

Chronic Bilateral Locked Anterior Shoulder Fracture-Dislocations

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Bilateral shoulder dislocations of the humeral head are uncommon injuries. Although they typically result from an awkward fall or trauma,¹⁻¹⁵ bilateral anterior dislocations can also be associated with systemic injuries such as seizure,^{2,5,16-23} electrocution,²⁴⁻²⁶ and hypoglycemia.^{27,28} Even more infrequently reported are bilateral shoulder fracture-dislocations (Table).^{2,4,10,11,15,18,19,22,24,25,27,29-31}

When a systemic insult, such as a seizure, causes bilateral dislocations of the glenohumeral joint, the diagnosis of a musculoskeletal injury can be delayed, as treatment of the overlying condition is given priority. Historically, many terms have been used to characterize delayed presentation of a shoulder dislocation: *missed*,³⁰ *undiagnosed*,¹ *unrecognized*,³² *unreduced*,³³ *neglected*,³⁴ *old*,⁴ *locked*,³⁵ and *chronic*.³⁶ In their case series of shoulder dislocations with delayed presentation, Rowe and Zarins³⁷ considered any dislocation with a reduction delay of at least 3 weeks to be chronic.

In the present report, we use such a delay to define chronic, bilateral, locked, anterior shoulder dislocations with bilateral greater tuberosity fractures. To our knowledge, this is the first reported case of bilateral open reduction and internal fixation (ORIF) for such an injury.

The authors have obtained the patient's informed consent to publish his report in print and electronic formats.

CASE REPORT

A 27-year-old right-hand-dominant man presented to our clinic about 2 months after his first seizure. He had been initially evaluated at an outside institution for the seizure, but his shoulder injuries had gone unnoticed. Past medical history had revealed an otherwise healthy man who smoked cigarettes and admitted to intermittent recreational opiate use. Although he had received an extensive neurologic workup, no specific etiology had been found for the

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epileptic event. The consensus of his physicians had been that the seizure may have been related to excessive opiate use or withdrawal.

On our initial evaluation, the patient complained of decreased bilateral shoulder function and motion, especially external rotation and abduction. On physical examination, his shoulders were squared off in appearance, with an obvious sulcus just inferior to the acromion (Figure 1). Active and passive range of motion (ROM) was similar bilaterally, with 45° of forward flexion, internal rotation to 60°, and external rotation only to neutral in adduction and in 45° of maximal abduction. There was generalized shoulder muscle atrophy, but distal motor, sensory, and vascular function was preserved.

X-rays showed symmetric anterior shoulder dislocations with displaced greater tuberosity fractures (Figure 2). The greater tuberosity fracture fragments had begun to heal in a malunited position along the posterolateral aspect of the humeral shaft. Computed tomography (CT) scans of the shoulders confirmed the radiographic diagnoses and showed the displaced location of the greater tuberosity fragments. The greater tuberosities had both healed to the lateral aspect of the proximal humeral shaft. In addition, the CT scans showed a significant amount of cancellous bone loss (large Hill-Sachs type lesion) where the humeral head was impacting the anterior rim of the glenoid (Figure 3).

Staged ORIF (open reduction of the anterior fracture dislocation of the shoulder and internal fixation of the greater tuberosity fragments) was performed. The right shoulder was approached first, 3 weeks were allowed for healing, and then the left side was addressed in the same manner. The fracture-dislocations were exposed through a deltopectoral approach. The humeral head was easily identified in its anterior, subcoracoid position. After release of the greater tuberosity malunion and débridement of fibrous tissue at the base of the compressed humeral head defect, access to the glenoid was gained by exploiting the rotator cuff interval. We selected a rotator cuff interval



Figure 1. Preoperative clinical photograph shows squared-off shoulders with underlying bilateral chronic anterior shoulder fracture-dislocations.

