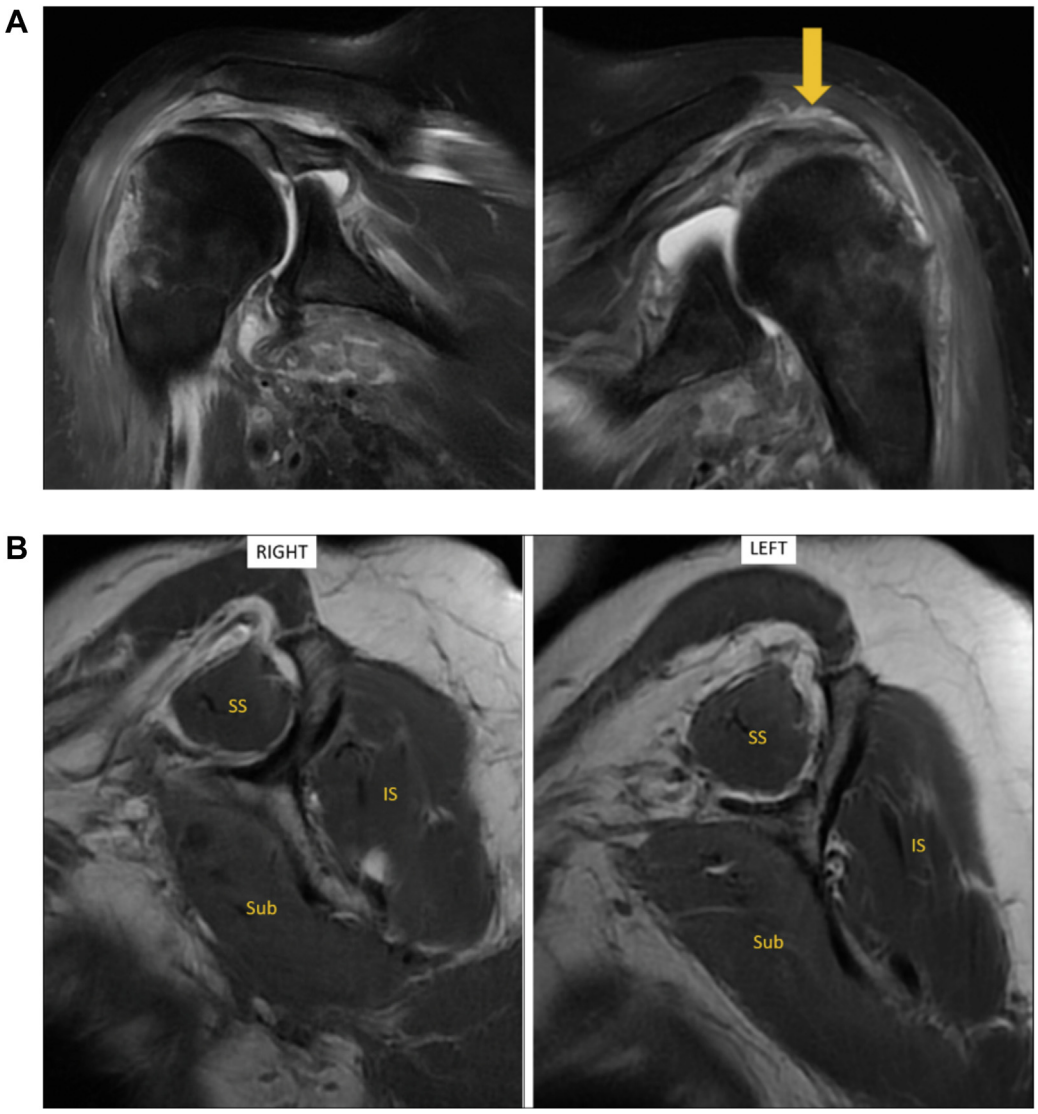

Figure 3 Preoperative MRI bilateral shoulders. (**A**) Coronal T2 sequence demonstrating intact rotator cuff tendons and displacement of tuberosity fragments, with increased displacement of left greater tuberosity compared to postreduction radiographs ( ). (**B**) Minimal fatty infiltration is present on sagittal Tl images of the rotator cuff muscles (SS, supraspinatus; IS, infraspinatus; Sub, subscapularis).

