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Arthroscopy Assisted 2 Cannulated Screw Fixation for Transverse Glenoid Fracture: A Case Report

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Arthroscopy is recognized as an important adjunct in treatment of intra-articular fractures. The author reports on successful treatment of a displaced transverse glenoid cavity fracture, reduced and fixed with arthroscopic assist, using two cannulated screws perpendicular to the fracture surface, in a patient with frail chest. One screw passed through the Neviaser portal, and the other screw passed through the base of the coracoid process. Arthroscopy assisted reduction and 2 cannulated screw fixation through the Neviaser portal and coracoid base appears to be a good method for treatment of transverse glenoid fractures.
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Key Words: Glenoid cavity; Transverse fracture; Arthroscopy; Cannulated screw; Perpendicular fixation

Fractures of the glenoid cavity are extremely rare. Scapular fractures constitute only 1% of all fractures and up to 10% of scapular fractures are glenoid cavity fractures.[1,2] Scapular fractures are usually caused by high-energy trauma. As a result, 80% to 95% of these fractures are associated with other injuries including clavicle fracture, brachial plexus injury, multiple ribs fractures, frail chest, lung contusion, hemo-thorax, and pneumothorax, which may be life threatening.[1,2] Life threatening injuries occasionally restrict the lateral decubitus position which is necessary in traditional extensive open surgery.[1,2] Arthroscopy-assisted reduction and percutaneous fixation in beach-chair position could be a solution; however, obtaining rigid fixation using two screws perpendicular to the fracture surface with percutaneous fixation is not easy. In this case report I share my experience with successful treatment of a displaced glenoid cavity fracture fixed with two cannulated screws perpendicular to the fracture surface after arthroscopy assisted reduction in a patient with frail chest.

Case Report

A 56-year-old man was involved in a motor-cycle accident which resulted in injury of both his shoulder and chest. Plain radiographs suggested an intraarticular glenoid fracture of the left shoulder and type 5 acromio-clavicular joint separations of the right shoulder (Fig. 1). The first to 6th ribs were fractured on both right and left side, with hemo-thorax and lung contusion combined. Two dimensional and 3 dimensional computed tomography showed a glenoid cavity fracture extending through the base of the coracoid process, type 3 glenoid fracture according to Ideberg classification in the left shoulder (Fig. 2).[3] The patient was in bed rest state with his arms resting on slings, and no other procedures to reduce the displaced fracture were performed. Hemo-thorax and lung contusion were healed enough to induce general anesthesia after 8 days of care by the chest surgery department. However, the lateral position for conventional open treatment could be dangerous because of the frail chest. Following induction of general anesthesia, the patient was placed in a beach chair position at 30°, in order to obtain a proper shoulder joint image through an X-ray image intensifier. Routine arthroscopy was performed by first establishing a posterior portal and then establishing an anterior portal (Fig. 3A). Blood clot and loose articular debris were irrigated from the joint. The long head of the biceps tendon was frayed,

