



Fracture dislocation of the proximal humerus with ipsilateral shaft fracture: a report of two cases

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We report two cases of ipsilateral proximal humerus fracture dislocation and shaft fracture in young adults. Fractures were treated with prosthetic replacement for the proximal humerus and open reduction and internal fixation for the shaft fracture due to the extent and complexity of the injury.

Key words: Fracture; humeral; ipsilateral; neck and shaft.

Proximal humeral fractures are common injuries accounting for 5 to 9% of all fractures.^[1] Multiple fractures of the humerus in a single incident are relatively rare, especially simultaneous proximal humerus and humeral shaft fractures.

Ipsilateral femoral neck and shaft fractures have been well documented in the literature.^[2,3] These fractures are usually seen in younger individuals involved in high-energy trauma. However, ipsilateral humeral neck and shaft fractures have been infrequently reported in current literature.

We report two cases of ipsilateral humeral neck and shaft fractures treated with prosthetic replacement and open reduction and internal fixation (ORIF) due to the characteristics of the sustained injury. Considering the rarity of this injury, this case report can provide valuable information to surgeons towards the management and the prognosis in these types of injuries.

Case report

Case 1

A 26-year-old presented to our institution after sustaining a road traffic accident. Primary trauma assessment

revealed no life-threatening injuries. The patient had multiple injuries on his left side, including fractures of the acromion, proximal humerus, humeral shaft, left femoral shaft, and a left hemothorax. There was no neurovascular impairment. The patient had previously undergone surgery for supracondylar fracture of the humerus and proximal ulnar fracture.

Plain radiographs of the humerus demonstrated a two-part fracture of the proximal humerus with posterior dislocation and an associated mid-shaft fracture of the humerus. Both fractures were comminuted with displacement. AO classification^[4] was C3 for the mid-shaft fracture and B3 for the proximal humerus (Fig. 1).

Due to the patient's poor general condition, surgery was conducted 7 days after the initial trauma. Surgery was performed with the patient in the beach chair position under general anesthesia, using the deltopectoral approach. The head was dislocated posteriorly with little soft tissue attachment with comminution of the neck. Considering the degree of injury, we decided to replace the head with a cemented prosthesis (DePuy Orthopaedics, Inc., Warsaw, IN, USA). The greater and lesser tuberosities were fixed with no. 5 nonab-

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Submitted: January 18, 2012 **Accepted:** September 20, 2012

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Available online at
www.aott.org.tr
doi:10.3944/AOTT.2013.2818
QR (Quick Response) Code:



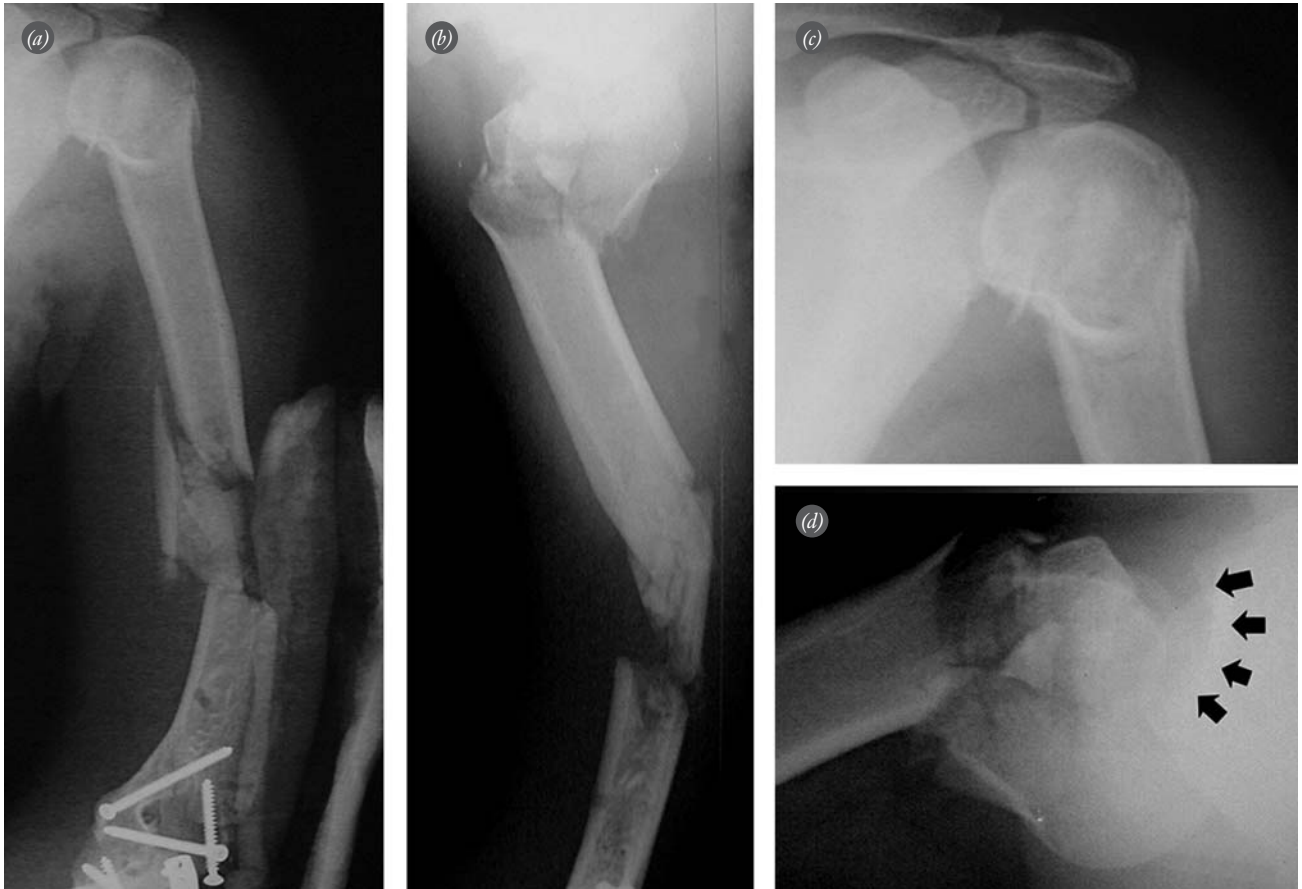


Fig. 1. A 26-year-old male (Case 1) sustained multiple fractures involving left ipsilateral humeral neck and shaft fracture. **(a, b)** Initial radiographs showed two-part surgical neck fracture angulated anteriorly with severe comminution in the shaft. The patient had a previous elbow fracture fixed with plate and screws. **(c)** Shoulder AP and **(d)** axillary lateral view demonstrated posterior dislocation of the humeral head. Glenoid articular margin is marked with black arrows.

sorbable sutures. Using the anterolateral approach to the humerus, the shaft fracture was fixed with an 8-hole dynamic compression plate (DCP) (Synthes Inc., Warsaw, IN, USA).

There was no postoperative complication and a shoulder immobilizer and a U-slab were applied for immediate immobilization. Pendulum exercises and passive shoulder stretching, including forward elevation, were begun 2 weeks and active range of motion exercises 3 weeks postoperatively. Radiographs at the 6th month follow-up showed complete healing of the humerus shaft fractures (Fig. 2). Patient demonstrated 110 degrees of forward flexion and 30 degrees of external rotation. The patient was able to perform most activities of daily living comfortably and demonstrated 120 degrees of forward flexion, internal rotation up to L1 level and external rotation of 45 degrees at the 8th month follow-up. At the final follow-up 4 years after operation, ASES score^[5] was 78 and Constant score^[6] was 80.

Case 2

A 28-year-old female sustained multiple fractures after a road traffic accident. Initial trauma assessment revealed no life-threatening injuries. Plain radiographs showed a 4-part proximal humerus fracture with posterior shoulder dislocation and a humeral shaft fracture. According to the AO classification, the shaft fracture was Type C3 and the proximal humerus Type B3 (Figs. 3a and b).

The patient was operated 5 days after the injury. Under general anesthesia, with the patient in the beach chair position, the deltopectoral approach was used to expose the dislocated humeral head. The fracture involved the anatomic neck of the proximal humerus. The fractured humeral head was posteriorly dislocated with little soft tissue attachment. The head was replaced with a cemented prosthesis (DePuy Orthopaedics, Inc., Warsaw, IN, USA) after minor trimming of the metaphyseal portion. The shaft fracture was approached anterolaterally and fixed with a 9-hole DCP (Synthes Inc., Warsaw, IN, USA).