had further improved, with active forward flexion of the right and left shoulder of 150° and 155°, respectively, without pain (Fig. 5) and 45° of active external rotation bilaterally. Abduction was measured at 155° on the right and 130° on the left. She was able to perform all activities of daily living without difficulty and was allowed to return to Pilates. There was radiographic evidence of healing as early as 1-month postoperatively with complete healing and incorporation of the fracture fragments seen at 6 months (Fig. 4). There was no loss of reduction or migration of the fragments.

Discussion

Traumatic anterior shoulder dislocations often occur with the upper extremity in a position of extension, abduction, and external rotation, consistent with our patient's mechanism of injury while performing resistance exercises on a Pilates reformer. Anterior bilateral fracture dislocations are rare as most bilateral shoulder dislocations displace posteriorly secondary to excessive internal rotation of the shoulders from pull of the pectoralis major following injuries such as seizures or electrocution. Furthermore, combined injuries such as shoulder fracture dislocations remain particularly infrequent, especially while performing what is commonly deemed to be a "safe and controlled" exercise such as Pilates. Given the symmetric appearance of bilateral upper extremities at the time of initial presentation, these injuries can be missed in up to 15% of cases, and a high index of suspicion is key to early diagnosis and appropriate treatment.[1] In our patient, early recognition of this complex injury and timely closed reduction on presentation to the outside emergency room undoubtedly helped contribute her favorable outcome. Recently, bilateral anterior shoulder dislocations were also described in a 41-year-old female during Pilates exercise. She was successfully treated with closed reduction and therapy. However, there were no fractures in that patient's case.[5]

There have been multiple studies looking at treatment and outcomes following bilateral shoulder dislocations without fracture, including those in elderly patients, but there is a paucity of literature regarding bilateral shoulder anterior fracture