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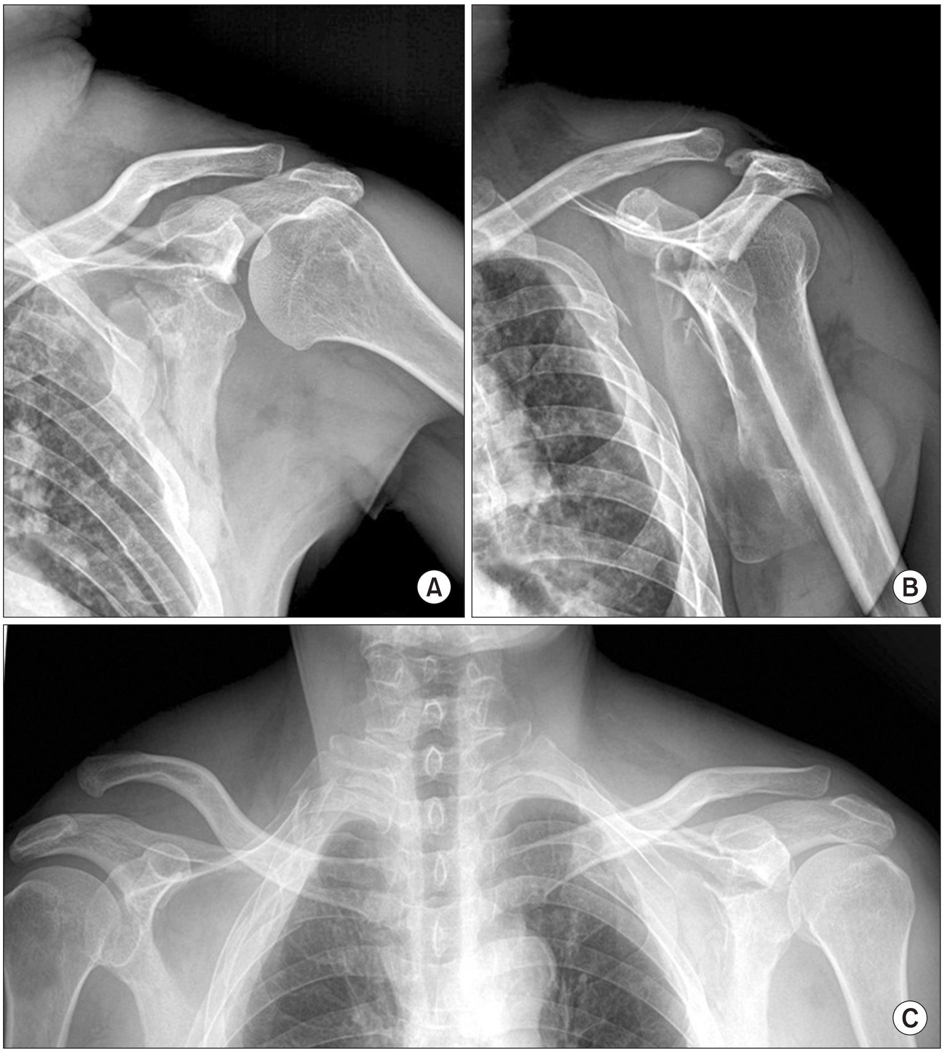

Fig. 1. (A) Anteroposterior radiograph of the left shoulder. (B) Lateral view of the left scapular showing a transverse intra-articular glenoid fossa fracture with a comminuted scapular body fracture. (C) Pearson's stress view documenting widened coraco-clavicular distance in the right shoulder, more than 3 times wider compared with the left shoulder.

