Distal Radius Fractures Overview

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Abstract

Distal radius fractures are very common orthopaedic injuries, accounting for approximately 20% of all fractures. The most common mechanism of injury is usually a fall onto an outstretched hand. Non-operative treatments include splint or cast immobilization with or without closed reduction (bone setting). Operative treatments include percutaneous pinning, external fixation, and volar or dorsal plating. Both non-operative and operative treatments can be successful depending on their application in the right situations. Although not common, complications can occur with any treatment modality.

Background Information

The wrist is made of several bones of the hand, called carpal bones and the two bones of the forearm, the radius and ulna. A wrist fracture refers to a break in one of those bones. The radius is the larger of the two bones of the forearm and the distal radius is at the end near the wrist where it lies on the side closest to the thumb. There are over 600,000 distal radius fractures each year seen in emergency rooms and they are more common in younger male patients and older female patients. Pediatric patients also experience a high incidence of distal radius fractures that can involve the growth plate.

Distal radius fractures account for approximately 20% of all fractures. Distal radius fractures are seen across all age groups and typically are seen in older patients due to low energy injuries, typically a fall from standing height. In younger patients they typically occur with high energy injuries like motor vehicle collisions and are typically accompanied by other injuries. Typically, the greatest frequency is seen in two age groups; 6-10 and 60-69 year olds with the incidence of distal radius fractures increasing with age related osteopenia (decrease in bone mineral density). Risk factors for distal radius fractures include female sex, white race, early menopause and decreased bone mineral density.

Why do we get it?

The most common mechanism of injury is usually a fall onto an outstretched hand. This is significant as the distal radius forms the functional foundation of the wrist joint. As the distal radius absorbs approximately 80% of the force of the body through the wrist, this type of injury does not need to involve a significant amount of energy. With enough energy and/or with any of the above mentioned risk factors, the distal radius can fail in predictable fracture patterns depending on how the hand and
wrist were positioned at impact. Higher energy trauma such as motorcycle and motor vehicle related accidents are also common causes.

How do we diagnose it? What are the symptoms?

Patients typically present to an emergency department or urgent care with a history of a fall or other type of injury and subsequent pain with a deformity at the wrist. The pain and misshapen wrist can be accompanied by localized tenderness, swelling, tingling, bruising and pain with any type of range of motion at their wrist. It is essential to perform a careful motor and sensory exam of the wrist and hand to identify any possible nerve, blood vessel, or tendon injury.

Diagnostic studies/testing

Imaging is the easiest and fastest way to tell that a bone is broken, and with distal radius fractures an x-ray generally gives us the information necessary to treat it. When surgery is planned, sometimes it is helpful to get a CT scan, which is a more complete form of x-ray that is useful to evaluate for fine fracture lines, amount of comminution (number of pieces), or to obtain a 3D recreated view of the fracture. Occasionally, an MRI is useful in evaluating the soft tissues, including ligaments of the wrist but this is not routinely performed.

Non-operative treatment

Treatment of distal radius fractures is based on numerous factors including patient’s age and activity level, fracture pattern (nature and location of the injury), hand dominance, occupation and fracture stability. As the distal radius is the anatomical foundation of the wrist joint, the goal is restoring painless function and useful range of motion. This means treatment is individualized and discussed with the patient so there is full understanding of all risks, benefits of management, and its alternatives.

Treatment for a wrist fracture can be nonsurgical or surgical. If the bone is fractured but in good or well-aligned position, a splint (plaster cast) may be applied to the wrist. With bad alignment of a distal radius fracture, it may be necessary to perform closed reduction (realign the bones) and then immobilization. Closed reduction (realigning bones without opening the skin with an incision) ideally should be done in most patients with displaced (shifted) fractures to minimize soft tissue swelling, provide pain relief, and relieve compression on the median nerve, one of the important nerves of the wrist. Closed reduction should only be attempted after the patient has received a hematoma block (local anestheisia) and/or conscious sedation (made drowsy for the purpose of procedure) to ensure the patient has adequate pain control. After reduction, the next step is immobilizing the patient in a well-molded splint or cast to maintain the reduction and fracture alignment. This typically is accomplished by placing the patient in a
sugar-tong splint to obtain adequate immobilization above and below the fracture. This employs a basic principle of immobilizing the joint above and below the fracture. Sugar-tong splints achieve this by immobilizing the elbow above and the carpometacarpal joint (base of the hand) below. It is important to leave the metacarpophalangeal (knuckle at the base of the finger) joint free to avoid complications with stiffness.

