Distal radius fractures are an increasingly prevalent upper extremity injury, especially among elderly patients. They represent approximately 3% of all upper extremity injuries. Severity of these fractures is directly related to bone mineral density of the patient, and clinical results are dependent on this parameter as well. There is a bimodal distribution of these injuries, with a peak between 18 to 25 years of age, predominantly male population and a second peak in the elderly, older than 65 years, predominantly female population. Early reports of fractures of the distal radius considered these fractures to be group of injuries with a relatively good prognosis irrespective of the treatment given. When it comes to complex fractures, regardless of the method applied, major or minor functional invalidity persists. With that in mind fractures of the distal radius are medical, social and economic problems of modern society.

Key words: fractures, distal radius, healing

INTRODUCTION

Distal radius fractures remain the most frequent fractures in the adult. They occur when a person falls on the palm of the hand with wrist in 40°-90° of extensions1. Typical fracture is localized at 1.5-2.5 cm above wrist. Fractures below this level is designated as low, while high fractures are situated more than 4 cm above wrist. In typical fractures distal fragment is dislocated backwards, laterally and upwards. In 50%-55% of cases there is concomitant fracture of ulnar styloid2. Junction between the arm and hand represents the wrist. It includes distal end of radius, triangular articular fibro cartilaginous disc and first three bones of proximal carpal row. Joint capsule is reinforced by ligaments divided into anterior, posterior and collateral. Distal radius has three concave articular surfaces: scaphoid fossa, lunate fossa and sigmoid concave depression-notch3. Wrist performs movements of flexion, extension, abduction, adduction, as well as circumduction. Articular surface of radius has radial inclination (slope) of 15°-25°, approximately 23° and volar slope of 10°-15°, approximately 11°. Radial slope is measured on AP radiographs and is represented by the angle described by tangential line along distal articular surface of radius and horizontal line along radioulnar joint. Slope of distal end of radius is measured on lateral radiographs and should be approximately 10°-15°. This is the angle formed by two tangential lines between dorsal and volar slopes of lunate facete of radius, and longitudinal axis of radius4. (Figure 1)

DIAGNOSIS

Diagnosis may be evident clinically when the distal radius is deformed but should be confirmed by x-ray. Fracture line is approximately 2.5 cm above wrist (typical site). Distal fragment of the radius is dislocated dorsally, laterally and upwards. Clinical presentation includes swelling, deformity and pain at the fracture site. Wrist motion is painful and limited. To make a definitive confirmation of the diagnosis, it is necessary to perform x-ray of the forearm and the wrist. Standard postero-anterior, lateral and oblique radiographs projections of the wrist show the fracture and the displacement. CT scan is warranted if conventional X-rays are insufficient to show the articular surface. This provides detailed insight into degree of dislocation and number of fragments, as well as relationship of fragments and articular surfaces5.

There are several eponyms that are commonly used in description of the fractures of distal radius:

- Colles’ fracture also Colles fracture (described in 1814) is a fracture of the distal radius in the forearm with dorsal (posterior) displacement of the wrist and hand. The fracture is sometimes referred to as a "dinner fork" or "bayonet" deformity due to the shape of the resultant forearm. It may coincide with fracture of the ulnar styloid process.
• Smith’s fracture also sometimes known as a reverse Colles’ fracture is a fracture of the distal radius with volar dislocation, described in 1847 and classified by Smith into types I and II, and by Thomas into type III in 1957.
• Barton’s fracture is an intra-articular fracture of the distal radius with dislocation of the radiocarpal joint. Articular surface of the distal radius dislocated in respect to carpus, with intraarticular fragment that may be volar (Smith II) and dorsal. It was described in 1838.
• Hutchinson’s or "Chauffeur’s" fracture is a type of fracture of the forearm, specifically the radial styloid process. They involve carpal dislocation and radial styloid process fracture in addition to fracture of the distal radius.

FRACTURE CLASSIFICATION

Classification of distal radial fractures has largely occurred in the past two hundred years. The goal of any classification is to perform division of injuries, establish the most optimal way of treatment and to predict ultimate outcome. The most commonly used are classifications by Frykman, Melone, AO and Fernandez.

The universal classification system fractures of the distal radius are generally divided into extraarticular and intraarticular fractures, depending on the fracture line entering joint space or not. Intraarticular fractures would be designated as those involving the radiocarpal joint, distal radioulnar joint, or both. Fractures are also divided into stable and unstable ones. Unstable fractures present with angulation in excess of 30° with concomitant comminution and shortening.

TREATMENT

Distal radius fractures can be treated with different methods, depending on the type of fracture. These fractures can be treated non-operatively or operatively.

