Arthroscopically Assisted Percutaneous Fixation and Bone Grafting of a Glenoid Fossa Fracture Nonunion

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abstract

Full article available online at Healio.com/Orthopedics. Search: 20120725-35

Arthroscopy is commonly used for evaluating intra-articular fracture patterns and assessing postfixation reduction; however, the use of arthroscopy for the definitive treatment of articular fracture nonunion has not been reported. This article describes a case of symptomatic glenoid fossa fracture nonunion that was successfully treated with arthroscopically assisted percutaneous screw fixation and bone grafting.

A 48-year-old laborer sustained a glenoid fossa fracture following a fall from a height. An initial period of nonoperative management was attempted; however, the patient reported continued shoulder pain during his rehabilitation course. Imaging 5 months after injury showed no osseous union at the fracture. Using an arthroscopically assisted technique, percutaneous fixation and bone grafting of the nonunion with cancellous allograft was performed. Postoperatively, the patient progressed through a structured therapy program, and his pain improved. A computed tomography scan 4 months postoperatively showed osseous union at the fracture site.

To the authors’ knowledge, this is the first report in the literature of definitive arthroscopically assisted bone grafting and percutaneous fixation of a diarthrodial joint nonunion. Advantages of arthroscopic fixation of glenoid fossa fracture nonunion include avoiding potential axillary nerve injury and preserving the native subscapularis insertion, which may be important if subsequent procedures require access to the anterior access to the joint.
Glenoid fossa fractures are relatively uncommon, representing 30% of scapula fractures. Most are amenable to nonoperative management with satisfactory outcomes; however, highly displaced or unstable fractures can result in glenohumeral instability, degenerative articular changes, or fracture nonunion and are traditionally managed with open surgery. Recently, the usefulness and safety of arthroscopically assisted fixation of these fractures has been established.

The incidence of scapula fracture nonunion is unknown but has been reported to involve the scapular body and spine, coracoid process, and acromion. These fractures can be clinically symptomatic and have been successfully treated with open reduction and internal fixation with bone grafting. Nonunion of fractures involving the glenoid fossa are less common but may also lead to persistent pain and dysfunction. This article describes a case of a symptomatic glenoid fossa fracture nonunion that was successfully treated with arthroscopically assisted percutaneous screw fixation and bone grafting.

**Case Report**

A 48-year-old, healthy, right-hand-dominant laborer was evaluated 1 week after falling 4 feet directly onto his left shoulder at a construction site. Plain radiographs and computed tomography, which the authors routinely obtain for all intra-articular fractures, showed an intra-articular glenoid fracture with mild (range, 3–4 mm) displacement at the junction of the middle and superior glenoid, along with fracture extension into the coracoid process and body of the scapula consistent with an Ideberg Type II fracture pattern (Figures 1A, B). Clinically, passive range of motion (ROM) consisting of forward elevation to 130° and external rotation to 20°, was tolerated by the patient without glenohumeral crepitus. Based on fracture alignment and clinical ROM, nonoperative management was chosen.

During his rehabilitation course, the patient reported continued shoulder pain with motion and cuff stresses. An electromyogram demonstrated normal function of the suprascapular nerve. However, imaging during the postinjury period demonstrated continued lack of fracture healing (Figure 1C). Given the patient’s progressive shoulder pain and limited fracture healing on imaging after 5 months of nonoperative management, he underwent an arthroscopic evaluation of the shoulder and arthroscopically assisted vs open repair of the nonunion.

The patient was placed in the beach-chair position. A 30°, 4.5-mm arthroscope was introduced into the shoulder through a standard posterior portal. Diagnostic arthroscopy revealed a normal-appearing rotator cuff insertion and biceps tendon, mild fraying of the labrum, and intact humeral articular cartilage. Inspection of the glenoid confirmed a transverse fracture nonunion through the superior and middle portions of the glenoid (Figure 2A). The base of the coracoid appeared intact and attached to the superior fracture fragment.

Following the creation of an anterior portal, the nonunion site was taken down arthroscopically using a motorized shaver, elevator, and rasps wires (Arthrex, Naples, Florida). Two guide wires (Synthes, West Chester, Pennsylvania) were then placed in a superior-to-inferior direction medial to the glenoid subchondral surface, and cannulated, partially threaded 4.0-mm screws (Synthes) were placed over the wires and visualized crossing the nonunion site through the arthroscope (Figure 2B). These screws provided some fracture compression but left a residual central defect that allowed for subsequent cancellous allograft delivery. Both screws were placed percutaneously, 1 via an anterosuperior position and the other through the superior recess at the location of a standard Nevaiser portal. The stability of the fracture fragments and coracoid were then reassessed and found to be rigidly stable.

Finally, reconstituted cancellous allograft (Integra, Plainsboro, New Jersey) was packed into the nonunion site.