There are numerous studies questioning whether a long arm splint or cast is needed for initial immobilization. The findings from these studies suggest that type of splint or cast is less important and that maintenance of fracture alignment depends mostly on the initial displacement of the fracture, degree of comminution, and bone quality. Loss of fracture reduction is common so it becomes important to follow the patient and monitor the fracture with weekly repeat x-rays for the first few weeks. In general, a cast is kept in place for anywhere from 4-6 weeks to keep the fracture immobilized.

Operative treatment

Surgery for distal radius fractures is performed for fractures that are open, unstable, have 2 mm or more of articular (joint surface) shift or those that are a part of a multi-traumatic injury. In patients over 55 years of age, there is no evidence that surgery has better outcomes than cast treatment. An unstable fracture has re-displacement following closed reduction and is associated with increasing patient age, energy of the initial injury, degree of initial displacement, comminution, shortening of the distal radius and associated ulnar styloid fracture. Based on x-rays after reduction, surgery can be recommended if the fracture still has radial shortening (compression) of more than 3 mm, tilt greater than 10 degrees upwards (dorsal tilt) or intra-articular displacement of greater than 2 mm. The ultimate goals of operative intervention are to recreate normal anatomy with appropriate stability to allow for immediate active motion at the wrist.

Multiple options exist for fixing distal radius fractures. Recommendations vary based on the age of the patient, quality of the bone, fracture pattern and surgeon experience. The most common options include percutaneous pinning, external fixation and internal fixation. Allograft bone grafting (cadaver donor bone) and cement support may be used in select cases if the surgeon feels it is needed, but this is not standard. There is no evidence to suggest that these items improve outcomes. Occasionally, arthroscopy can be done at the time of surgery to identify and treat additional problems seen.

Distal radius fractures commonly have associated ulnar styloid fractures at the same time and this does not usually need to be fixed surgically unless there is instability between the two bones of the forearm at the wrist in the distal radioulnar joint (DRUJ).

Outcomes/Results of treatment/Prognosis
In most cases after sustaining a distal radius fracture, patients are able to return to their previous activities without much struggle. Open reduction refers to directly accessing the fractured bone with skin incision and cutting via the soft tissue planes to be able to apply a device to fix the bones together. When surgery is chosen, many surgeons use percutaneous (minimally invasive) metal pinning or external fixation (where most hardware remains outside of the body), however as the types of surgical hardware are improving the trend is moving towards plates and screws to put the pieces back together. Whichever technique is used, for most patients the long-term prognosis is quite good. If the articular (joint) surface is able to be reconstructed well enough, patients will have a low chance of developing arthritis in the future. This is most dependent on the severity of the initial injury. Successful outcome is also associated with restoring the anatomy and relationships of the bones, tendons, ligaments, and muscles that were injured. It is also important to promote early wrist and finger motion in order to improve motion as much as possible, and this can also lead to a decrease in pain as patients heal from the injury. Athletes should not participate in contact sports for 3-4 months to prevent any fall from the sport from causing re-injury to the wrist.

Complications

Complications from distal radius fractures are not common. Often after being immobilized in a splint or cast, patients may have stiffness early on. Most times, the stiffness improves once out of the splint or cast, but sometimes patients may need help regaining their motion back, and an occupational therapist may be recommended by the surgeon. In addition to wrist motion, patients may have difficulty with full supination (rotating the hand or forearm so that the palm faces up) or pronation (rotating the hand or forearm so that the palm faces down).