Table. Bilateral Anterior Shoulder Dislocations Reported in the English Literature Since 1966

Case Report Author(s)	Year	Mechanism of Injury	Patient		Type of Reduction
			Age (y)	Sex	
Bilateral Anterior Dislocations Without Fractures					
<i>Acute at Diagnosis</i>					
Brown ²	1984	Trauma/fall	60	M	CR
Brown ²	1984	Trauma/fall	65	M	CR
Cresswell & Smith ³	1998	Trauma/fall	31	M	CR
Hartney-Velazco et al ¹⁷	1984	Seizure	22	F	CR
Jones ⁵	1987	Trauma/fall	24	?	CR
Litchfield et al ²⁸	1988	Hypoglycemia	21	M	CR
Maffulli & Mikhail ⁷	1990	Trauma/fall	31	M	CR
Mathis ¹²	1990	Trauma/fall	23	M	CR
McFie ³	1976	Trauma/fall	31	F	CR
Mehta & Kottamasu ⁹	1989	Trauma/fall	53	M	CR
Sciammarella ²¹	1986	Seizure	30	F	CR
Segal et al ¹⁸	1979	Seizure	60	M	CR
Segal et al ¹⁸	1979	Trauma/fall	19	M	CR
Singh & Kumar ³¹	2005	Trauma/fall	21	M	CR
<i>Chronic at Diagnosis</i>					
Brown ²	1984	Seizure	31	M	OR
Onabowale & Jaja ²³	1979	Unknown	62	M	BN
Costigan et al ¹	1990	Unknown	74	F	BN
Sadhra ²⁰	1984	Seizure	?	F	BN
Bilateral Anterior Dislocations With Unilateral Fracture Involving Tuberosity or Neck—Acute at Diagnosis					
Brown ²	1984	Trauma/fall	49	M	CR/OR
Brown ²	1984	Trauma/fall	54	M	CR
Brown ²	1984	Trauma/fall	71	F	CR
Dinopoulos et al ⁴	1999	Trauma/fall	76	F	CR
Dunlop ⁵	2002	Trauma/fall	91	F	CR
Ng et al ¹⁴	2000	Trauma/fall	70	F	CR
Ribbans ¹⁶	1989	Seizure	38	M	CR
Sadhra ²⁰	1984	Seizure	32	F	CR
Yuen & Tung ²⁶	2001	Electrocution	41	M	CR
Velkes et al ¹³	1991	Trauma/fall	70	F	OR
Bilateral Anterior Dislocations With Bilateral Fractures Involving Tuberosity or Neck					
<i>Acute at Diagnosis</i>					
Aufranc et al ¹⁹	1966	Seizure	36	M	ORIF/hemi
Brown ²	1984	Trauma/fall	23	M	OR
Cottias et al ²⁷	2000	Hypoglycemia	33	M	CR/OR
Lal et al ¹⁵	1992	Trauma/fall	36	M	CR
Lal et al ¹⁵	1992	Trauma/fall	45	F	CR
Markel & Blasier ²⁹	1994	Seizure	28	M	ORIF
Nagi & Dhillon ¹⁰	1990	Trauma/fall	49	M	ORIF/hemi
Paley et al ¹¹	1986	Trauma/fall	60	M	CR
Segal et al ¹⁸	1979	Seizure	32	M	CR
<i>Chronic at Diagnosis</i>					
Carew-McColl ²⁴	1980	Electrocution	78	F	OR
Salem ²⁵	1983	Electrocution	37	M	OR
Thomas & Graham ³⁰	1996	Trauma/fall	65	F	Hemi
Yadav ²²	1977	Seizure	56	M	BN
Present case report	2008	Seizure	27	M	ORIF

Abbreviations: M, male; F, female; CR, closed reduction; OR, open reduction; BN, benign neglect; ORIF, open reduction and internal fixation; hemi, hemiarthroplasty or replacement of humeral head.

splitting approach, rather than a traditional anterior glenohumeral approach, to maintain the remaining vascular and soft-tissue attachments to the anterior humeral head and lesser tuberosity. The rotator cuff interval was also the natural plane of dissection created by the injury itself. The subscapularis was found intact to its attachment to the lesser tuberosity, and the supraspinatus was found intact to its insertion on the displaced greater tuberosity. Dissection was not carried distally along the bicipital groove so that the primary blood supply to the humeral head—the

anterior humeral circumflex artery—could be preserved. Significant scar tissue had formed within the vacant glenoid fossa. Through the exposed rotator cuff interval, this fibrous tissue was excised, and the humeral head was manipulated and reduced.