There was no postoperative complication. Rehabilitation program was similar to that of Case 1. Radiographs at 5 months showed significant healing of the humerus shaft fracture. The patient demonstrated 110 degrees of forward flexion and 40 degrees of external rotation. At the final follow-up at 3 years and 4 months, the patient gained motion to 130° of forward flexion, 110° of abduction and 45° of external rotation. Radiographs showed complete fracture healing (Figs. 3c and d). ASES score was 82 and Constant score was 71 at the final follow-up.

Discussion

Humeral shaft fractures comprise 1 to 3% of all fractures^[7-10] and proximal humerus fractures 5 to 9%.^[1] In spite of the high rates of these fractures, ipsilateral humeral shaft and neck fractures are seen together extremely rare. According to Flint et al., a total of 20 cases of shoulder dislocation with humeral shaft fracture have been reported in the literature; 5 of which had an associated greater tuberosity fracture and none with involvement of the surgical or the anatomic neck.^[11-14]

The mechanism of this complex injury cannot be clearly determined. In previously reported cases of shoulder dislocation with humerus shaft fracture, injuries were caused by high-velocity vehicular accidents, falls from a height, or machinery accidents. Authors have proposed that the axial loading force leads to the transfer of energy to the shaft of the humerus and into the shoulder, resulting in simultaneous injuries.^[15,16] This was the probable mechanism in our cases.

Flint et al. reported a proximal humeral three-part fracture with anterior dislocation, combined with humeral shaft fracture managed conservatively in a 69-year-old female.^[11] Themistocleous et al.^[17] reported a case of ipsilateral proximal, mid-shaft and distal humerus fracture in an 80-year-old female. The patient was managed conservatively. The age and fracture profiles are different in our patients.

Inan et al.^[18] reported the case of a 27-year-old male with anterior dislocation of the proximal humerus, greater trochanter fracture, middle-third shaft fracture, and elbow dislocation. Closed reduction for the dislocations and plating were performed. Good functional outcome was seen at 15 months. Sasashige et al.^[19] reported two cases in patients aged 18 years and 22 years with shoulder dislocation and humeral shaft fracture treated with retrograde nailing for the shaft fracture. One patient underwent closed reduction for the dislocation while the other required open reduction. Both patients showed good functional outcome at the 11th year follow-up. The age profile of our patients matches those of Inan

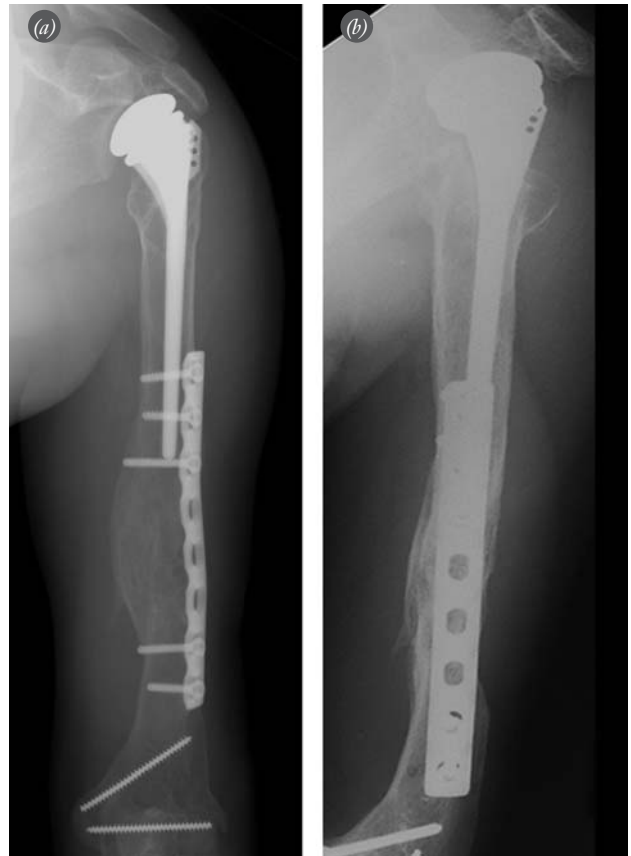


Fig. 2. (a, b) The plain radiographs of Case 1 from the latest follow-up at the 4th postoperative year showing solid bone union and stable prosthesis with no signs of loosening.

and Sasashige, but the cases are different in that they involve fracture dislocation of the proximal humerus.

