Isolated ulnar shaft fractures

Retrospective study of 46 cases

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Retrospectively, we reviewed the treatment and outcome of 46 isolated fractures of the ulnar shaft. Of 18 fractures treated by immediate open reduction and internal fixation, one open fracture became infected and failed to unite. Of 28 fractures treated closed, seven failed to unite. The factors prognostic of nonunion in closed treated fractures were (1) fracture in the proximal third of the ulna and (2) displacement 5 mm or more. In such cases, we recommend internal fixation.

In the treatment of isolated ulnar shaft fractures, Pollock et al. (1983) suggested that immobilization is unnecessary. Other authors have recommended internal fixation of many ulnar fractures (Blecher and Saunders 1977, Corea et al. 1981). In an attempt to clarify the indications for internal fixation of isolated ulnar shaft fractures, we reviewed our experience in their treatment.

Patients and methods

Retrospectively, we reviewed 76 consecutive patients with isolated ulnar diaphyseal fractures admitted to our hospital from July 1980 to September 1986. Ulnar shaft fractures without ipsilateral radial, humeral, or wrist fractures were considered isolated; many of these patients had additional visceral or neurologic injuries, or orthopedic injuries to other regions. Monteggia fractures were excluded, as were fractures of the olecranon or coronoid or styloid processes.

Of the population of 76 patients, a sample of 46 had adequate data to be included in this review. The excluded patients did not differ from the sample in terms of age or nature of the fracture. The large dropout rate seems unavoidable in studying a mobile, transient population as we have done in California.

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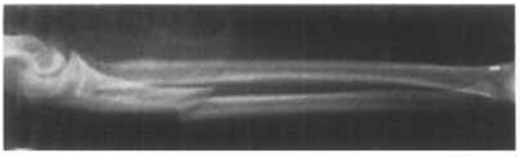
There were 12 females and 34 males with a median age of 30 (16–64) years. The fractures resulted from assault with a clublike weapon, motor vehicle accident, motorcycle accident, pedestrian vs. automobile, gunshot injuries, or a fall; in 1 case the history was unclear. Nine open and nine closed fractures were treated with immediate open reduction and internal fixation with plates and screws. Seven open and 21 closed fractures were treated closed with a long or short arm cast or cast brace. The location of the fractures (proximal, middle, or distal shaft) and displacement of the bone ends are indicated in Tables 1 and 2.

Table 1. Union rate of ulnar fractures as a function of displacement and position

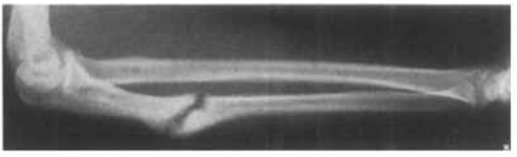
	Displacement		Total
	≤ 5 mm	> 5 mm	
Proximal third	1/3	0/1	1/4
Middle third	9/10	8/11	17/21
Distal third	15/16	5/5	20/21
Total	25/29	13/17	

Table 2. Union rate of ulnar fractures as a function of displacement and treatment

	Displacement		Total
	≤ 5 mm	> 5 mm	
Closed treatment	20/24	1/4	21/28
ORIF	5/5	12/13	17/18
Total	25/29	13/17	



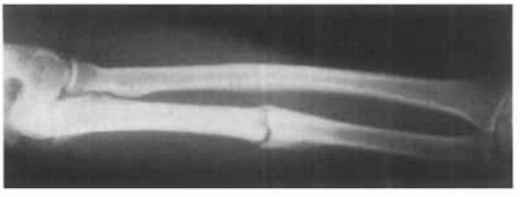
Initial injury.



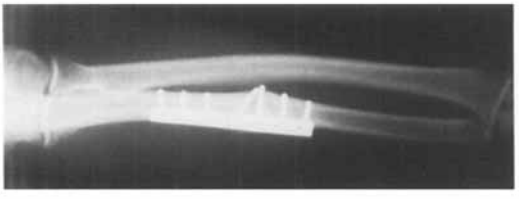
Nonunion 1 year after injury.

Figure 1. A 20-year-old male involved in a high-speed motorcycle accident sustained a displaced proximal third ulnar shaft fracture.

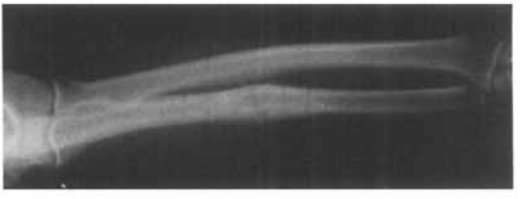
On admission.



20 months later after treatment in a Sarmiento brace revealing midshaft nonunion.