Once reduced, the humeral head was easily dislocated with external rotation and abduction. This instability was treated by reducing the greater tuberosity fracture fragment to a posterior, slightly medial position on the humeral head, effectively closing down the bone-loss defect involving the

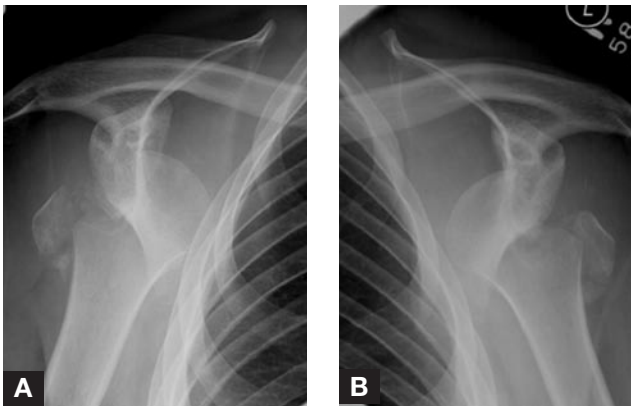


Figure 2. Presentation anteroposterior x-rays of right (A) and left (B) shoulders show anterior shoulder dislocations with displaced greater tuberosity fractures.

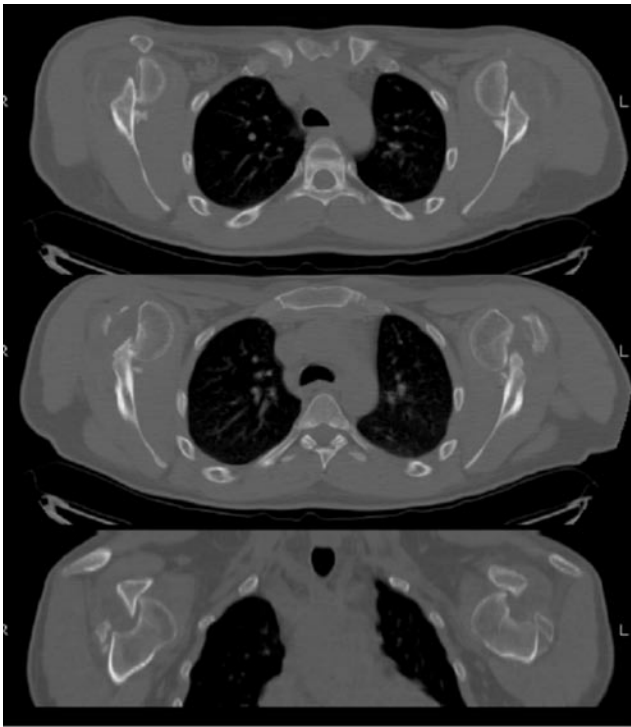


Figure 3. Multiple axial and reformatted computed tomography scans of shoulders show medialization of humeral heads and sizable humeral head defects enlarged by anterior rim of the glenoid.

posterolateral aspect of the humeral head. Before cannulated, partially threaded, lag-screw fixation was performed, allograft bone was impacted to support the posteriorly repositioned greater tuberosity fragment. A nonarticular defect remained at the anterolateral portion of the humeral head (Figure 4). Nevertheless, glenohumeral joint stability to a full range of abduction and external rotation was confirmed during surgery, after internal fixation was complete. The mild infraspinatus and supraspinatus insertion shortening that resulted from posterior reduction of the greater tuberosity fragment did not cause recognizable laxity in the rotator cuff. Three screws were used on the right, but only a single screw was needed for stable fixation on the left. Careful and

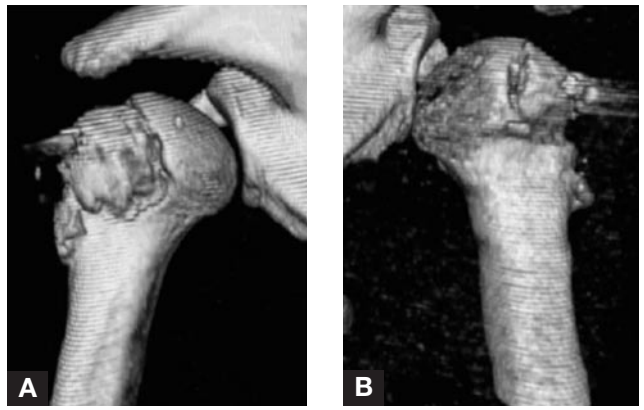


Figure 4. Postoperative computed tomography scans (3-dimensional reconstruction) of right (A) and left (B) shoulders show posteromedial reduction of greater tuberosity fracture fragments with internal fixation.

