ELSEVIER

Operative Techniques in
Orthopaedics

The Role of External Fixation in the Treatment of Unstable Distal Radius Fractures

Jonathan Pritt, MD, and Marco Rizzo, MD

Fractures of the distal end of the radius represent a common and varied set of injuries. Management of unstable fractures of the distal radius continues to evolve. External fixation with or without secondary augmentation has been used with success in the treatment of these difficult injuries for some time. When considering the best management option for a particular patient and injury, it is important to understand the indications and varied techniques that are available. External fixation continues to be used with frequency and can result in good functional outcomes. It is important for surgeons who are managing these injuries to have a good understanding of external fixation and its proper applications.

KEYWORDS distal radius fracture, external fixation

External fixation is an established treatment in the management of unstable fractures of the distal radius. The role of external fixation, with or without Kirschner (K)-wire augmentation, has been influenced by the development and use of fixed-angle plating systems. However, external fixation remains a valuable technique in the management of these fractures. It is important for treating surgeons to have an understanding of the indications, principles, and techniques of external fixation, as it applies to the treatment of distal radius fractures.

Indications

Closed fractures of the distal radius that show significant displacement can be initially managed with closed reduction and splinting. If fracture reduction cannot be maintained with closed means alone, then surgical stabilization is indicated.[1,2] Historically, external fixation has been the treatment of choice for unstable fractures of the distal radius.[3-6] With the development of locked volar plating technology, the indications for external fixation have changed and continue to evolve, with recent studies affirming the role of external fixation in the management of these diverse fractures.[7-14] Indications for external fixation would include temporary stabilization in the management of open fractures with soft-tissue compromise that may require repeat debridement and secondary soft-tissue procedures. External fixation can be used for stabilizing fractures in the setting of polytrauma. External fixation is also an option for definitive management of selected isolated unstable distal radius fractures, including extra- and intra-articular fractures. External fixation may be used in the management of severely comminuted fractures with improved outcome.[1]

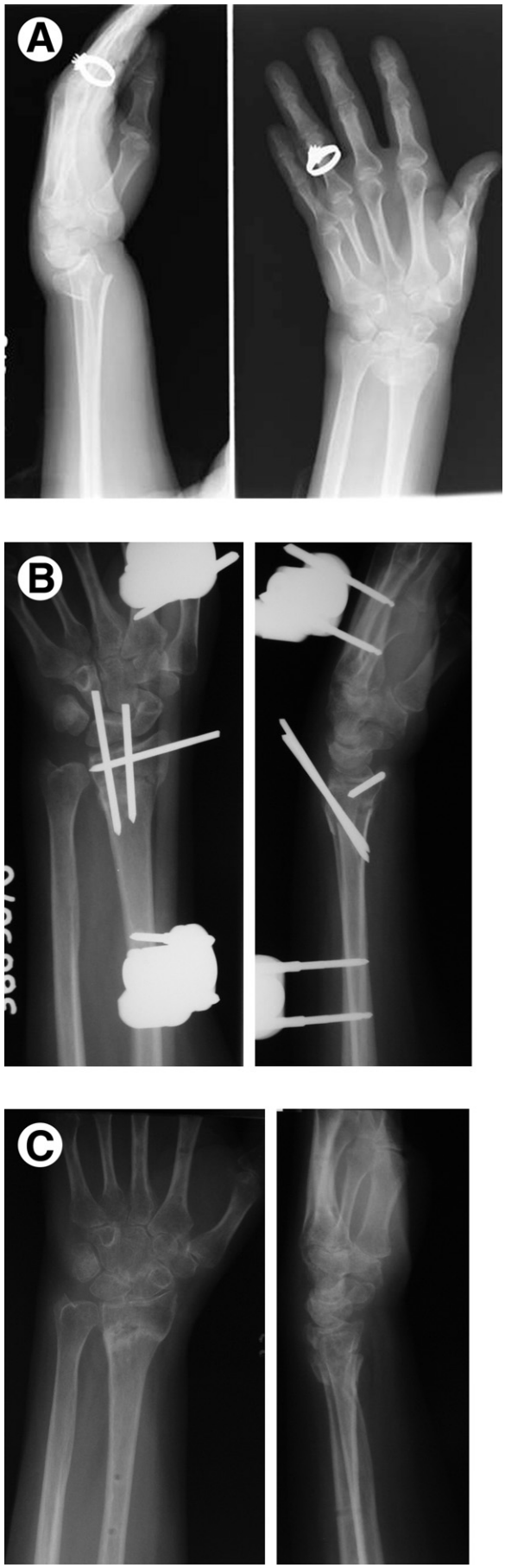
Patient-specific management decisions should be made with a good understanding of the specific injury. This would include a radiographic assessment as well as an evaluation for injury to the carpus or soft tissues around the wrist. Other important conditions to consider and rule out are compartment syndrome or neurovascular compromise. It is critical to have a good understanding of the patient's social history, handedness, and future activity demands. External fixation alone may be contraindicated when insufficient soft tissue is attached to the fracture fragments or intra-articular extension is noted, rendering closed reduction unsuccessful.[15-18]