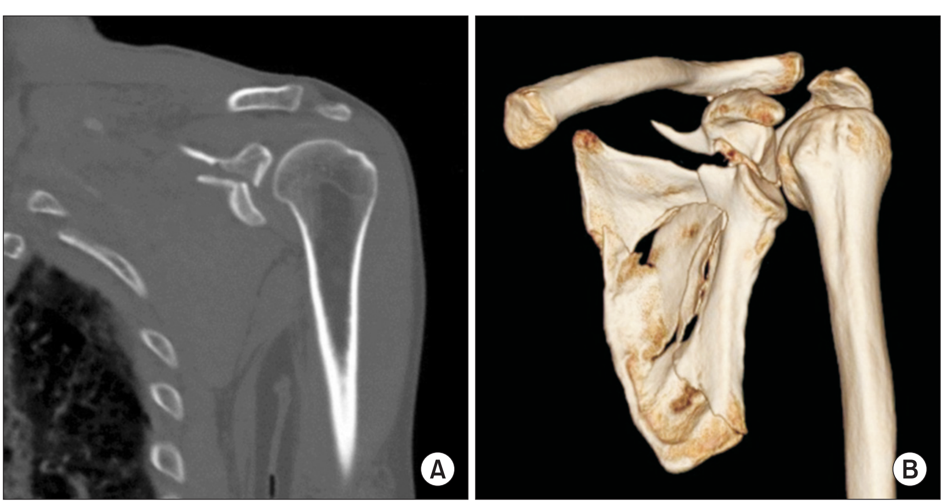

Fig. 2. (A) Coronal cut of two dimensional computed tomography scan showing a displaced intra-articular glenoid fossa fracture with step off. (B) Three dimensional computed tomography scan showing a glenoid cavity fracture extending through the base of the coracoid process, type 3 glenoid fracture according to Ideberg classification, combined with a comminuted scapular body fracture.

but no other associated injuries were detected. The displaced transverse intra-articular glenoid fracture was easily visualized (Fig. 3B). The displaced fracture surface was widened with a probe and a periosteal elevator and hematoma and loose debris inside of the gap were evacuated using a motorized shaver. The upper fragment was then movable enough to reduce using a

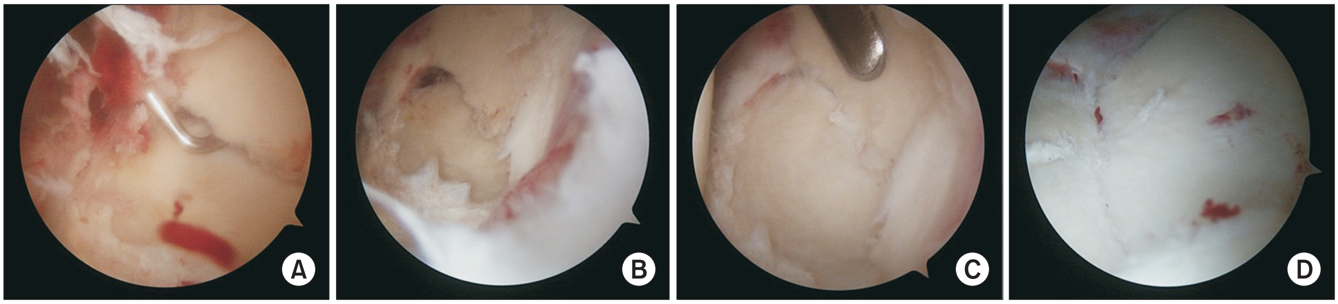

Fig. 3. (A) Arthroscopic image of the gleno-humeral joint depicting a probe placed in a transverse fracture site through the middle portion of the glenoid fossa. Blood clot and loose articular debris were irrigated from the joint (arthroscope in the posterior portal). (B) Blood clot and loose articular debris were evacuated from the joint. The displaced transverse intra-articular glenoid fracture was easily visualized. (C) The fracture was reduced using a periosteal elevator placed through the anterior portal. (D) After fixation with 2 cannulated screws, the fracture site was compressed with no step on the articular surface, and there was no evidence of intra-articular invasion of the joint by the hardware. However, slight angulation was observed at the fracture site.

