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Double-column fixation for type C fractures of the distal humerus in the elderly

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Background: Although several studies reported good results of open reduction and internal fixation of displaced fracture of the adult distal humerus, few studies have specifically addressed the results of such surgical fixation in osteoporotic bone in the elderly.

Methods: This study focused on AO type C fractures in the elderly by using 2 plates for fixation of the lateral and medial columns to reconstruct a stable triangular frame of the distal humerus. The study comprised 35 patients, and 32 were available for final evaluation at a mean follow-up of 24.5 months (range, 14-60 months).

Results: Mayo Elbow Function Score showed 25 patients (78%) achieved an excellent functional result, and 7 (22%) had a good result. No patients were considered to have a fair or poor result. At the final follow-up, the mean range of flexion to extension of the elbow was 22° (range, 10°-40°) to 125° (range, 100°-140°). All fractures united at average of 3.5 months (range, 2.5-5.3 months).

Conclusion: Open reduction and internal fixation using double-columned plating is a useful and effective technique in the management of displaced, comminuted, intra-articular fractures of the distal humerus in elderly patients.

Level of evidence: Level 4; Case series, treatment study.

Keywords: Distal humerus; fracture; intra-articular fracture; ORIF; double-column fixation; osteoporotic bone

Displaced comminuted articular fractures of the distal humerus in adults are difficult problems due to the complex anatomy of the elbow, small fracture fragments, and the limited amount of subchondral bone.[7] The lateral and medial columns of the distal humerus form a stable triangular frame. The structure of this stable triangular frame is destroyed after fractures of the distal humerus, especially complex AO type C fractures.

Intercondylar fractures of the distal humerus in younger patients are considered to occur after high-energy trauma. In the elderly patient, however, minimal trauma may result in fractures due to osteoporotic bones, especially in elderly women. Palvanen et al[14] defined an osteoporotic fracture of the distal humerus as a fracture that occurred in individuals aged 60 years or older as a consequence of a moderate or minimal trauma only; for example, a fall from a standing height of 1 meter or less. The treatment of humeral fractures

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is much more difficult in the elderly. The complexity of these fractures, the articular involvement, and concurrent osteopenia challenge even the most experienced orthopaedic surgeon.

Immobilization was the primary mode of treatment of such fractures until the early 20th century, but the results were notoriously poor. Several attempts to treat fractures of the distal humerus surgically also had poor results because of inadequate surgery and prolonged immobilization.[2] With the advent of AO/ASIF techniques in the early 1980s, the results of surgical treatment have been improved. The traditional teaching that advocates applying plates in 2 perpendicular planes, 90° to each other, as is recommended by the AO/ASIF group, is currently used by most surgeons.[16,19]

Although several studies have reported good results of open reduction and internal fixation (ORIF) with double plates of displaced fractures of the adult distal humerus with AO/ASIF techniques,[4,17] few studies have specifically addressed the results of such surgical fixation in elderly osteoporotic patients. As the aging population increases, there is a greater need to investigate the role of such surgical treatment, particularly because there is a dearth of evidence regarding the significance of internal fixation of these fractures. Hausman and Panozzo[5] believed that geriatric patients with osteopenic bone required different strategies from the traditional treatment philosophies and techniques. The use of a modified olecranon osteotomy, the development of newer plating systems and techniques, and tricortical bone grafts to replace comminuted segments of the medial and lateral columns may improve fixation in the distal fragments and compression at the supracondylar level, thus obtaining stable initial fixation in the presence of osteoporosis.[11,12]

This study was designed to focus on displaced comminuted AO type C fractures of the distal humerus in the elderly, with restoration of the anatomy using a triangular construct on the lateral and the medial columns and 2 plates for fixation.

Materials and methods

From May 2000 to January 2006, 35 consecutive geriatric patients (10 men, 25 women) with acute displaced comminuted fractures of distal humerus were treated with ORIF at our institution. The mean age was 68.7 years (range, 62-79 years). Injury in 8 patients resulted from bicycle crashes, and in 27, from a fall. Eleven fractures involved the left elbow and 24 involved the right. No patient had any preexisting arthritis in the injured elbow, and the injured limbs were capable of normal levels of activity before the injury. According to the AO/ASIF fracture classification system, there were 15 C1, 13 C2, and 7 C3 fractures. All 35 patients underwent operative treatment within 2 weeks of injury.

All patients received general anesthesia and were placed in a lateral decubitus position. A posterior approach was used, and a V-shaped olecranon osteotomy was performed. The ulnar nerve was freed from the cubital tunnel and protected by vascular loops. The trochlea was reduced first. Large fragments were fixed with transverse cannulated screws (DePuy ACE, Johnson & Johnson, Le Locle, Switzerland), and small fragments with 1-mm Kirschner wires. Two plates (DePuy ACE) were prepared according to distal humeral anatomy and placed on the medial and lateral posterior surfaces of the distal humerus so that the concave undersurface of the plates could lock the fragments and dramatically improve fixation of the distal fragments. The distal humeral stability of the triangle was rebuilt by fixing the medial and lateral columns with two plates and screws (Figure 1).

After stable fixation was achieved, the ulnar nerve was transposed anterior to the medial epicondyle. Tension band wiring was used for fixation of the olecranon osteotomy. For patients, who had severely comminuted fractures in the distal humerus, we used tricortical bone grafts from the iliac bone to maintain column height and width and obtain stable fixation.

All patients were given Celecoxib (Celebrex, Pfizer Pharmaceuticals Ltd, New York, NY) postoperatively (200 mg every 24 hours) for a mean of 6 weeks. All patients with C1 fractures began elbow joint functional exercise aided by a continuous passive motion machine on day 3 after surgery. All C2 fractures were protected for 5 to 7 days, after which range of motion exercise was begun. If the patient had a C3 fracture, a long arm cast was placed with the elbow in 80° of flexion for 3 weeks, after which physiotherapy and motion were started.

Results

The 32 patients were followed up for an average of 24.5 months (range, 14-60 months). All the fractures and the olecranon osteotomies united without implant failure or migration. The union time was 3.5 months (range, 2.5-5.3 months). Anatomic reduction was achieved in 19 patients, satisfactory reduction was achieved in 12 patients, and 1 had a poor reduction. The final range of flexion to extension of the elbow averaged 22° (range, 10°-40°) to 125° (range, 100°-140°). The final ranges of pronation and supination were 75° (range, 60°-85°) and 68° (range, 60°-80°; Figure 2).

Results as graded by the Cassebaum elbow motion classification[3] were excellent in 16 patients, good in 9, fair in 6, and poor in 1 (Table I). According to the Mayo Elbow Performance Score,[10] the result was excellent in 25 patients and good in 7 (Table II). Complications included 2 superficial wound infections, 2 iatrogenic ulnar nerve injuries, and 7 heterotopic ossifications. The superficial wound infections were treated successfully with antibiotics. The iatrogenic ulnar nerve injury recovered spontaneously and completely within 4 months. Radiographic evidence of heterotopic ossification around the elbow was present in 7 patients; however, no significant effect on the range of elbow motion was evident in 6 of these patients. The only patient with extensive heterotopic ossification still had poor elbow function at the final follow-up.