Minimally Invasive Finger Fracture Management

Wide-awake Closed Reduction, K-wire Fixation, and Early Protected Movement

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KEYWORDS

• Finger fracture • K wire • Phalanx • Closed reduction

KEY POINTS

- This article explains why closed reduction can lead to superior results compared with open reduction for finger fractures.
- This article introduces the concept of early protected movement after closed reduction and K-wire fixation of finger fractures.
- This article discusses specific operative techniques for closed reduction K-wire fixation of finger fractures.
- This article compares outcomes between open and closed techniques for the management of finger fractures.

Videos of acute and chronic mallet fractures, distal phalanx fractures with nail injuries, and early protected movement of K-wired fractures accompany this article at http://www.heartfailure.theclinics.com/

INTRODUCTION: NATURE OF THE PROBLEM

An open approach to fractures requires substantial soft tissue dissection. A wound is created every time a fracture is treated openly. Within this wound, the gliding tendons and moving joint structures are exposed to the postoperative healing process and ultimately are affected by restrictive scar tissue and callus formation. The blood that fills the surgical wound creates an inflammatory response, adding more scarring and callus. All the foreign materials left in the wound, such as plates, occupy space, hindering tendon and joint movement. In addition, scar always forms over the plate and can be 1 to 2 mm thick. Each of these processes contributes to limitations of tendon and joint mobility.

Despite its negative impact on the soft tissue envelope, open reduction and internal fixation of unstable finger fractures is recommended because it is thought that more rigid fixation (ie, plate or screw) allows early range of motion, thereby preventing adhesions and stiffness. However, fingers differ from other bones in the body with their small size and high mobility demands. The finger's small

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soft tissue envelope and close proximity of gliding structures can cause stiffness and swelling with any soft tissue dissection, negating the advantage of rigid fixation.

A less invasive approach using K wires can overcome some of the problems with an open approach. When a finger is treated with closed reduction and K-wire fixation, the advantage is that there is no scarring from surgical dissection. There is reduced space for postoperative internal bleeding to accumulate and evolve into callus and scar formation. In addition, there is no hardware to restrict motion. K wires also provide functionally stable fixation. Although not rigid, this type of fixation allows bone to heal in a good position of function so that gliding and good range of motion is achieved. K-wire fixation has advantages suited to the unique issues of finger fractures.

The major concern about K-wire fixation for finger fractures is that the fixation is not strong enough to allow early movement. Early protected movement for finger fractures is important because a stiff finger is a useless finger. The concerns that surgeons have traditionally had with regard to early protected movement with K-wire fixated finger fractures are (1) fear of loss of reduction, and (2) skin irritation/infections generated by K wires. We believe that both these concerns can be minimized, allowing the benefits of K wires and early protected motion.

To minimize risk and optimize the results with K-wire fracture fixation, we have developed a protocol that allows early mobilization after K-wire fixation. In the appropriate patient population, this technique uses minimal soft tissue dissection and allows early motion. The technique relies on the patients' perception of pain to ensure that the motion does not exceed the stability of the fracture reduction construct. This article provides an overview of the technique, patient selection, and the postoperative protocol.

INDICATIONS AND CONTRAINDICATIONS

Patient selection is critical for the success of early protected movement after closed reduction and wide-awake K-wire fixation of finger fractures. Table 1 provides a list of the indications and contraindications.

Table 1
Patient selection: indications and contraindications

Indications	Contraindications
Patient willing to have wide-awake finger fracture surgery	Fracture not amenable to closed reduction with K wires
Cooperative patient off of all pain medication: understands to not move the finger if painful	Fracture fragment movement after K-wire fixation when tested with active patient movement during wide-awake surgery
Fracture amenable to K-wire reduction	Uncooperative patient on pain medication should not be allowed to do early active movement after surgery
Stable reduction of fracture with K wires: confirmed during wide-awake surgery when the patient intraoperatively tests the fixation with active movement	

PREOPERATIVE PLANNING

The wide-awake surgical reduction permits intraoperative patient active movement assessment before and after K-wire closed reduction. Patients are usually cooperative when it is explained to them that surgeons can do a better job if they see the patient move the fracture during the surgery. The surgeon must first clarify the diagnosis of the finger fracture before proceeding with K-wire fixation. Diligent history focusing on the mechanism of injury, thorough clinical examination, and careful review of 3-view radiographs are crucial for understanding the nature of the fracture, including type and location. In addition, patient factors such as occupation, compliance, and handedness should be respected when planning the operation.

Choosing the appropriate technique of K-wire fixation depends on the location and pattern of the fracture and is discussed later. The surgeon should also anticipate the need to convert the operation into open reduction and internal fixation and have the equipment ready.

PREP AND PATIENT POSITIONING

The patient's hand is prepped and sterilized using chlorhexidine solution and placed on a properly draped hand table. A fluoroscopy device needs to be accessible to assess the fracture reduction during the operation. We prefer a low-power device to minimize patient and surgeon radiation dosage. The patient should receive antibiotic prophylaxis before the procedure.