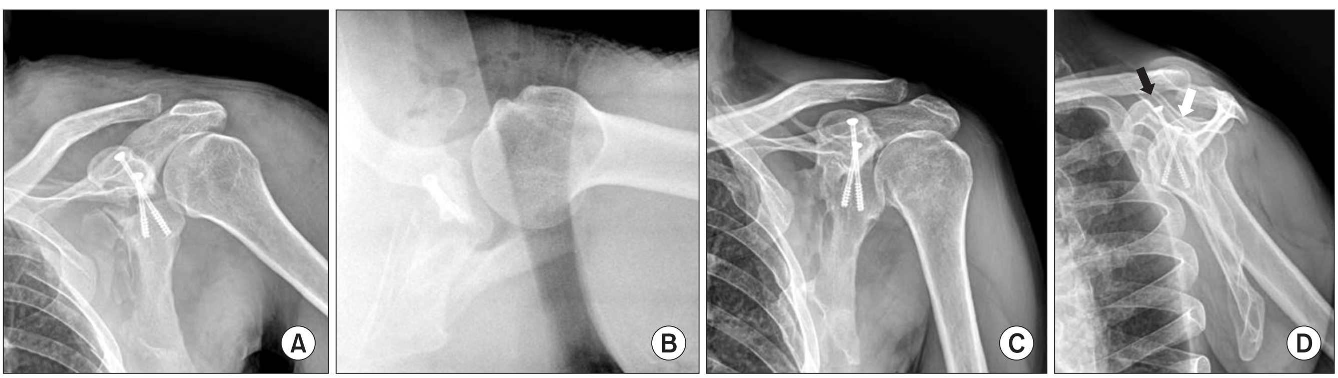

Fig. 4. (A) Immediate postoperative left shoulder anteroposterior radiograph showing anatomic fixation of a transverse glenoid fracture with two partially threaded cannulated screws, placed perpendicular to the fracture surface. (B) Immediate postoperative axillary view confirmed that the two screws were fixed in proper divergent direction. There was no evidence of intra-articular invasion of the joint by the hardware. (C) Anteroposterior view of the left shoulder 25 months postoperatively showing a well healed fracture with acceptable alignment. (D) Lateral view of the left scapular showing screws placed 35 degrees divergent in the coronal plane. The white arrow indicates the screw through the Naviaser portal and the black arrow indicates the screw through the base of the coracoid process.

periosteal elevator placed through the anterior portal until there was no step in articular cartilage (Fig. 3C). The interval between labrum and supraspinatus muscle was released with caution to gain access to the superior aspect of the scapular neck. A small incision was made to establish a superior (Neviaser) portal and a guide pin from a 4.0-mm cannulated screw set from Synthes (Paoli, PA, USA) was placed through the portal. Arthroscopic observation confirmed that the guide pin was placed at the superior aspect of the glenoid neck approximately 1 cm medial to the articular surface to avoid supra-scapular nerve injury.[4] The displaced upper fragment was compressed inferiorly with the guide pin and pushed laterally with the periosteal elevator. The guide pin was passed through the fracture surface perpendicularly without articular surface invasion. Another small incision was made on the superior end of the coracoid process, and an additional guide pin was fixed from the posterior end of the base of the coracoid process to the postero-inferior direction, which was also perpendicular to the fracture surface (Fig. 4A, B). The X-ray image intensifier showed acceptable reduction and proper location of the 2 guide pins; 4.0 mm partially threaded cannulated screws were used to fix the fractured fragment. On probing of the fracture fragment, the fixation with two screws appeared to be stable and was not subject to any rotational instability. Arthroscopic observation confirmed that there was no evidence of intra-articular invasion of the joint by the hardware (Fig. 3D). The image intensifier also documented an anatomically fixed glenoid fracture with no hardware invasion (Fig 4A, B). The coraco-clavicular ligament was repaired and the acromioclavicular joint was fixed with a Hook plate® (Synthes) in the right shoulder. Postoperatively, the vasculo-nervous status was normal. The patient started pendulum exercises 3 days after easing of acute pain. Gentle active motion was allowed at 4 weeks, and the patient was encouraged to regain his range of motion at 6 weeks. The hook plate in the right shoulder was removed 3 months after surgery. At 6 months, he returned to his usual activities and restarted hard manual work with full range of mo-

Fig. 5. Photographs of the patient taken at 25 months postoperatively, showing abduction of the left shoulder joint to 180 degrees and forward flexion to 180 degrees (The patient permitted a use of this photograph.).

tion. Two years after surgery, radiographs showed excellent bone healing with screws placed perpendicular to the fracture surface in the sagittal plane (Fig. 4C) and 35° divergent in the coronal plane (Fig. 4D). The patient was pain free and he could forward flex his left shoulder to 180°, abduct to 180°, externally rotate 60°, and rotate internally to T8 (Fig. 5).