Non-operative treatment

No operative management consists of closed treatment with casting. This treatment is used mostly in fractures that are stable, simple, closed, non-dislocated or with minor dislocation. This way of treatment may be used in selected intraarticular fractures, where anatomical alignment of articular surfaces is preserved and where fragment dislocation is minimal. Treatment consists of closed reduction and adequate immobilization. Radius plaster cast or open circular cast is applied up to metacarpophalangeal (MCPH) joints, holding the wrist in slight flexion and ulnar deviation, also known as Cotton-Loder position. In case of redislocation after one week, another reduction may be attempted. It is general opinion that reduction is acceptable if dorsal angulation is less than 10°, shortening less than 5 mm and/or incongruence of articular surfaces up to 2 mm.

Operative treatment

Some of the fractures of the distal radius require operative treatment. Numerous factors influence choice of the operative plan. These include fracture location, stability, magnitude of deformity, whether the fracture is open or a closed one. Redislocated fractures and concomitant injuries are also to be considered for operative treatment. Patient’s age, occupation, psychophysical condition, social and economic status has also to be taken into account. In all operatively treated patients it is necessary to administer prophylactic parenteral antibiotic therapy. Generally, operative techniques include Open Reduction Internal Fixation (ORIF), external fixation, percutaneous pinning, or some combination of the above.

Most frequently used operative techniques are:
• Kirschner (K) wire or pin fixation. Several types of pin fixations have been described, including placement through the radial styloid, two pins crossing the radius, intrafocal pinning through the fracture site, ulna-to-radius pinning without locking the DRUJ, and ulna-to-radius with locking of the DRUJ. Most of the-
se techniques require postoperative casting or splinting. It is commonly used in fractures with redislocation and in Hutchinson’s fracture of radial styloid process. Technique involves closed reduction and percutaneous fixation under X-ray monitor control (Figure 2). They are removed after four to six weeks, depending on the fracture type, followed by the mandatory plaster cast immobilization. Plate fixation of unstable distal radial fractures is quickly becoming the standard treatment for this common injury. Fixation is achieved by the means of dorsally or volar placed T-plate and screws, choice depending on the fracture type and level. It is indicated in closed fractures. It is also performed in unstable, as well as intraarticular fractures of the distal radius. (Figure 3). Postoperative six to eight weeks plaster cast immobilization is mandatory. Plate and screws are left in place for a minimal period of six months, usually a year.

- External fixation is performed in open fractures, severely comminuted fractures and complex intraarticular fractures. It is also treatment of choice in fractures involving bony defects and in patients whose general condition prevents them from undergoing more extensive surgery. Fracture is stabilized using Mitkovic external fixator, Orthofix or improvised external apparatus (Figure 4). External fixation in open fracture allows physician access to the wound while maintaining stability, which is necessary in order to change dressings. External fixator may be removed after six to eight weeks, or replaced by plaster cast immobilization as necessary.

- Operative techniques may be combined. For instance, external fixation and K wires, or plating and K wires may be used at the same time. This is also useful in case of fracture of the distal radius that is part of or is concomitant with carpal luxation or carpal bone fractures.

- In case of closed complex comminuted fracture involving bony defect there is an option of corticocancellous and/or cancellous bone grafting.

**COMPLICATIONS**

Complications may be early and late.

Early complications include secondary dislocation and infection. Fracture may dislocate due to bone resorption at the fracture site several days following the injury, or after subsidence of swelling. Infection may occur in primarily contaminated open fractures despite surgical treatment of the wound and antibiotic prophylaxis. There is also a risk of infection in an operative treatment of closed fractures.

Fracture malunion is perhaps the most common late complication. It is usually the consequence of poor treatment choice, specifically in case of misjudgment that a fracture may be treated non-operatively. This leads to functional disability and esthetic deformity. Loss of anatomical alignment results in a limited range of motion in radiocarpal joint. Pain is frequently present

Fracture nonunion is a rare complication of the fracture of the distal radius. It is often caused by distraction at the fracture site due to excessive traction, or it may be result of infection.

Loss of power and limited motion in radiocarpal joint are among common late complications of the fracture of the distal radius. These may occur due to duration and position of the limb during immobilization, inadequate rehabilitation and fracture severity. Motivation and psychological condition of the patient play a major part.

Carpal tunnel syndrome may occur for several reasons. Bone fragments compressing on the nerve is the most common one, but swelling and hematoma may cause pressure as well. Other risk factors include inadequate immobilization, positioning of the wrist in the excessive flexion and diabetes.
Carpal instability is consequence of severe and complicated fractures of the distal radius that are concomitant with ligament lesions and carpal injuries.

Rupture of the muscles extensor pollicis longus tendon also represents a late complication and is usually seen during physical therapy following removal of the plaster cast. This is consequence of the close anatomical relationship of the tendon and distal radius.

**CONCLUSION**

Main goal in treatment of the fractures of the distal radius is complete and swift functional recovery. Level of the functional restoration depends on fracture severity, treatment, physical therapy and psychophysical condition of the patient. Regardless of the available literature and described treatment methods, it is up to surgeon himself to evaluate severity of the injury, his patient and to determine the optimal course of action. Best approach is the least invasive one, providing that it leads to expected results. It is necessary to inform the patient of possible complications and consequences that may arise in spite of all measures undertaken in the course of treatment.

**REFERENCE**