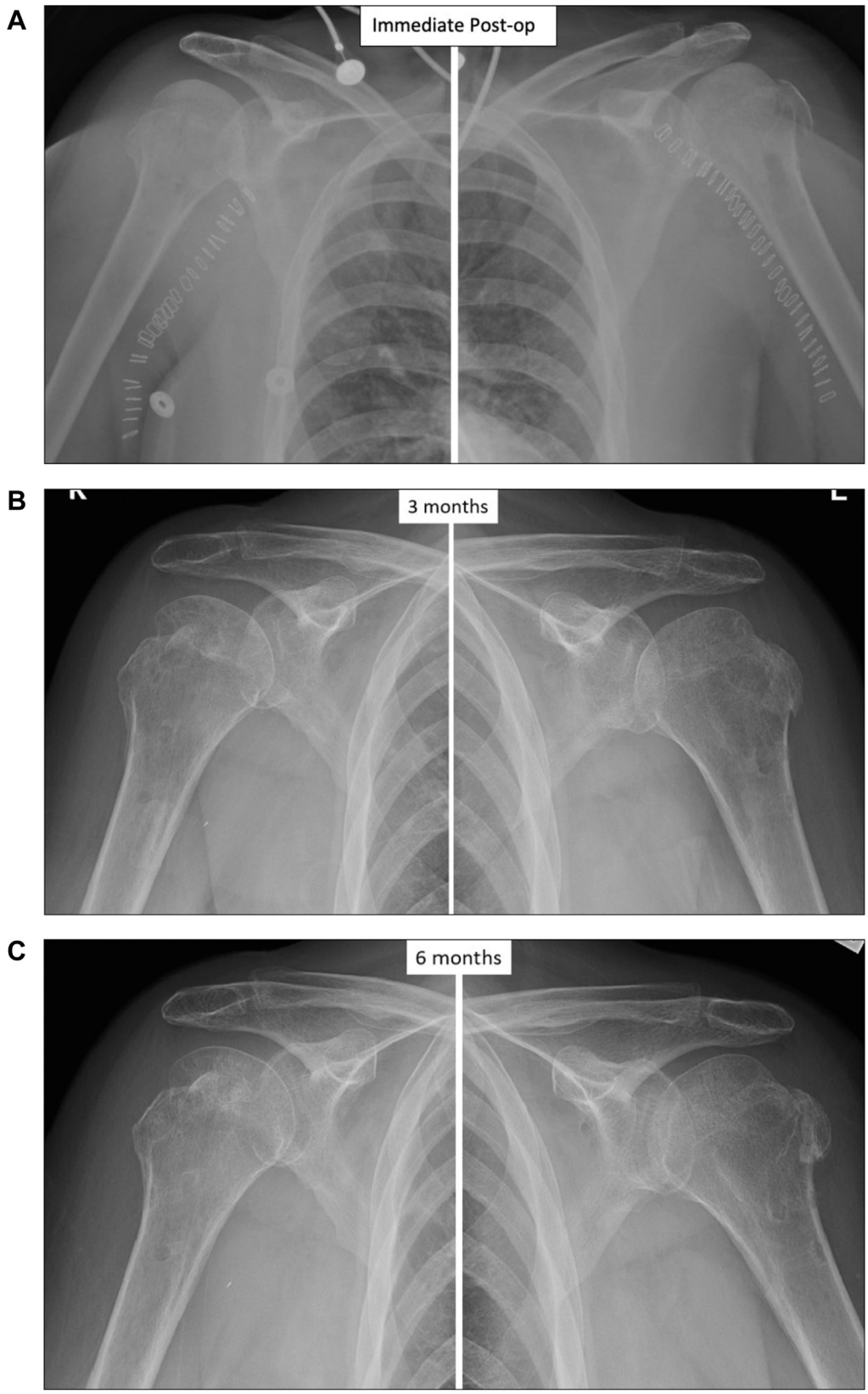

Figure 4 (**A**) Immediate, (**B**) 3-month, and (**C**) 6-month postop radiographs.

dislocations.[1,3,8] In their review of the literature, Ballesteros et al noted that only 9 of 70 cases of bilateral anterior shoulder dislocations were treated with ORIF.[1] However, outcomes were not reported for these patients. Dlimi et al reported successful closed treatment with rehabilitation for a 76-year-old female who sustained bilateral anterior shoulder fracture dislocations.[4] However,