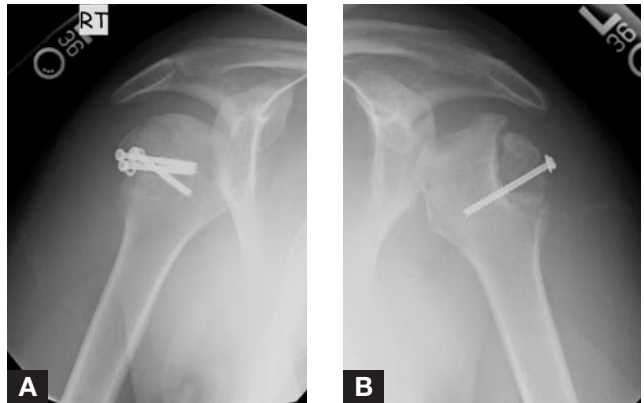


Figure 5. (A) Six-month follow-up anteroposterior x-ray of right shoulder shows united greater tuberosity fracture and subtle, clinically insignificant focus of avascular necrosis of the superomedial humeral head. (B) Similar x-ray of left shoulder shows nonunion of greater tuberosity fracture and large collapsed segment of the humeral head.

secure closure of the rotator interval robustly and bilaterally augmented the stability achieved with screw fixation.

The patient was placed in a shoulder immobilizer for the first 2 weeks after surgery. After coming in for the initial postoperative follow-up after the second surgery, he did not return to clinic the next 6 months. Although he had undergone no formal physical therapy, he had regained function in both arms, returned to activities of daily living, and resumed office work. The dominant, right side had active, painless ROM of 120° of forward flexion, 90° of internal rotation, 90° of abduction, and 60° of external rotation in abduction. On the left side, the active and mildly painful ROM was 100° of forward flexion, 90° of internal rotation, 75° of abduction, and 30° of external rotation in abduction.

X-rays taken 6 months after surgery showed both shoulders concentrically reduced, with healing of the right greater tuberosity fracture and nonunion of the left greater tuberosity fracture. Although screw fixation was loosened on both sides, the reduced greater tuberosity fracture fragments showed no evidence of displacement (Figure 5). In addition, both humeral heads had evidence of avascular necrosis (AVN).

Eight months after original injury (or 6 months after ORIF), the region of AVN on the right humeral head was small and subtly visible only on the internal rotation view of the shoulder, and the left humeral head was collapsed 2 cm. Although there was a 3-week difference in open reductions, operative exposure and procedure were identical apart from using 1 screw rather than 3 screws. Although the radiographic evidence of AVN and collapse was clear, the patient had not developed significant pain. Certainly, if these lesions were to become symptomatic enough, the patient would become a candidate for partial resurfacing arthroplasty of the humeral head or hemiarthroplasty of the shoulder.

DISCUSSION

In the literature, chronic, bilateral anterior dislocations with associated greater tuberosity fractures have seldom been reported. We found only 4 other reports of this specific injury.^{22,24,25,30} Yadav²² reported the similar case (also caused by seizure) of a 56-year-old man, but the patient was treated with benign neglect and, at 6-month follow-up, was performing activities “without much difficulty” despite limited abduction to 70° bilaterally. Carew-McColl²⁴ described a case that had been caused by electrocution and treated with open reductions and no fixation. At final follow-up, the 78-year-old female patient had limited abduction (80° bilaterally) and no external rotation.

Thomas and Graham³⁰ treated the same injury in a 65-year-old woman who had fallen from a bus but not been diagnosed until 8 months later. Given the patient’s osteoporosis, the patient was treated with staged bilateral hemiarthroplasties. Salem²⁵ reported the same injury in a 37-year-old man who had been electrocuted at work. Diagnosis was delayed 9 weeks, and he was treated with bilateral open reductions without fixation. No mention was made of fracture reduction. After physical therapy, the patient returned to his job as a manual laborer. Ten years later, he had full ROM in the right shoulder and only mildly limited external rotation in the left shoulder.

