J Shoulder Elbow Surg (2018) 27, 291–297

ELSEVIER

Journal of Shoulder and Elbow Surgery

www.elsevier.com/locate/ymse

Osteosynthesis of AO/OTA 13-C3 distal humeral fractures in patients older than 70 years

Steven F. Shannon, MD[a,*], Eric R. Wagner, MD[a], Matthew T. Houdek, MD[a], Daniel Mascarenhas, BS[b], Raymond A. Pensy, MD[b], Walter A. Eglseder, MD[b]

[a]*Department of Orthopedic Surgery, Mayo Clinic, Rochester, MN, USA*
[b]*Department of Orthopaedic Surgery, Division of Orthopaedic Traumatology, R. Adams Cowley Shock Trauma Center, Baltimore, MD, USA*

Objective: The purpose of this retrospective case series was to examine the AO Foundation and Orthopaedic Trauma Association (AO/OTA) 13-C3 distal humeral fractures treated with open reduction–internal fixation (ORIF) in patients older than 70 years.

Methods: During an 8-year period, 21 patients older than 70 years with AO/OTA 13-C3 distal humeral fractures were treated with ORIF performed by 2 senior upper extremity traumatologists. There were 16 patients with >1 year of follow-up, with a mean age of 78 (70-84) years.

Results: At a mean follow-up of 4 years (1-8 years), all 16 patients demonstrated radiographic signs of bone union. Three patients underwent reoperations, including irrigation and débridement for postoperative infections (n = 2) and removal of implant for symptomatic olecranon intramedullary screw (n = 1). The mean postoperative total arc of ulnohumeral motion was 97° (80°-145°), including a mean flexion of 117° (106°-126°) and flexion contracture of 20° (14°-26°). The mean pronation was 69° (55°-85°), and supination was 78° (74°-9°0). The mean Quick Disabilities of the Arm, Shoulder, and Hand score was 19 (standard deviation, 6.9; confidence interval, 15.4-22.8), and the mean Mayo Elbow Performance Score was 91 (standard deviation, 8.2; confidence interval, 86-95).

Conclusions: ORIF remains a reliable option for treatment of AO/OTA 13-C3 distal humeral fractures in elderly patients. Excellent clinical outcomes can be achieved with preservation of motion and arm function through anatomic reduction, rigid internal fixation, and early mobilization.

Level of evidence: Level IV; Case Series; Treatment Study

Keywords: Distal humeral fracture; elbow fracture; osteoporotic fracture; open reduction–internal fixation; osteosynthesis; periarticular fracture; upper extremity fracture

Distal humeral fractures are relatively common injuries in the elderly population.[23] With the ever-aging population, the incidence of these injuries is on the rise.[17] Currently, there is debate as to whether to treat elderly patients with significantly comminuted intra-articular distal humeral fractures with open reduction–internal fixation (ORIF) or total elbow arthroplasty (TEA).

Historically, osteosynthesis of distal humeral fractures in the elderly has been proven to be one of the technically most difficult operations in orthopedics, especially in the setting of osteoporosis. This is often due to the presence of significant metaphyseal comminution in osteoporotic bone, which has led to variable outcomes in performing ORIF.[4,8-10,19,24,25]

The University of Maryland, Baltimore Institutional Review Board approved this study: No. HP-00071150.

*Reprint requests: Steven F. Shannon, MD, Mayo Clinic, 200 First St SW, Rochester, MN 55905, USA.

E-mail address: Shannon.steven@mayo.edu (S.F. Shannon).

1058-2746/$ - see front matter © 2017 Journal of Shoulder and Elbow Surgery Board of Trustees. All rights reserved.
https://doi.org/10.1016/j.jse.2017.09.012

Complications including malunion, nonunion, failure of fixation, ulnar neuropathy, and elbow stiffness plague patients sustaining these injuries, with complication rates up to 35% being reported in the literature.[10,12,13,16,24] Although the complication rates are relatively high, ORIF preserves bone stock and allows salvage arthroplasty. The advent of precontoured, anatomic locking plates has also allowed traumatologists to increase the locking screw density into the articular block, where the majority of fixation failure typically occurs.

Previous studies examining this population of patients have only looked at patients aged 60 years and older or 65 years and older and did not use precontoured, anatomic locking plates.[2,5,7,12,14,15,18,20,26] Current literature does not examine only patients aged 70 years and older with AO Foundation and Orthopaedic Trauma Association (AO/OTA) 13-C3 fractures. In this population, advocates of surgery favor the use of joint replacement because many of these patients are considered "low demand" and present with severe metaphyseal comminution and osteoporotic bone. Arthroplasty also has potential for possibly improved motion and fewer complications, but salvage options are tenuous, and the rate of loosening for TEA is not insignificant.[1]

The purpose of this study was to examine the clinical outcomes and complications of our elderly patients with AO/OTA 13-C3 distal humeral fractures surgically treated with osteosynthesis.