Damage or excessive swelling to the wrist can cause pressure to one of the nerves in the wrist tunnel (carpal tunnel) called the median nerve. This is more common when the wrist is in a flexed position or the injury happened by high energy force. If the patient notices severe burning, tingling, or shooting pains into the fingertips, this is a high possibility, and may benefit from emergent surgery to decrease pressure on the nerve by releasing the carpal tunnel.

Another complication from having a distal radius fracture is a higher risk of developing arthritis or instability of the wrist.

There is one tendon in particular, called the extensor pollicis longus, which has a higher rate of tearing in patients that are treated without surgery in patients with nondisplaced distal radius fractures. It is thought to occur because of mechanical irritation or local loss of blood flow to the tendon after a distal radius fracture, and can cause the thumb to be unable to extend back. If this occurs, another tendon can be rerouted surgically to gain back the thumb motion.
Sometimes a patient may not heal the break (nonunion), or the bones may heal improperly or in an incorrect position (malunion). When this happens, surgery is usually necessary in order to correct the situation, and sometimes bone healing is stimulated by using help from donor bone sites (bone graft).

During percutaneous pinning or external fixation, there is risk of injury to the radial sensory nerve during the insertion of a pin or rod. This is limited by the surgeon making as few attempts as possible when inserting a pin. There is also risk of infection at a pin site, which can be lessened by keeping the site clean. If infection does develop, it usually clears up with oral antibiotics, and if not then the pin can be removed. It is rare to get an infection of the bone itself, which is called “osteomyelitis.”

Distal radius plates and screws can be placed on the palm side (volar) or opposite side of the wrist (dorsal). Both have possible complications when not performed carefully. With the volar plates, when a screw is inserted to lock the plate down, the tip of the screw may exit out the dorsal part of the bone. If it protrudes too much, the sharp tip can cause injury to the extensor tendons of the wrist and actually cause them to tear. Tendons on the volar side may also be strained by rubbing on a plate that is too prominent. With the dorsally placed plates, similar problems can arise if the surgery is not done carefully.

Authors Preferred Treatments

For all patients we recommend initially splinting patients with sugar-tong immobilization, with or without closed reduction depending on how the fracture looks. For non-displaced or minimally-displaced fractures, on follow up in the office, x-rays are often repeated on a weekly basis to determine if the position or stability is changing. In other instances (for reasons stated in above indications), surgery is decided upon. We prefer volar locking plates for distal radius fixation as it provides excellent results in most patients and allows for early range of motion. Smoking cessation and avoiding anti-inflammatories are highly recommended. Patients may also consider supplementation with calcium and vitamin D to promote bone density, and vitamin C and avoid pain related complications such as complex regional pain syndrome, although this is controversial.

Conclusion

Distal radius fractures are very common orthopaedic injuries, accounting for approximately 20% of all fractures. The most common mechanism of injury is usually a fall onto an outstretched hand. Non-operative treatments include closed reduction, with splint or cast immobilization. Operative treatments include percutaneous pinning, external fixation, and volar or dorsal plating. Although complications are not common, they can occur and vigilance is necessary to avoid common surgical mistakes.
Bullet Points

Distal radius fractures are very common orthopaedic injuries, accounting for approximately 20% of all fractures.

The most common mechanism of injury is usually a fall onto an outstretched hand.

Non-operative treatments include closed reduction, with splint or cast immobilization.

Operative treatments include percutaneous pinning, external fixation, and plating.

Surgery may be an option if the fracture is open, has radial shortening (compression) of more than 3 mm, dorsal tilt greater than 10 degrees or intra-articular displacement of greater than 2 mm.

In patients over 55 years of age, there is no evidence that surgery has better outcomes than cast treatment.

Although complications are not common, they can occur with both casting and surgery.

In distal radius fracture patients smoking cessation, avoiding anti-inflammatories, supplementation with calcium, vitamin D, protein, and vitamin C may be encouraged.

References