The present report is the first account of chronic, bilateral anterior dislocations and associated greater tuberosity fractures treated with ORIF. Although our patient did not participate in physical therapy, both shoulders nevertheless regained useful function. At 6 months, healing and bony stability were sufficient, but AVN was found radiographically in both shoulders. Whereas the necrotic segment on the dominant side was small and not clinically significant, there was significant collapse of the humeral head on the nondominant side. Given the delay in presentation of this injury and the patient’s smoking history, certainly there were risk factors for developing AVN.^{38,39}

Although we exploited an open approach to the shoulder, we purposely dissected through the rotator interval to maintain the soft-tissue attachments of the humeral head. Certainly, a rotator interval approach would not have been reasonable if there had not been a greater tuberosity fracture. The bony and soft-tissue trauma created by this injury facilitated the rotator interval dissection. In addition, care

was taken to preserve the ascending branch of the anterior humeral circumflex artery. None of the previously mentioned bilateral case reports refers to AVN, but a series of chronic, unilateral, anterior shoulder fracture-dislocations describes AVN as a potential outcome.³⁷

In some case series, the incidence of AVN in complex fractures of the humeral head was as high as 37%.^{40,41} AVN of the humeral head has also been reported in cases of acute anterior fracture-dislocations,⁴² though the incidence appears to be more common when the fracture involves the surgical or anatomical humeral neck.⁴³ Rowe and Zarins³⁷ reviewed a large case series of unilateral chronic shoulder dislocations and found patients had improved functional outcomes with operative management, including open reductions and hemiarthroplasties. For delayed-presentation posterior fracture-dislocations, Martens and Hessels⁴⁴ suggested hemiarthroplasty as a technique for preventing AVN.

Given our patient’s young age and high risk for developing AVN,⁴⁴ we preserved his anatomy and treated his AVN symptomatically rather than treating him with primary hemiarthroplasties. In a young patient, shoulder hemiarthroplasty is not without risk for wear, deteriorating function, and reoperation; in addition, there have been reports of revascularization in fracture-dislocations treated operatively.^{45,46} In a shoulder hemiarthroplasty study, native glenoid wear was assessed in 8 young adult patients.⁴⁷ After a mean follow-up of 43 months, all 8 patients demonstrated progressive glenoid wear correlating with worsening outcome scores. In examining the outcomes of young adults treated with shoulder hemiarthroplasty for various conditions, including AVN and trauma, Burroughs and colleagues⁴⁸ at a mean of only 5.6 years did not find accelerated deterioration of function using a subjective grading scale. At a mean follow-up of 12.3 years, however, Sperling and colleagues^{49,50} found that almost half their patients had an unsatisfactory result.

Functional results from these types of injuries depend significantly on the acuity of the diagnosis.¹⁴ Although these fractured-dislocated shoulders are at risk for developing stiffness and AVN, acute management of these injuries decreases that risk. Markel and Blasler²⁹ described bilateral anterior shoulder fracture-dislocations that were secondary to seizure, presented acutely (within a week of injury), and managed with ORIF. Those authors used a similar technique to reposition the greater tuberosity fragment posteriorly to obtain bony stability, but they were able to advance it distally to maintain tension on the rotator cuff. Their patient achieved fracture union and nearly full ROM without evidence of AVN at 6-month follow-up. Paley and colleagues¹¹ also reported on bilateral anterior shoulder dislocations with bilateral greater tuberosity fractures diagnosed and closed-reduced acutely. At 18-month follow-up, their patient had full ROM and no evidence of AVN.

In a case report on bilateral posterior fracture-dislocations, Martens and Hessels⁴⁴ wrote, “Bilateral dislocations are nearly always caused by convulsive seizure.” For bilateral posterior dislocations, their statement may be true, but, regarding anterior shoulder dislocations, 23 of 41 reported

cases were caused by trauma or an awkward fall, and only 14 were caused by seizure or hypoglycemia. According to our literature review, there is a clear difference in outcomes between acutely treated bilateral anterior dislocations and those managed after delayed presentation. Chronic, bilateral anterior dislocations with associated greater tuberosity fractures should be managed thoughtfully with patient-specific treatment plans that recognize the risk for AVN.

AUTHORS' DISCLOSURE STATEMENT

The authors report no actual or potential conflict of interest in relation to this article.

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