Reported rates of postoperative avascular necrosis (AVN) are highly variable (3 to 37%) and preoperative prediction of this complication has been inaccurate.^[20] Hertel et al. showed that AVN could be anticipated in 97% of cases if the patient had a fracture at the anatomical neck, short medial calcar and a disruption of the medial periosteal hinge.^[21] Resch showed that a disruption of the medial periosteal hinge occurred with lateral displacement of the head of greater than 6 mm.^[22]

Neer^[23] reported poor results with nonsurgical management and osteosynthesis of displaced three- and four-part proximal humerus fractures. He reported high rates of nonunion, malunion, tuberosity resorption and osteonecrosis of the humeral head in significantly displaced four-part fractures managed without humeral head replacement and concluded that humeral head replacement was the treatment of choice for displaced four-part proximal humerus fractures. We considered that both our patients had a high possibility of developing AVN and hence performed a hemiarthroplasty.

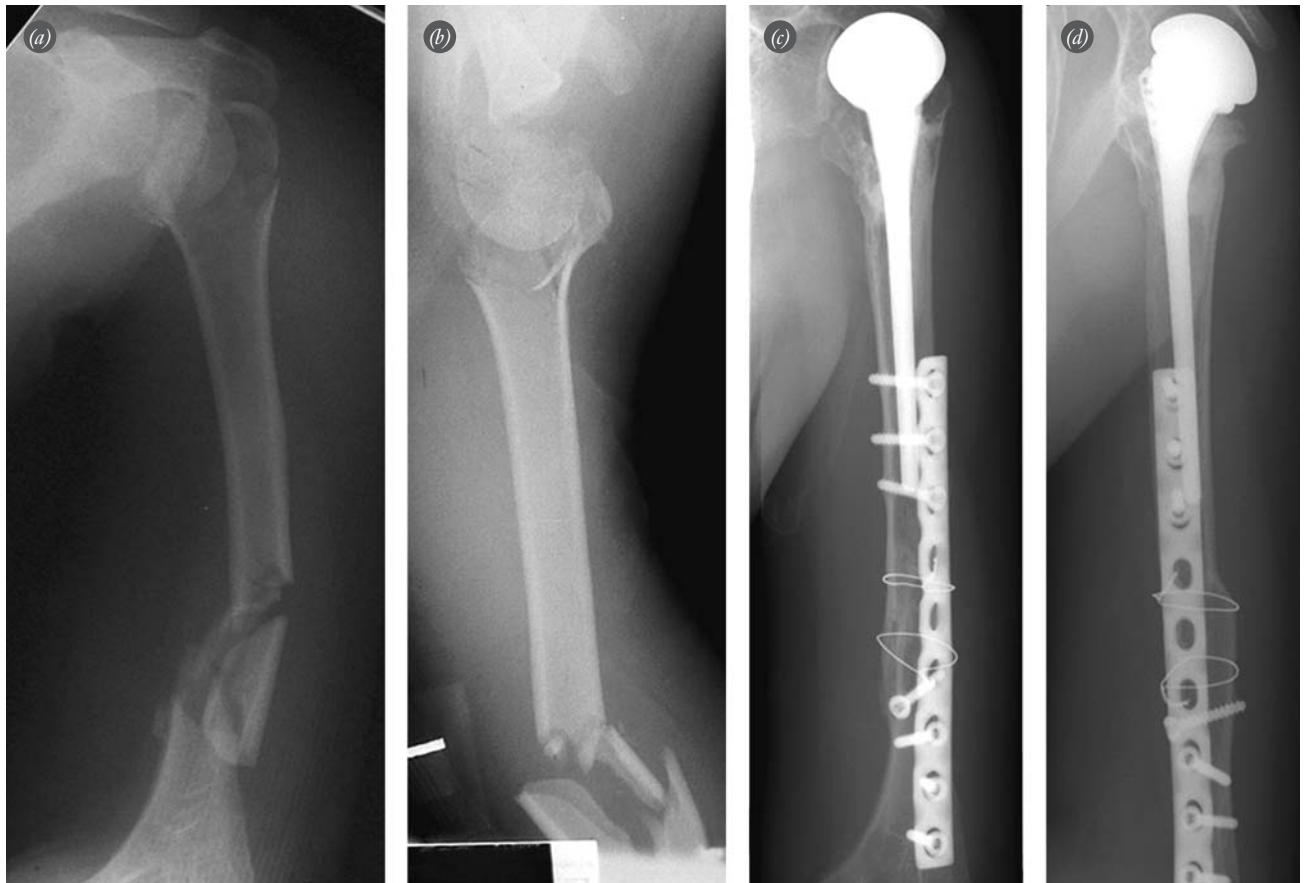


Fig. 3. Plain radiographs of a 28-year-old female (Case 2) showing ipsilateral humeral neck and shaft fractures. **(a, b)** Severe comminution in the shaft with displaced anatomic neck fracture can be seen. **(c)** Shoulder AP and **(d)** axillary lateral view at the latest follow-up demonstrated solid union of the shaft without signs of prosthesis loosening.

The locking plate for fixation of proximal humerus fractures is a site-specific, low-profile plate, precontoured for the proximal humerus. The insertion of locking screws obviates the need for a plate-to-bone compression, preserving the blood supply to the bones.^[24] The multiple polyaxial locking screws provide a fixed-angle support in multiple planes maintaining the reduction while allowing for early mobilization.^[1] The threaded screw heads prevent screw toggle, slide, and pull-out.^[25] However, Clavert et al. highlighted complications, such as screw cut-out, nonunion, secondary failures, and osteonecrosis in 3-part and 4-part fractures and dislocations even with the use of locking plates.^[26] Neviasser et al. have recently described a technique using locking plate with an endosteal implant in complex proximal humerus fractures and have reported negligible rates of osteonecrosis with their technique.^[27] Similarly, Vundelinckx et al. have shown good results using the Humerus Block (Synthes, Oberdorf, Switzerland) in proximal humerus fractures.^[28]