Principles of External Fixation

In general terms, external fixation consists of pins or wires inserted into the bone and connected externally by a frame. There are several types and designs of external fixators. Two main types of external fixators used for the treatment of distal radius fractures include bridging and nonbridging fixators. A bridging technique spans the radiocarpal joint. The nonbridging designs span the fracture and but do not span the radiocarpal joint, and therefore allow motion at that joint. Both bridging and nonbridging techniques of external fixa-

Department of Orthopedic Surgery, Mayo Clinic, Rochester, MN.
Address reprint requests to Marco Rizzo, MD, Department of Orthopedic Surgery, Mayo Clinic, 200 First St SW, Rochester, MN 55905. E-mail: Rizzo.marco@mayo.edu

1048-6666/09/$-see front matter © 2009 Elsevier Inc. All rights reserved.
doi:10.1053/j.oto.2009.05.004



tion have been shown to have satisfactory clinical outcomes.[19-22]

Closed reduction of a displaced distal radius fracture is done via ligamentotaxis, which allows for indirect reduction of the fracture fragments. Soft-tissue attachments to the boney fragments are helpful in allowing for indirect reduction in this manner. Indirect reduction of the fractured fragments can be done with initial distraction before the application of the external fixator, or the fixator can be applied first and distraction of the fracture fragments with the fixator in place can be performed to initiate reduction. Longitudinal traction alone is often sufficient to correct radial length but may fail to correct proper volar tilt or radial inclination.[23] In this setting, multiplanar ligamentotaxis may be required.[24] The rigidity of the external fixator construct influences the biology of the fracture healing. A more rigid construct would lead to primary bone healing, whereas a construct that allows more motion at the fracture interfaces leads to callus formation and secondary bone healing.

Augmentation with accessory K-wires, pins, and the use of bone graft material or bone cement is often necessary to provide structural support for the subchondral bone or stabilizing intra-articular fracture fragments and can offer improved clinical outcomes.[15,25]

Preferred Technique

The preferred technique for the authors when proceeding with external fixation to treat an unstable fracture of the distal radius is to use a bridging external fixator with augmentation as needed.[26]

The patient is placed in supine position and a tourniquet is used on the extremity. Initially, the proximal fixator pin sites are exposed with a small incision made via a mini-open technique on the dorsal radial aspect of the radial shaft. It is important to identify the superficial branch to the radial nerve (SBRN) and protect it before pin insertion as the SBRN is susceptible to injury during this step. Proximal pins can be placed in the interval between the extensor carpi *Radialis brevis* and longus, thereby reducing the risk of irritation of the SBRN. The pins are placed in the radial shaft after predrilling and using a soft-tissue protector. The spacing of the 2 proximal pins is often determined by the particular fixator being used but should be at least 2-3 cm apart. The pins are hand driven into the far cortex of the radius and their position is confirmed with fluoroscopy. The skin is then closed around the proximal pin sites. The distal pins are placed on the dorsal radial aspect of the second metacarpal through small incisions followed by blunt dissection down to the metacarpal. Again a soft-tissue protector is used and the distal pins are

Figure 1 (A) Injury films (area postrema and lateral) of a 43-year-old woman who fell onto her outstretched hand. (B) She underwent operative stabilization with a bridging external fixator and K-wires. (C) X-rays following removal of the wires and fixator demonstrate radiographic healing and a well-maintained reduction.