



## Case Report

# Articular osteotomy of the distal humerus and excision of extensive heterotopic ossification



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## ABSTRACT

Prior case series of corrective osteotomy of substantial intra-articular malunion after a fracture of the distal humerus described concomitant heterotopic ossification in a subset of patient, but only in mild forms. We present our experience in treating two patients with malunited articular fractures of the distal humerus with extensive heterotopic ossification and near ankylosis where the lateral articular fragments were encased in heterotopic bone. Although osteotomy of articular malunion after distal humeral fracture along with excision of extensive HO is challenging and risky due to potential devitalization of the fragments, articular deterioration during the delay to osteotomy, and recurrence of heterotopic bone among other concerns, restoring articular congruity in these patients using articular fracture fragments extracted from heterotopic ossification can lead to improved function of the elbow.

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## Introduction

Substantial intra-articular malunion is uncommon after fracture of the distal humerus. Corrective osteotomy can improve motion and may delay arthrosis [1], but the procedure is challenging and risky. Prior case series of intra-articular osteotomy of the distal humerus described concomitant heterotopic ossification (HO) in many of these patients, but only in mild forms [2]. This small and relatively inconsequential HO does not seem to affect operative management or the results of treatment [1–3].

Heterotopic ossification that hinders motion is common after elbow trauma, more so after head and spinal cord injury, delay from injury to surgery, and burns [4]. Excision of heterotopic ossification, including complete bony ankylosis, and proximal radioulnar synostosis, achieves substantial gains in elbow motion [5–12]. In fact, some authors suggest that excision of heterotopic ossification gains more elbow motion on average than excision of contracted capsule [13].

We treated two patients with malunited articular fractures of the distal humerus with extensive heterotopic ossification and near ankylosis where the lateral articular fragments were encased in heterotopic bone. Prior to treating these patients, we were concerned about devitalization of the fragments, articular deterioration during the delay to osteotomy, and recurrence of heterotopic bone among other concerns. The results of surgery were rewardingly good and we thought a description of these patients might help future patients and surgeons plan treatment.

## Patients

### Patient 1

A 22-year-old man had multiple injuries including a left open bicolumnar distal humerus fracture in a motor vehicle crash. The wound was debrided, but the fracture was not repaired. Two months after injury, he presented to our office for further care. The left elbow range of motion was 80 to 100 degrees. The lacerations were healed. There was visible and palpable deformity of the humerus. There was heterotopic bone to the level of the subcutaneous tissue palpable on the anterolateral elbow. Radiographs and computed tomography (CT) scan with three-dimensional (3-D) reconstruction revealed that the distal humerus was

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**Fig. 1.** Case 1. Left distal humeral fracture with deformity, bony ankylosis, and extensive heterotopic ossification. (A) Pre-operative radiograph (AP view). (B) Pre-operative radiograph (lateral view). (C) Pre-operative 3-D CT image. (D) Post-operative radiograph (AP view). (E) Post-operative radiograph (lateral view).

healed with substantial angular and articular deformity. There was extensive heterotopic ossification (HO) (Fig. 1A–C).

During surgery two months after injury, the distal, lateral spike of the humerus shaft fragment humerus was noted to have a white material on the endosteal surface. There was no purulence. The material was presumed to be a low-grade infection and it was sent to pathology and cultured with 4 specimens. The involved bone was debrided and the bones and wound were irrigated extensively. The heterotopic bone was isolated and removed. The incompletely healed humerus fracture became mobile as this was accomplished. The malunited lateral condyle was extracted from heterotopic bone, realigned, and along with the realigned metaphyseal/diaphyseal component of the fracture secured with a single lateral plate. A single direct lateral plate (Wright Medical; Memphis TN) was used to limit the degree of stripping and the number and size of foreign material in case there was an infection. An external fixator would not have provided adequate fixation or stability (Fig. 1D, E).

He was initially placed on broad spectrum antibiotics (Linezolid, Bactrim, Cefepime, and Flagyl), but when the culture grew only *Stenotrophomonas* this was narrowed down to Bactrim alone. Active, self-assisted stretching exercises were initiated three months after surgery. The fracture healed and he regained elbow flexion from 20 to 120 degrees. Fourteen months after open reduction internal fixation, the lateral plate was removed and the prophylactic antibiotics were discontinued. Two and a half weeks after plate removal, motion was again 20 to 120 degrees of flexion with full pronation and supination and his QuickDASH score was 3.

#### Patient 2

A 57-year-old man fell from a roof and had a cervical spine fracture with quadraplegia and a left complex bicolunar distal humeral fracture after a fall from two stories. The distal humerus fracture was treated with open reduction internal fixation (ORIF) 7 weeks after injury due to his critical state after the fall. There was substantial residual malalignment after surgery. Five months after internal fixation, the patient presented to us for additional care. The left elbow was deformed, nearly ankylosed at 70 degrees of flexion (10–20 degrees of motion), and tender with attempted motion. He had 10 degrees each of pronation and supination. Radiographs and a 3D CT revealed articular malunion of the distal humerus and near complete bony ankylosis due to heterotopic ossification (Fig. 2A–C).

At surgery, the ulnar nerve was transposed into a subcutaneous pocket anteriorly. On the lateral side of the elbow, a large block of heterotopic bone was removed, carefully preserving the capitellum and trochlea fragment that faced posteriorly and was embedded in the bone. Subsequently, the plate was identified on the medial side as heterotopic bone was removed. The trochlea and medial condyle were healed several centimeters proximally to the normal anatomical position, but with little angular deformity and good articular cartilage. Bone was removed from the lateral column to bring it to the same position as the medial column and the large capitellum and trochlea fragment were secured to the lateral column with two 3 mm headless cannulated screws (Synthes, Paoli, PA) and a lateral plate and screws (Acumed, Hillsboro, OR). (Fig. 2D, E)

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