Intramedullary nails are available with proximal locking options to hold any displaced fragments (Polarus; Acumed, Hillsboro, OR, USA). The potential advantages are limited soft tissue trauma from percutaneous insertion and that the implant is buried in the bone. The disadvantages are damage to the rotator cuff insertion, eventual conversion to open reduction if reduction is not achieved by indirect means and limited options on screw placement in the proximal fragments.^[29] Kazakos et al. treated an anterior shoulder dislocation with ipsilateral shaft fracture with an intramedullary nail and achieved an excellent outcome.^[30] However, Thomazeau et al.'s recent study using antegrade nailing for 3-part and 4-part fractures showed malunion in 29% and osteonecrosis in 32% of patients, with both complications higher in the 4-part group.^[31]

Shoulder arthroplasty in young patients has been studied in those with rheumatoid arthritis (RA), osteonecrosis, trauma, and hemophilic arthropathy.^[32] Patients who underwent hemiarthroplasty for hemophilia had the best functional scores, followed by trauma and

AVN and RA. In a meta-analysis of hemiarthroplasty for proximal humeral fractures,^[33] rates for superficial and deep infection in 771 cases were just 1.6% and 0.6%, respectively. Complications related to the tuberosity fixation and healing were reported in 11.2% of cases. Heterotopic ossification was observed in 8.8% although this did not significantly limit shoulder function. Proximal migration of the humeral head was seen in 6.8% of cases. Younger patients fared better than older patients. Early prosthetic replacement of the fracture led to a better outcome. Mighell et al. found statistically significantly better ASES scores in patients treated within two weeks in comparison with those treated more than two weeks after the initial injury.^[34]

In conclusion, in cases of ipsilateral humerus shaft and neck fractures, neck fractures are usually displaced and shaft fractures unstable and comminuted. Failure rates maybe high with attempts to fix the neck fracture. Hemiarthroplasty for neck fracture and fixation for the shaft fracture produced reliable mid-term outcomes. As a number of studies have cited development of glenoid arthrosis after hemiarthroplasty, it is imperative that the possible recurrence of pain and need for future revision to a total shoulder arthroplasty be included in patient counseling regarding this procedure.

Conflicts of Interest: No conflicts declared.

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