**Figure 1:** Anteroposterior (A) and axillary (B) radiographs 1 week after a fall onto the left shoulder showing mild displacement at the junction of the middle and superior glenoid, along with fracture extension into the coracoid process and body of the scapula (Ideberg Type II). Anteroposterior (C) and axillary (D) radiographs 5 months after injury demonstrating nonunion of an intra-articular glenoid fossa fracture.
by creating an accessory anterior portal, reducing fluid inflow, and delivering graft with Russian forceps (Surtex Instruments, Ltd, Surrey, United Kingdom) and a bone tamp (Surtex Instruments, Ltd). The entire void at the fracture nonunion was completely filled with cancellous graft (Integra). Any free-floating cancellous bone was irrigated and removed. The portals were closed, and the patient was discharged that day in a sling.

Postoperatively, the patient remained in a sling for 2 weeks and then began an active assisted ROM protocol consisting of supine forward elevation and external rotation. At 6 weeks postoperatively, he was advanced to a formal therapy program consisting of full active ROM with gentle cuff strengthening and a gradual increase in weight bearing to no restrictions at 12 weeks postoperatively. Although the patient reported an almost immediate improvement in pain, his progress was slowed by stiffness, and a computed tomography scan obtained at 4 months postoperatively showed fracture union with maintained alignment and intact hardware (Figure 2D). The patient continued a structured therapy program and obtained a ROM of 140° of forward elevation, 25° external rotation at the side, and internal rotation to L2 with no crepitans. Although the nonunion appeared healed, the patient reported some shoulder pain at 10-month follow-up and had not returned to work as a construction worker secondary to pain and a pending workers’ compensation complaint.

**DISCUSSION**

Arthroscopy is commonly used for evaluating intra-articular fracture patterns and assessing postfixation reduction; however, a paucity of literature pertains to the use of arthroscopy for the definitive treatment of articular fracture nonunion. To the authors’ knowledge, this is the first case reported in the literature of definitive arthroscopically assisted bone grafting and percutaneous fixation of a diarthrodial joint nonunion.

The traditional treatment of symptomatic glenoid fossa fractures involves an open approach and internal fixation. However, open surgery places the axillary nerve at risk and requires the mobilization of the subscapularis, which may be detrimental if future procedures require anterior access to the joint. Recently, the safety and clinical usefulness of arthroscopically assisted percutaneous screw fixation of glenoid fossa fractures has been demonstrated. Using cadavers, Marsland and Ahmed performed arthroscopically assisted percutaneous wire insertion into the glenoid using anterior, superior, and posterior approaches. After wire insertion, the cadavers were dissected, and distances from wires to relevant neurovascular structures were measured and analyzed. The authors reported that an anterior approach was associated with a clinically significant risk to the cephalic vein, mus-

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**Figure 2:** Glenohumeral arthroscopic image depicting a probe resting on a transverse fracture fibrous nonunion through the superior and middle portion of the glenoid fossa (arthroscope in posterior portal) (A). The fibrous nonunion has been debrided, and 2 cannulated partially threaded 4.0-mm screws are visualized crossing the nonunion site (arthroscope in posterior portal) (B). Reconstituted cancellous allograft has been packed into the nonunion site, completely filling nonunion void (arthroscope in posterior portal) (C). Sagittal (D) and coronal (E) cut of computed tomography scan 4 months postoperatively showing glenoid fracture union with maintained alignment and intact hardware.
culocutaneous nerve, and inferior branch of the suprascapular nerve. However, percutaneous screw fixation through the superior and posterior approaches was safe and placed no neurovascular structures at risk. Yang et al. reported clinical outcomes following arthroscopically assisted reduction and percutaneous screw fixation in 18 patients with acute Ideberg type III glenoid fractures. Although retrospective in nature, the authors reported that all fractures healed with no major complications, demonstrating the value of arthroscopic treatment for these injuries. A theoretical limitation of arthroscopic management for glenoid fracture nonunion is the requirement of bone grafting. However, in the current case, the delivery of cancellous bone allograft was relatively easily accomplished using an accessory anterior portal and reducing fluid inflow, enabling the graft to be percutaneously delivered to the nonunion site under direct visualization.

Several technical points should be considered for successful arthroscopically assisted management of a glenoid fossa nonunion. First, the morphology of the fracture pattern should be relatively transverse to allow percutaneous screws to be placed from the superior to inferior direction perpendicular to the nonunion site. Fracture patterns that are not relatively transverse in nature may not be amenable to this technique. Second, the fracture line should lie superior to the glenoid equator to provide adequate access to the nonunion site for debridement and bone grafting. Finally, the entire nonunion fracture line should be visualized to confirm that it does not involve the coracoid process. If the coracoid is involved, an open approach with fixation should be considered.

**CONCLUSION**

Symptomatic glenoid fossa fracture nonunion with fracture patterns amenable to arthroscopic management can be successfully repaired with arthroscopically assisted nonunion debridement, bone grafting, and percutaneous screw fixation. Advantages of definitive arthroscopic fixation include avoiding potential axillary nerve injury and preservation of the native insertion of the subscapularis, which may be important if subsequent procedures require access to the anterior access to the joint.

**REFERENCES**