CURRENT CONCEPTS

# Distal Radius Fractures: Approaches, Indications, and Techniques

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Distal radius fractures remain among the most common fractures of the upper extremity. The indications for operative management continue to evolve based on outcomes from the most recent clinical studies. Advancements over the past decade have expanded the variety of fixation options available; however, the clinical superiority of a particular treatment modality remains without consensus. Each approach requires the use of unique surgical techniques, and the choice of a particular implant system should be based on the surgeon's familiarity with the implant design and its limitations. As our understanding of the management of distal radius fractures improves, so will our indications for each specific treatment modality. *(J Hand Surg Am. 2016;■(■):■−■. Copyright © 2016 by the American Society for Surgery of the Hand. All rights reserved.)*

**Key words** Distal radius fracture, approaches, techniques, imaging, fixation.

DISTAL RADIUS FRACTURES ARE common orthopedic injuries with a bimodal peak incidence in both the young and elderly population. Because of the common nature of this injury and continued biomechanical and clinical research, our understanding and treatment of these fractures has improved. However, there is little consensus regarding the optimal management of these fractures,[1] and factors such as the fracture pattern, patients' functional demands, concurrent other injuries, and integrity of the overlying soft tissues must be considered. With the advent of volar locking plates, the management of these fractures has improved substantially; however, the current best available evidence fails to establish the superiority of any specific fixation technique definitively. It is important to consider all options for individualized management of this common injury.

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## INDICATIONS FOR SURGICAL INTERVENTION

The American Academy of Orthopedic Surgeons (AAOS) in 2009 concluded with moderate strength that surgical fixation be considered in fractures with intra-articular displacement or stepoff greater than 2 mm, radial shortening greater than 3 mm, or dorsal tilt greater than 10° from neutral.[1] The AAOS task force also provided guidelines for nonsurgical management recommending serial radiographs in the first 3 weeks and at final follow up.[1] More recently, the AAOS provided the Appropriate Use Criteria for distal radius fracture management.[2] The scoring system is based on injury and patient factors, providing some guidelines for management. Unfortunately, the validity of the Appropriate Use Criteria in clinical practice has not been shown.

Lafontaine et al[3] and Mackenney et al[4] addressed the question of instability in distal radius fractures with validated models. The ability to "hook" the volar cortex and restore volar cortical continuity may be the best predictor of final carpal alignment at union.[5] The criteria of Lafontaine et al can aid us in guiding optimal fracture management with 3 positive criteria denoting instability (Table 1). Increasing patient age

 

**TABLE 1. Criteria of Lafontaine et al[3]**

| |
|---|
| Initial dorsal angulation > 20° |
| Dorsal comminution |
| Radiocarpal intraarticular involvement |
| Associated ulna fracture |
| Age > 60 y |

Fractures with ≥3 gravity factors are associated with loss of position regardless of cast immobilization.

**TABLE 2. Risk of Displacement With Age and Time From Reduction**

| | Risk of Displacement (%) | |
|---|---|---|
| Age, y | Immediately After Reduction | 1 Wk After Reduction |
| 30 | 17 | 6 |
| 40 | 27 | 10 |
| 58 | 50 | 25 |
| 70 | 66 | 42 |
| 80 | 77 | 57 |

Adapted from Nesbitt et al.[6]

is also a consistent factor in predicting instability, with a 50% chance of loss of reduction during initial presentation for patients who are aged 58 years (Table 2).[6] In addition, there is evidence to support favorable functional outcomes with nonsurgical management in patients over age 60 years.[7,a,b]

Indications for operative fixation include fractures that cannot be adequately closed or reduced, unstable fractures, open fractures, polytrauma patients, concomitant carpal fracture, and severe articular displacement. Hand dominance, gender, AO classification, and radiographic parameters do not correlate with functional outcome and cannot be use as strict criteria for surgical intervention.[8]

## APPROACHES

### Dorsal approach

The dorsal approach was commonly used for internal fixation of dorsally displaced fractures by applying the traditional AO technique for buttress plating. The interval between the extensor carpi radialis brevis and extensor pollicis longus allows for direct visualization of the radial shaft and the articular surface. For severely comminuted fractures, indirect reduction of the articular surface may be performed through the fracture site. The main indication for this approach is for isolated or combined dorsal articular shearing injuries that cannot be controlled using a volar plate. Intraoperative stress testing of dorsal fragments can aid in the decision to stabilize them (Fig. 1).

### Volar approach

The volar approach is commonly used and takes advantage of the interval between the flexor carpi radialis (FCR) subsheath and the radial artery, allowing access to the deep volar compartment.[c] The pronator quadratus (PQ) can be elevated off the radius in an L-shaped manner or a pronator-sparing technique can be used by preserving the longitudinal limb of the muscle.[9,d] Theoretical benefits of repairing and preserving the PQ include improved distal radioulnar joint (DRUJ) stability, increased soft tissue coverage over the hardware, and improved pronation strength; however, there is a lack of good evidence to support these potential advantages in preserving or repairing the PQ muscle.[10] Deep distal dissection should be limited to avoid disruption of the volar radiocarpal ligaments, which can result in inadvertent destabilization of the radiocarpal joint.

Wijffels et al[11] described an intraoperative maneuver (Orbay maneuver) for visualizing the subchondral surface of the distal radius during a volar approach by pronating the radial shaft out of the surgical field while extending the distal fragment (Video 1). This allows for the reduction of articular surfaces and bone grafting. In addition, this maneuver can be performed to aid in the open reduction of fractures that have delayed presentation or lost reduction by allowing for stripping of the posterior soft callous in the first 6 to 8 weeks after injury.

### Extended flexor carpi radialis approach

Gwathmey et al[12] described the technique of releasing the transverse carpal ligament through the traditional FCR approach. This can improve fracture visualization and retraction of the carpal contents with no additional morbidity to patients. There are some data supporting an equivalent functional outcome in patients with and without the extended FCR approach.[13] However, there is a potential risk of injuring the palmar cutaneous branch of the median nerve, and it remains unclear as to which fracture patterns benefit from this approach.

### Volar-ulnar approach

The interval between the flexor digitorum superficialis and flexor carpi ulnaris with the ulnar neurovascular bundle can be used for isolated lunate