# Distal Third Radius Fractures with an Intact Ulna

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## Contents




**Abstract**

Distal third radius fractures are common injuries in childhood and can often be treated nonoperatively with closed reduction and casting. Fracture management becomes slightly more challenging when the radius is displaced and the ulna is either nondisplaced or intact. Sometimes, isolated distal third radius fractures cannot be close reduced, and even when closed reduction is achieved, the fracture may subsequently displace. Therefore, close monitoring is required for early detection of displacement. Cast wedging can improve alignment, but patients may ultimately require operative intervention. Techniques include closed reduction and percutaneous pinning, open reduction with internal fixation using plates and screws, and intramedullary fixation.


## 1 Brief Clinical History

The patient is a 10-year-old female who sustained an injury to her left wrist while "Rip Sticking" and was placed in a sugartong splint by an outside provider (Fig. 1). She followed up in the pediatric orthopedic clinic 1 week after her injury. On exam, she had some swelling about her wrist, but no visible deformity. She was placed in a long-arm molded cast and was scheduled to follow-up in 1 week for close evaluation. She presented at 14 days with increasing angular deformity (Fig. 2) and was indicated for closed versus open reduction and stabilization.


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C. A. Iobst, S. L. Frick (eds.), *Pediatric Orthopedic Trauma Case Atlas*,
https://doi.org/10.1007/978-3-319-29980-8_43


**Fig. 1** Initial presentation to orthopedic clinic 1 week after injury with AP (**a**) and lateral (**b**) radiographs demonstrating a mildly displaced distal third radius fracture and a nondisplaced distal third ulna fracture


**Fig. 2** At the following orthopedic visit, AP (**a**) and lateral (**b**) radiographs demonstrate increased volar apex deformity of the distal third radius fracture

## 2 Preoperative Clinical Photos and Radiographs

See Figs. 1 and 2.

## 3 Preoperative Problem List

None.

## 4 Treatment Strategy

Wedging could have been attempted in this scenario, but given the intact ulna and delayed presentation, it would likely not have been successful. We did discuss the possibility of repeat reduction and casting, but after discussing risks and benefits with the family, closed reduction and percutaneous pinning was chosen. In the operating room, the distal radius fracture reduced fairly easily with manipulation; the ulna fracture was completed with this technique (Fig. 3). The decision of Kirschner wire placement (distal or proximal to the physis) is surgeon- and fracture-dependent. If there is adequate space, it is preferable to place the pin proximal to the physis, but occasionally the pin must traverse the growth plate to obtain proper stability. Smooth pins should be utilized, crossing the physis only once in order to reduce the risk of physeal arrest. Placing a small incision, spreading the soft tissues, and utilizing a soft tissue protector while advancing the pin helps ensure protection of the radial sensory nerve. Often one larger Kirschner wire (size 0.062 inch or 2 mm) will suffice, but stability can be tested in the operating room, and a decision to add further fixation is made on a case-by-case basis. We apply a long-arm cast with a gentle dorsal mold, pull the pin at 4 weeks, and often transition into a short arm cast for two more weeks.

## 5 Basic Principles

Although many distal radius fractures may be treated with closed reduction and cast immobilization, close follow-up is essential, particularly with the isolated radius fractures. Loss of reduction in distal radius fractures occurs approximately 30% of the time (Proctor et al. 1993; Zamzam and Khoshhal 2005; Miller et al. 2005), but isolated radius fractures have been found to need re-manipulation 91% of the time (Gibbons et al. 1994). Risks for loss of reduction include a cast index of greater than 0.7, incompletely reduced fractures

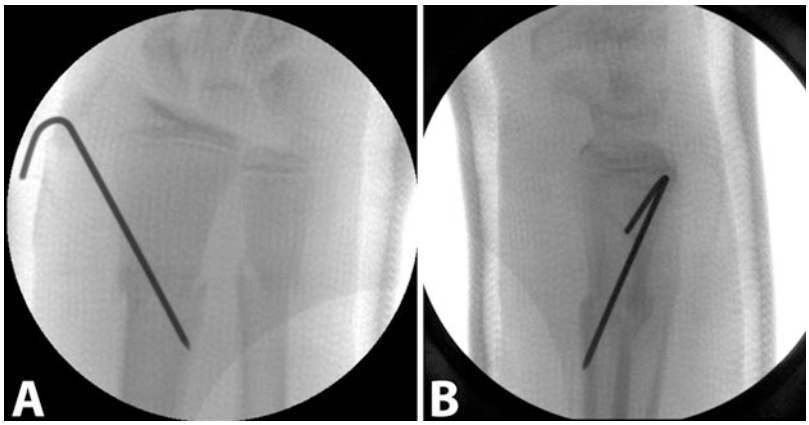


**Fig. 3** AP (**a**) and lateral (**b**) intraoperative fluoroscopy images demonstrate closed reduction and percutaneous pinning, with the pin start site proximal to the distal radius growth plate