3 months after open-reduction internal fixation with a 3.5 DC plate and iliac-crest bone grafting. The fracture is united at this point.



18 months after operation.

Figure 2. A 43-year-old male sustained a left comminuted segmental midshaft ulnar fracture after falling 13 meters.

The method of treatment was the decision of the attending physician; no fracture treatment protocol was followed. Follow-up ranged from 1 to 56 months, and the study comprised review of patients' charts and radiographs.

Upon review, union was consistently defined as bridging callus and a nontender, nonmobile fracture site to palpation and range of motion. Nonunion was declared when there was evidence of hypertrophic callus without bridging and continued symptoms of pain and motion at the fracture site.

Results

Of the 18 fractures treated with internal fixation, one Type III open fracture became infected with subsequent loosening of the plate and failure to unite. Of the 28 fractures treated closed, seven failed to unite after 4 to 12 months of treatment. One fracture was declared a failure of closed treatment after loss of adequate alignment in a cast, occurring at 23 days; open reduction with internal fixation was then performed. The mechanism of injury in those fractures that failed to unite was a motor vehicle accident in 6 (Figure 1), a gunshot wound in 1, and a fall from 13 meters in 1 (Figure 2).

Discussion

Du Toit and Grabe (1979) stated that operation has no place whatsoever in the treatment of ulnar shaft fractures; they recommend casting as the treatment of choice, as do others (Hooper 1974). Our nonunion rate of one fourth for conservatively treated isolated ulnar shaft fractures is considerably worse than nonunion rates reported by others: Sarmiento et al. (1976) reported 0.6 percent, Zych et al. (1987) 0 percent, and Pollock et al. (1983) 1.4 percent. In part, this may reflect that the fractures in our series were more severe. In our sample of 46 fractures, one third were open, as compared with less than 10 percent in the series quoted. Fractures caused by vehic-

ular accidents or gunshot injuries involve a much higher energy than the standard fracture by a "nightstick." All of our nonunions occurred in high-energy fractures, an experience also shared by Cai (1983).

The degree of displacement of the fractures is another indication of the level of energy causing the fracture. In a cadaver study, Dymond (1984) showed that displacement of the fracture by more than one half the shaft width entails substantial disruption of the periosteum and of the interosseous membrane. In a minimally displaced ulnar shaft fracture, these structures, together with the intact radius, exert a strong stabilizing influence, which may be why Pollock et al. (1983) were able to achieve good results by treating low-energy ulnar fractures without immobilization. Hoffer and Schobert (1984), however, have pointed out the failure of this method in the less cooperative patients. Sarmiento's excellent results with conservative treatment were all in fractures with minimal or no displacement. Two recent studies have confirmed that isolated ulnar shaft fractures in the middle and distal third of the ulna with minimal displacement are stable and can be treated with early mobilization (Ekelund and Nilsson 1989, de Jong and de Jong 1989). In a review of 254 isolated ulnar fractures, Corea et al. (1981) found nonunion in 1.4 percent of undisplaced fractures, in 8 percent of fractures displaced one fourth the shaft width, in 15 percent of fractures displaced one half the shaft width, and in 20 percent of fractures displaced more than one half the shaft width. The majority of the nonunions in our series occurred with displacement of the fracture ends by 5 mm or more, indicating disruption of the interosseous membrane and loss of stabilization by soft tissues.

Another notable correlate of nonunion in our series was location in the proximal third of the shaft. None of the three closed-treated fractures in this location healed. Corea et al. (1981), in a study of 254 isolated ulnar fractures, had all of their poor results with conservatively treated fractures in the proximal third. Zych et al.'s (1987) series of 73 ulnar fractures treated with a brace included two fractures of the proximal third, one of them poor. It may be that the soft-tissue forces tend to destabilize fractures in this region. It is also possible that some of these are occult Monteggia fractures that have spontaneously reduced; even vigorous advocates of casual treatment of shaft fractures recognize the necessity of rigid fixation of Monteggia fractures.

Based on the foregoing, we make the following recommendations: All the fractures of the proximal third are best treated by open reduction and internal fixation. Diaphyseal fractures in the distal two thirds in which the bone ends are displaced by 5 mm or more should possibly be treated with open reduction and internal fixation, particularly if the mechanism of injury was high energy. Remaining fractures of the distal two thirds may be treated conservatively by casting (Hooper 1974) or cast bracing (Sarmiento et al. 1975). An exception is the head-injured, spinal-cord injured, or polytrauma patient in whom internal fixation of distal two-thirds ulnar fractures may facilitate acute care or rehabilitation (Nottage 1981, Riska et al. 1977).

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