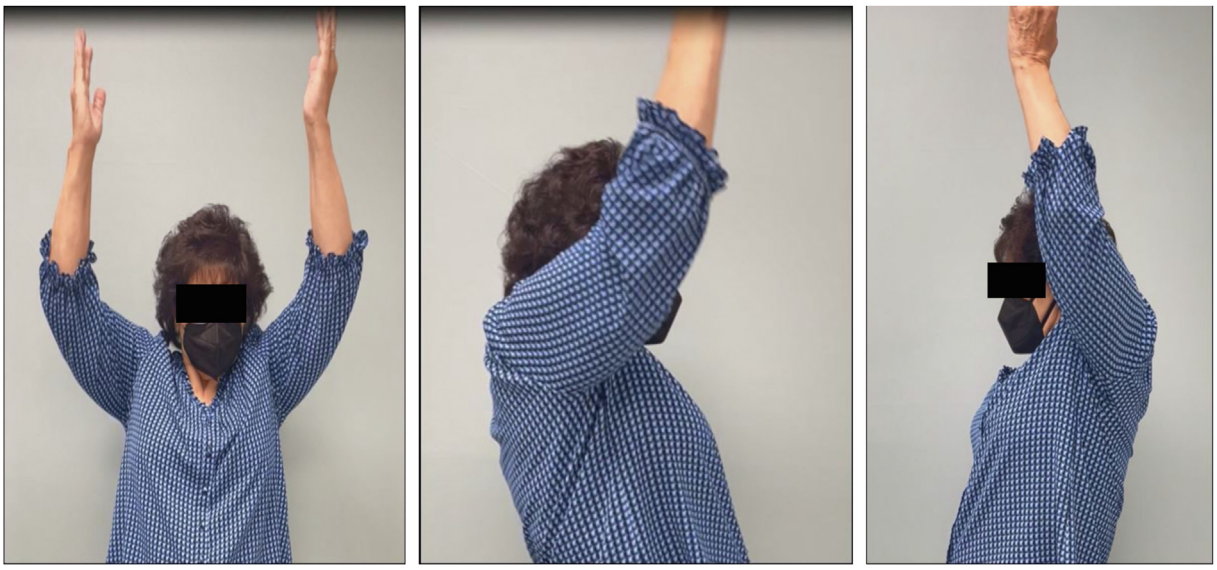

Figure 5 Clinical images 6 months postop.

tuberosity fragments were not significantly displaced after reduction. ORIF would be the treatment of choice for displaced greater tuberosity fragments in a younger patient with a similar injury, but this may not be the case for elderly patients given the known prevalence of asymptomatic full-thickness RTC tears being 28% in patients aged ≥60 years and 50% in patients aged ≥70 years.[2,6,9] As such, MRI postreduction is recommended for elderly patients in the setting of bilateral shoulder fracture dislocations to evaluate for pre-existing, asymptomatic RTC tear(s), indicated by more advanced Goutallier staging or in the unlikely case that there is both a tuberosity fracture and acute RTC tear. Should MRI demonstrate an RTC tear or advanced Goutallier stage, open treatment may still be indicated to address significantly displaced fracture fragments resulting in mechanical block to motion, but rTSA should be considered to optimize functional outcome.

In our case, treatment options were influenced by the following factors: bilateral fracture dislocations, significantly displaced tuberosity fragments including possibility of subacromial impingement, high baseline activity level in the setting of advanced age, and questionable preinjury RTC competency based on patient age. Thus, a thorough preoperative work-up was performed including an MRI to assess the integrity and Goutallier stage of the RTC. MRI also afforded further assessment of fracture fragment morphology, location, and degree of displacement (Fig. 3). Nonoperative management was not considered a viable treatment option given the significant displacement of the greater tuberosity fragments and risk of subacromial impingement. rTSA was discussed with the patient. However, preoperative imaging demonstrated intact RTC tendons and musculature without significant fatty infiltration, indicating that good functional recovery could be expected assuming tuberosity healing. Additionally, her baseline activity level was high, and bilateral rTSA would likely limit her ability to achieve her postoperative goal of return to Pilates. Therefore, we elected to proceed with ORIF given the significant displacement of the fragments and the absence of RTC pathology, with the goal of returning to her baseline activity level.

Both arthroscopic and open approaches were considered based on fracture displacement, location, and surgeon comfort to access and adequately reduce the fragment. Given degree of displacement, an open approach was chosen. We elected to use a deltopectoral approach, as opposed to a deltoid split, limit risk to the axillary nerve, and facilitate rTSA in the future should need arise.

Conclusion

Here, we present the case of an active 69-year-old female who sustained bilateral anterior shoulder fracture dislocations with significantly displaced greater tuberosity fragments. We have provided a focused discussion of both the diagnostic and treatment algorithm including preoperative MRI to evaluate the integrity and Goutallier stage of the RTC, patient and injury characteristics that influenced the decision to proceed with ORIF, and technical considerations in executing our preoperative plan. We performed ORIF of bilateral shoulders using a double-row repair technique during a single anesthetic event. The patient has had an excellent outcome including active forward flexion >150^{o} in bilateral shoulders and has regained an ability to perform daily activities to her tolerance with minimal to no pain. Finally, we would like to emphasize the importance of supervised exercises of elderly patients during “safe and controlled” activities including Pilates.

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