**Fig. 4** A 12-year-old female with a displaced radial shaft fracture with distal third ulna buckle fracture (**a**, **b**) underwent closed reduction and casting and presented to the orthopedic clinic 10 days later with further displacement, shortening, and loss of the radial bow (**c**, **d**). She was indicated for surgical intervention, and necessitated open reduction at the fracture site, as closed reduction attempts were unsuccessful. AP (**e**) and lateral (**f**) fluoroscopy films demonstrate placement of 2 mm titanium elastic nail, with the start site proximal to the growth plate

(i.e., residual displacement and/or angulation following manipulation), degree of initial fracture displacement/obliquity (bayonet apposition, greater than 50% translation, and greater than 30° angulation), muscle atrophy, and resolution of initial soft tissue swelling while in the cast. Complete metaphyseal fractures in children older than 10 are at a very high risk of loss of reduction (Miller et al. 2005).


**Fig. 5** Radiographs at 4 weeks (**a**, **b**) demonstrate callus formation and overall acceptable alignment. The pin was pulled at this visit and a short-arm cast was applied for 2 more weeks


**Fig. 6** Radiographs taken 4 years later for a different injury demonstrate good remodeling and overall alignment

## 6 Images During Treatment

See Fig. 3(a), (b).

## 7 Technical Pearls

If a radius fracture necessitates surgical intervention, options include repeat reduction and casting, closed reduction and pinning, open reduction and internal fixation with plates/screws, or flexible intramedullary nails. The decision must assimilate the fracture location, surgeon experience, patient age, and patient/family preferences.

Open reduction and internal fixation with plates and screws does require a more extensive exposure and requires a decision to subsequently remove the hardware. Removal of plate and screw constructs is associated with a risk of re-fracture.

Intramedullary fixation requires attention to the growth plate, with initiation of the start site proximal to the physis. The start site may either be between the third and fourth extensor compartments or on the radial aspect of the metaphysis, with care to protect the radial sensory nerve and the dorsal extensor tendons. If the fracture is fairly distal, a more dorsal starting site is easier to prevent displacement, but is associated with extensor tendon ruptures. One must also place a three-point bend to help re-create the radial bow before inserting the rod, although often, the bend is reduced with advancement into the medullary canal. While drilling the start site, a tissue protector is utilized and the drill is directed nearly in line with the radius to open the cortical entrance. Care should be taken not to drill the second cortex, or passage of the nail may be difficult. Repeated closed reduction attempts and repeated attempts at passage of the intramedullary nail can lead to compartment syndrome, so one should have a low threshold to open the fracture site if encountering difficulty (see Fig. 4).

## 8 Outcome Clinical Photos and Radiographs

See Figs. 5(a), (b) and 6.

## 9 Avoiding and Managing Problems

The best chance to avoid loss of reduction is to apply a well-molded cast without too much cast padding. These fractures tend to displace with apex volar and ulnar angulation (See Fig. 7), and therefore a good dorsal mold with the wrist in ulnar deviation is paramount.

If a reduction is lost, cast wedging remains a good technique that may avert surgical intervention (Samora et al. 2014). The better the cast index, the greater success for wedging. We try to wedge the cast within the first 1 to 2 weeks, but we have had success as late as 3 weeks. The cast is cut nearly circumferentially, leaving a bridge less than one-fourth of the circumference (Fig. 8). The size of wedge depends on the amount of correction needed and the placement of the cut in relation to the fracture. If it is unclear where the fracture is, one can always place a radiographic marker


**Fig. 7** An example of a distal third radius fracture (**a**, **b**) with minimal ulnar involvement that was reduced nicely (**c**), but because the cast was not well applied, it subsequently lost reduction by the 1 week clinic appointment (**d**, **e**)


**Fig. 8** Sometimes, a cast can be wedged to improve alignment. This 7-year-old patient presented to clinic 1 week after closed reduction and casting with loss of reduction (**a**). Wedging was performed acutely (**b**), and at 5 weeks, radiographs demonstrated overall acceptable alignment (**c**).

and then obtain either an AP or lateral image to ensure proper position of the wedge before cutting the cast.

Complications of surgical intervention can include infection, nonunion, malunion, tendon rupture, radial sensory nerve irritation, compartment syndrome, re-fracture, stiffness, hypertrophic scar formation, and hardware irritation. Compartment syndrome can be avoided by setting a timer when attempting a closed reduction and flexible intramedullary nailing. We have the circulating nurse set the timer for 10 min; if we cannot reduce and pass the rod in this time, we will open the fracture site. Furthermore, we only attempt at most three passages across the fracture site before opening. Most of these problems can be avoided with good surgical technique, but patients and families should be aware of these potential outcomes.

## 10 Cross-References

- Compartment Syndrome of the Hand
- Midshaft Both Bone Forearm Fracture: Intramedullary Rod Fixation
- Physeal Fracture of the Distal Radius
- Proximal Third Both Bone Forearm Fractures
- Volar Shear Fractures of the Distal Radius

## References and Suggested Reading

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