Discussion

Scapular fractures are uncommon, constituting only 1% of all fractures, and usually caused by high-energy trauma. Other injuries, which may be multiple, major, and even life-threatening are reported in association with 80% to 95% of these fractures.[1,2] Fractures of the glenoid cavity constitute 9% to 20% of scapular fractures.[2] Displaced intra-articular glenoid cavity fractures can result in considerable morbidity secondary to chronic instability or degenerative joint disease.[4,5] Extensive open reduction was required to restore the anatomical joint surface, but, occasionally, associated injuries would restrict extensive surgery. In recent years, arthroscopy is increasingly being recognized as an important adjunct in treatment of displaced intra-articular fractures.[4,5] Fixation performed under arthroscopic control can restore the articular surfaces with the advantages of more accurate fracture reduction, less surgical trauma, less soft-tissue dissection, short postoperative recovery time, better cosmetic result, and easier conversion to arthrotomy.[4,5] However, as in other arthroscopy–assisted fracture reduction and fixation procedures, a careful check for compartment syndrome is required during the operation. The technically demanding nature of the procedure with a prolonged learning curve and limited fixation alternatives are disadvantages of this technique.[4,5] Direct neurovascular injury is the major concern regarding arthroscopic surgery in treatment of glenoid fractures.[4] An anatomical research study by Marsland and Ahmed,[4] using 18 cadaveric shoulders reported that the guide wires through the Neviaser portal and superior wires passing the interval between the distal clavicle and coracoid process were relatively safe in relation to the suprascapular nerve, with 95% confidence, defining 15 mm as a safe distance. The anterior wires, 1 and 2 finger breadths below the level of the coracoid, have a greater potential for injury to the cephalic vein, inferior branch of the supra-scapular nerve, musculocutaneous nerve, and brachial plexus.[4,6] Consequently, cannulated screws could be more safely inserted perpendicular to the transversely oriented fracture via superior approaches either just anterior or posterior (Neviaser portal) to the clavicle.[4,7] Ko et al.[8] reported on a Ideberg type 3 glenoid fracture patient treated with one cannulated screw fixation through the Neviaser portal, and Yang et al.[9] treated 23 consecutive patients with Ideberg type 3 glenoid fractures, using one cannulated screw through the Neviaser portal. However, the arms were protected by a sling for 6 weeks.[8] Noh et al.[10] reported on fixation of transverse glenoid fractures fixed with 2 cannulated screws. One screw passed through the Neviaser portal, but the other screw through the lateral portal which would be placed obliquely to the surface of the transverse glenoid fracture. The safety of the medial end of the screws has not yet been established.[4,6,7,10]

The author treated a transverse glenoid fracture with two cannulated screws. One screw passed through the Neviaser portal, and the other screw passed from the base of the coracoid process to the postero-inferior direction. The presented method could be considered to ensure more stable fixation for transversely oriented glenoid fractures, because the screws were fixed 35° divergently in the coronal plane and perpendicular to the fracture surface in the sagittal plane. The fixation in the presented case was stable enough to start pendulum exercise immediately after surgery. In addition, review of cadaveric studies found that the two accesses for cannulated screws were relatively safe without neuro-vascular injury.[4,6] However, during the procedure, the screws might penetrate the articular surface if the wires are placed too laterally, therefore the surgeon should use the image intensifier in combination with arthroscopic observation. To avoid supra-scapular nerve injury, the guide wire through the Neviaser portal should be placed within 2-cm distance from the glenoid articular surface.[4] To avoid injury of the cephalic vein, musculocutaneous nerve, brachial plexus, and inferior branch of the suprascapular nerve, the guide wire through the base of the coracoid process should be kept above the level of the coracoid process.[4,6]

For better management of glenoid transverse fractures and its consequence, studies regarding a more stable fixation method and the possibility of neuro-vascular injury should be conducted by analysis of a larger patient cohort s and longer term follow-up.

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