Methods

In this retrospective case series, we reviewed the records of all patients sustaining an AO/OTA 13-C3 fracture during a 7-year period (2007-2014) treated surgically at our institution. There were 256 patients identified, of whom 22 patients were 70 years of age or older. All patients were treated with ORIF involving at least single-column plating osteosynthesis except for 1 patient with a nondisplaced AO/OTA 13-C3.1 fracture, who was treated nonoperatively. Operative indications included open fractures and any displaced AO/OTA 13-C3 fracture. The indication for TEA was any fracture that was found to be unreconstructable intraoperatively. Of the fractures treated operatively (n = 21), the majority of fractures (n = 9 [56%]) were observed to be AO/OTA 13-C3.3; the remaining fractures included AO/OTA 13-C3.2 (n = 4 [25%]) and AO/OTA 13-C3.1 (n = 3 [19%]). Minimum follow-up was 1 year. Three patients died before 1-year follow-up, 2 patients were lost to follow-up, and 16 patients were available for follow-up beyond 1 year, with a mean of 4 years (range, 1-8 years). The mean age of the patients was 78 years (70-84 years), and there was an equal distribution of women (n = 8) and men (n = 8); all 16 patients were right hand dominant.

Primary outcomes included fracture healing, defined as bridging cortical bone on 3 of 4 cortices on orthogonal radiographs; Quick Disabilities of the Arm, Shoulder, and Hand (QuickDASH) score; Mayo Elbow Performance Score (MEPS); and complications (Table I). The causes of the fractures were all associated with trauma, including fall (n = 14), motor vehicle collision (n = 1), and crush injury (n = 1). There were 4 open fractures and 12 closed injuries. The surgical setup was standardized for every patient; all patients had a sterile tourniquet and were placed lateral decubitus over a sterile Mayo stand. The transolecranon posterior approach was used in 15 (94%) cases and the triceps-splitting approach in 1 case. The ulnar nerve was never transposed. The olecranon osteotomies were fixed by compression screws (n = 7) or screws augmented with tension band wiring (n = 8). The distal humeral columnar plates used were the Synthes locking compression plates. Bicolumnar plating was used in 88% of patients (n = 14), with the lateral column receiving the Synthes precontoured distal humeral posterolateral locking plate (n = 14) and the medial column receiving either the Synthes precontoured distal humeral medial locking plate (n = 6) or the Synthes 3.5-mm locking reconstruction plate (n = 8), with at least two bicortical screws in each column plate. Augmentation devices including mini-plates, mini-fragmentary screws, and K-wires were used in addition to bicolumnar plating to increase construct rigidity in either the perpendicular or parallel plating technique (Figs. 1-3). In regard to the 14 patients who had the bicolumnar construct, 10 patients received perpendicular plating (Figs. 1 and 2) and 4 received parallel plating (Fig. 3). The fixation strategy to use perpendicular or parallel plating was based on intraoperative assessment of bone quality with the goal of creating a cage around the capitellum, restoring both columns and arch with the objective of achieving as many locking screws as possible in the distal fragments and then enhancing the construct by reinforcing the columns and arch with augmentation devices. The remaining patients received a single lateral column Synthes posterolateral locking plate with medial pins (n = 1) and a posterolateral locking plate (n = 1). Nearly anatomic reduction was obtained in all patients; no patients were found to be unreconstructable intraoperatively, and no patients were converted to TEA. Radiographic union was assessed at routine follow-up visits. Radiographic evaluation was performed using elbow anteroposterior and lateral views to review for union, delayed union, malunion, nonunion, and implant failure at each follow-up visit, and radiographs were independently reviewed by the 3 main authors.

Postoperative rehabilitation protocol was uniform in all patients. Patients were not permitted to weight bear on the affected arm (crutch, transfer, or platform) for 12 weeks after surgery, or until definite union occurred, as our institution requires weight bearing orders for every extremity, secondary to the frequency of concomitant lower extremity and pelvic injury. Patients received a sling and began full active assisted range of motion on postoperative day 1 or 2; there were no range of motion limitations, and an elastic wrap or stocking was used for edema control. The decision for formal inpatient or outpatient therapy was made on an individualized patient basis. No patients received indomethacin or radiation therapy for heterotopic ossification prophylaxis.

Results

Clinical outcomes

All patients demonstrated radiographic signs of bone union (Table I). The mean postoperative total arc of ulnohumeral motion was 97° (80°-145°), including mean flexion of 117° (106°-126°) and flexion contracture of 20° (14°-26°). The mean pronation was 69° (55°-85°), and supination was 78° (74°-90°). The mean QuickDASH score was 19 (standard deviation, 6.9; confidence interval, 15.4-22.8), and the mean MEPS was 91 (standard deviation, 8.2; confidence interval, 86-95). Distribution of MEPS (excellent, >90 points; good, 75-89 points;