Fixation of Distal Ulna Fractures Associated with Distal Radius Fractures Using Intrafocal Pin Plate

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Abstract

Background Unstable distal ulna fractures in the setting of distal radius fractures can present a challenging problem, especially in the elderly population. Operative fixation of the subcapital distal ulna fracture may help to provide a stable ulnar buttress for attempting to reduce the distal radius fracture. Traditional fixation techniques of the distal ulna may prove unsatisfactory in the setting of osteoporosis and comminution.

Description The intrafocal pin plate is placed through a small incision distally and uses the curve of the plate to obtain multiple points of fixation within the intramedullary canal. The overhang of the distal aspect of the plate helps to reduce the fracture. The plate is secured using unicortical locking screws in the ulnar head.

Patients and Methods The most ideal fracture pattern for this fixation technique is a subcapital distal ulna fracture that is unstable and associated with a distal radius fracture. This technique is contraindicated in ulnar head fractures, segmental fractures with proximal extension, and open fractures with gross contamination as well as in the setting of active infection.

Results This technique has provided a stable ulnar buttress and aided in the reduction of grossly unstable distal radius fractures. All of these patients have gone on to union, and we have not experienced a need for plate removal due to pain or soft tissue irritation.

Conclusions We have found the intrafocal pin plate to provide both a stable ulnar buttress as well as intramedullary fixation to aid in the fixation of distal radius fractures associated with unstable distal ulna subcapital fractures.

Keywords

- ▶ distal ulna fracture
- ▶ intrafocal pin plate
- ▶ distal radius fracture

Distal radius fractures are often associated with fractures of the distal ulna, most commonly the ulnar styloid. Fractures of the ulnar head and neck can lead to instability and have been associated with distal radius nonunion, distal radioulnar joint (DRUJ) instability, and decreased forearm rotation.^{1–3} When distal radius fractures are associated with fractures of the distal ulna there is increased instability, which can lead to a difficult reduction given the lack of ulnar support, especially in the setting of comminution or osteoporosis. Multiple studies have advised operative fixation of unstable ulna fractures involving the neck or metaphysis.^{1,3–5} Operative fixation of these unstable fractures presents a challenge

because of poor bone quality, subarticular location of the fracture, and added operative time.

Internal fixation utilizing percutaneous Kirschner wire (K-wire) techniques, locked plates and blade plates, have been used. Percutaneous K-wire techniques offer the advantage of being minimally invasive to the surrounding soft tissues but offer limited stability in comminuted fractures or fractures involving osteoporotic bone. Internal fixation utilizing dorsal plating may cause extensor tendon irritation, and secure fixation may be difficult in the setting of osteoporosis. Only one or two screws can be accommodated in distal fixation of these distal fractures, and those screws must often be

Fig. 1 Intrafocal pin plate, two sizes shown. The distal aspect of the plate provides an ulnar buttress as well as locking screw fixation. The proximal aspect provides multiple points of fixation within the intramedullary canal.

unicortical because of the proximity of the DRUJ. Ring reported good results after internal fixation using a condylar blade plate; however, seven of the 24 patients in the series required removal of the plate as a result of soft tissue irritation.^{5,6}

The intrafocal pin plate device has been designed for fixation of distal radius fractures. These plates offer locking technology distally with a curved intramedullary stem proximally (→Fig. 1). At our institution, we have found that these plates offer a good alternative for unstable, displaced subcapital fractures of the ulna that occur in conjunction with distal radius fractures. The intrafocal pin plate has a low profile, requires minimal dissection, and provides a fixed angle mechanism. The purpose of this article is to describe our technique for fixation of these difficult fractures utilizing an intrafocal pin plate device (Tornier Inc., Medina, MN).

Patients and Methods

The intrafocal pin plate is designed for the treatment of distal radius fractures. It has a long S-shaped stem with a locking one- or two-hole plate distally. The S shape design provides multiple points of fixation within the shaft. This implant is also indicated in the setting of an unstable distal radius fracture with a displaced subcapital fracture of the ulna. The low profile of the plate offers advantages, especially on the ulnar side of the wrist in the elderly patient. Not all distal ulna fractures require surgical fixation. Typically the stability of the ulna fracture is assessed after reduction and fixation of the associated distal radius fracture. In the setting of gross instability, we recommend fixation of the ulna first to provide stability by creating a stable ulnar column (→Fig. 2). A stable ulnar column will improve the ability to obtain reduction of the distal radius fracture. By design, the intrafocal pin plate provides an ulnar buttress to the distal fragment as well as multiple points of fixation within the ulnar shaft, thus providing rotational stability. The overhang of the plate prevents collapse by engaging the cortex of the proximal fragment. The use of the intrafocal pin plate is contraindicated in the setting of open fractures with gross contamination, active infection, ulnar head fractures, and more proximal or segmental fractures.

Surgical Technique

If the radius cannot be reduced and the unstable ulnar fracture is felt to be contributing, the ulnar fracture may be reduced with the application of the intrafocal pin plate prior to fixation of the distal radius fracture. The intrafocal pin plate is held next to the ulna, and, using intraoperative fluoroscopy,

Fig. 2 Posteroanterior left wrist radiograph of a 62-year-old woman who fell off a ladder and sustained a comminuted displaced distal radius fracture and subcapital ulna fracture.

Fig. 3 (a) The intrafocal pin plate is held next to the ulna, and, (b) using intraoperative fluoroscopy, the appropriate location for the incision can be determined.

