Excision and Reimplantation of the Proximal Humerus After Fracture-Dislocation

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abstract

Fractures of the proximal humerus are common and the treatment for both displaced and comminuted variants remains controversial. Treatment options initially consisted of closed reduction, traction, casting, and abduction splints. In the early 1930s, operative treatment for displaced fractures gained popularity, which continued in the 1940s and 1950s. Humeral head replacement for severely displaced fractures of the proximal humerus was introduced in the 1950s. In the 1970s, the Association for Osteosynthesis/Association for the Study of Internal Fixation popularized plates and screws for fracture fixation, and humeral head prostheses were redesigned. The traditional management of severely displaced proximal humerus fractures has been with arthroplasty because of the significant risk of osteonecrosis of the humeral head following open reduction and internal fixation. The authors present a case of a 51-year-old right-hand–dominant man who sustained a seizure along with a posteriorly displaced proximal humerus fracture-dislocation of the right upper extremity. This was treated with surgical extrusion of the entire humeral head and subsequent open reduction and internal fixation. During the surgical procedure, the patient’s humeral head was completely extruded from the body through a posterior incision and then reduced back to the proximal humerus through the standard anterior deltopectoral approach. After 4 years of follow-up, the patient remains pain free, has functional range of motion, and is without signs of osteonecrosis on plain radiographs. This case illustrates that even with complete disruption of the vascular supply to the humeral head, revascularization after osteosynthesis is possible. [Orthopedics. 2016; 39(4):e779-e782.]

Proximal humerus fractures account for approximately 10% of all fractures. The majority of these fractures present with minimal or no displacement and are managed nonoperatively with excellent results. However, treatment for displaced and comminuted fractures remains controversial. Multiple factors influence the success of operative treatment, including amount of commination and displacement, vascularity of the humeral head, injury to the rotator cuff, and degree of osteoporosis. Current literature has reported on surgical treatment with locking plates, intramedullary nails, and prosthetic replacement but remains inconclusive regarding the preferred management.

A primary consideration in surgical management of displaced fractures is assessment of the vascular supply of the fracture fragments. This concern is because of the devastating consequence of post-fracture osteonecrosis of the humeral head. Certain fracture patterns have been associated with a higher rate of postoperative osteonecrosis. Traditional teaching has favored surgical treatment with pros-

The authors are from Orthopaedic Research of Virginia (SRH, SEP, PEC) and Tuckahoe Orthopaedic Associates, Ltd (PEC), Richmond, Virginia.

Dr Hanzlik has received grants from Arthrex, Bon Secours, DJO, DePuy-Mitek, and Smith & Nephew. Dr Pearson has received grants from Arthrex, Bon Secours, DJO, DePuy-Mitek, and Smith & Nephew. Dr Caldwell has received grants from Arthrex, Bon Secours, DJO, DePuy-Mitek, and Smith & Nephew.

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Received: May 3, 2015; Accepted: September 23, 2015

doi: 10.3928/01477447-20160526-12
thetic replacement as opposed to open reduction and internal fixation (ORIF) when the fracture orientation predisposes the humeral head to osteonecrosis. The authors present the case of a patient with a posteriorly displaced proximal humerus fracture-dislocation in which the humeral head was subsequently removed from the body during surgery and reimplanted for ORIF.

**CASE REPORT**

A 51-year-old right-hand–dominant man with an intracranial meningioma sustained a seizure with subsequent fracture and posterior dislocation of the right proximal humerus. He reported no prior trauma or surgery to the right shoulder. His medical history was significant for Type 2 diabetes, hepatitis C, and hypertension. Plain radiographs and a computed tomography scan showed the fracture and posterior dislocation (Figure 1). The patient was taken to the operating room on the first day after his injury for operative fixation after obtaining medical clearance from both the intensive care unit staff and his neurosurgeon.

The patient was placed in the modified beach chair position and the fracture was accessed through a standard deltopectoral approach. The subscapularis was completely ruptured and biceps tendon subluxed medially. The glenoid vault was empty and the entire articular surface of the humeral head and part of the shaft were dislocated posteriorly. The remainder of the humeral shaft and greater tuberosity were intact and still attached to the additional rotator cuff muscles. The authors attempted to reduce the posterior fragment through their anterior approach without success. A second, accessory posterior incision was made to aid in reduction of the humeral head. The humeral head was irreducible and had to be removed from the body through the posterior incision (Figure 2). The head was then reduced to the shaft through the deltopectoral incision and fixed with a 3.5-mm LCP Proximal Humeral Locking Plate (Synthes, West Chester, Pennsylvania). The subscapularis was repaired with nonabsorbable suture through the plate, and a soft tissue biceps tenodesis was performed as well. A drain was placed and the tissue closed in layers. The patient’s postoperative fluoroscopic image is shown in Figure 3.

Following surgical fixation, the patient was placed in a sling and began passive range of motion (ROM) with physical therapy. He began active motion at 6 weeks and strengthening at 3 months. A computed tomography arthrogram at 14 weeks postoperatively showed a well-healed fracture and no evidence of a rotator cuff tear. He continued physical therapy for 6 months and progressed to a home program. At 1 year postoperatively, he was still having mild pain with end ROM and had restrictions in both active and passive ROM in all planes consistent with adhesive capsulitis. Radiographs showed a well-healed proximal humerus without signs of osteonecrosis in the humeral head (Figure 4). He continued a stretching and strengthening regimen for his restriction in ROM. At 19 months postoperatively,
the patient had resumed all of his prior activities with a pain-free ROM (Figure 5). He is now more than 4 years out from his injury and following up on an as-needed basis.

**DISCUSSION**

Proximal humerus fractures are common and the preferred surgical intervention in the treatment of displaced fractures remains controversial. To the authors’ knowledge, there are no similar cases in the literature describing fixation of a humeral head removed from the body. This case shows complete disruption of the vascular supply to the humeral head, which has traditionally led many authors to recommend arthroplasty. The current authors advocate that ORIF can lead to an excellent outcome at 4 years without subsequent osteonecrosis.

The majority of studies comparing different surgical techniques for displaced fractures are case series as opposed to randomized controlled trials, making optimal treatment controversial. Multiple studies have shown no difference in surgical outcomes comparing ORIF and hemiarthroplasty in the treatment of displaced proximal humeral fractures. Additional studies compared hemiarthroplasty and osteosynthesis and found better functional outcomes in the internal fixation group. The vascularity of the humeral head is a significant consideration and the prevalence of avascular necrosis of the humeral head following 3- and 4-part fractures of the proximal humerus has ranged from 21% to 75%. Although the majority of the literature regarding outcomes has focused on 3- and 4-part proximal humeral fractures, the current case shows a displaced 2-part fracture and cannot be directly compared.

Removal and subsequent reimplantation of an articular segment has been most commonly reported with the talus. These studies have shown high complication rates, with infection and osteonecrosis being the most common. Vallier et al showed a high rate of osteonecrosis in open injuries of the talus and Smith et al reported that 75% of patients showed collapse at 1 year following extruded tali with a fracture. The risk of infection would presumably be higher with open fractures vs...
a planned surgical extrusion that occurs in a sterile operating room environment.

**CONCLUSION**

To the authors’ knowledge, this is the first clinical report documenting reimplantation of a humeral head that was removed from the body during surgery after fracture-dislocation of the proximal humerus. Preservation of the native humeral articular surface is always preferable, and the authors would endorse internal fixation as opposed to arthroplasty in similar cases where vascular compromise might be in question.

**REFERENCES**