Fig. 4 (a) A small incision is made on the ulnar border of the distal ulna. The fascia between the extensor carpi ulnaris and flexor carpi ulnaris is incised to expose the fracture site. (b) The plate is inserted using the inserter device and introduced into the fracture site.

the appropriate location for the incision can be determined (►Fig. 3). The approach to the ulnar fracture utilizes the interval between the extensor carpi ulnaris (ECU) and the flexor carpi ulnaris (FCU). The intrafocal pin plate requires only a small incision, ~2 cm in length. If the dorsal cutaneous sensory nerve is visualized, care should be taken to protect it.

The soft tissue dissection is carried down to the level of the fascia of the ECU and FCU. The fascia is incised longitudinally, allowing exposure of the ulna fracture. The intrafocal pin plate is placed into the inserter device and is introduced into the fracture site (►Fig. 4). The pin is then advanced proximally into the medullary canal of the ulna (►Fig. 5). The plate is first positioned such that the hook is pointing radially to engage the fracture. The plate is then rotated 180 degrees, pointing the hook ulnarly, while advancing the plate proximally. Prior to insertion, the pin may need to be slightly straightened in the setting of a narrow ulnar canal. The distal fragment is then aligned with the proximal segment, and the plate portion of the device is aligned along the ulnar border of the distal fragment. Once the plate is fully inserted, the plate portion lies snugly along the distal fragment, reducing the fracture. Care is taken that the ECU tendon is not trapped beneath the plate. Intra-

Fig. 5 (a, b) The plate is advanced proximally into the medullary canal of the ulna, reducing the fracture.

operative fluoroscopy is used to confirm appropriate reduction of the fracture and pin plate placement. The distal, metaphyseal fragment is then locked to the plate with one or two locking unicortical screws that enter the ulnar head from and ulnar to radial direction (►Fig. 6). Now, attention can be turned to the radius, which may reduce against the now stable ulnar column (►Fig. 7).

Postoperatively, the patient is placed in a sugar tong splint to minimize forearm rotation. The patient is seen in 10–14 days, the splint is removed, and new radiographs are obtained. Further splinting and immobilization may then be dictated by the distal radius fracture and the treating surgeon. Formal exercises involving pronation and supination of the forearm do not begin prior to 6 weeks after surgery.

Results

We have used this technique in patients with elderly osteoporotic distal radius fractures and associated subcapital ulna fractures and have adequate follow-up on four patients. These patients have gone on to heal without difficulty. None of the patients has had symptoms associated with the retained hardware necessitating removal. The details regarding patient age, fracture type, time to union, and range of motion can be found in ►Table 1.

Fig. 6 (a–d) The distal, metaphyseal fragment is then locked to the plate with one or two locking unicortical screws that enter the ulnar head from and ulnar to radial direction.

Fig. 7 (a–c) Left wrist posteroanterior, oblique and lateral radiographs after fixation of the distal radius fracture with a locked volar distal radius plate.

Table 1 Four patients treated with fixation of subcapital ulna fracture with intrafocal pin plate

Patient	Age at injury	Fracture type	Treatment of radius fracture	Time to union (weeks)	Range of motion at last follow-up
1	78	Intraarticular distal radius fracture and subcapital ulna fracture	ORIF with volar locking plate	5	55° wrist extension 60° wrist flexion 80° pronation 70° supination
2	61	Intraarticular distal radius fracture and subcapital ulna fracture	ORIF with volar locking plate	5	30° wrist extension 20° wrist flexion 80° pronation 20° supination
3	70	Extraarticular distal radius fracture and subcapital ulna fracture	ORIF with volar locking plate	10	Full wrist flexion and extension Full pronation and supination
4	75	Open distal radius fracture and subcapital ulna fracture	External fixator and K-wires	6	30° wrist extension 30° wrist flexion 50° pronation 50° supination

Abbreviations: ORIF, open reduction with internal fixation.

Discussion

Treatment of distal radius fractures has become more and more aggressive with internal fixation since 2000.⁷ Distal ulna fractures associated with unstable distal radius fractures have led to further debate regarding treatment recommendations. Not all of these distal ulna fractures will need to be treated operatively. In 2004, Ring et al demonstrated good alignment, function, and healing when distal ulna fractures were treated with a condylar blade plate. Unfortunately, there was a relatively high rate of secondary procedures to remove the plate as a result of symptoms associated with soft tissue irritation.⁵ In 2007, Dennison et al showed good results with respect to fracture union, fracture alignment, and motion when these fractures were treated with locked plating.⁶ However, in 2012, Cha et al demonstrated that these fractures can often be successfully treated nonoperatively.⁸

An unstable, displaced distal ulna fracture in the setting of a distal radius fracture can lead to decreased forearm rotation, DRUJ instability, difficulty with reduction of the distal radius fracture, and nonunion of the distal radius.^{1,3} Several fixation options have been described including percutaneous K-wire fixation, condylar blade plate fixation, and locked plating. Complications associated with these types of fixation include pin irritation and pin site infection, prominent hardware, extensor tendon irritation, soft tissue stripping, and inadequate fixation in the setting of osteoporotic bone. The intrafocal pin plate offers the advantage of locked plating technology in the metaphyseal segment combined with intramedullary fixation proximally within the shaft of the ulna. The minimally invasive approach preserves soft tissue, and the low profile of the plate decreases the need of secondary procedures for hardware removal.

Conflict of Interest

None

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