

COMPLICATIONS THAT MAY OCCUR IN DISTAL RADIUS FRACTURES AS A RESULT OF SURGICAL TREATMENT

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ABSTRACT

Distal radius fractures are among the mostly seen orthopaedic traumas and constitute nearly 20% of fracture cases applying to the emergency. In case segmental and unstable fractures seen on the surface of joint are not appropriately treated, serious complications occur. In selection of the applied treatment methods, patient's age, job, functional status and daily activities play an important role for the patients with distal radius fractures. In addition to chronological age, the physiological condition of the patient and general state of health should be examined carefully. Surgical treatment can be considered for young and active patients for better results. There is a wide range of methods for surgical treatment and these are "Closed reduction and percutaneous pinning, Closed reduction and external fixation, Percutaneous pinning in addition to closed reduction and external fixation, Grafting in addition to closed reduction and external fixation, Closed reduction and external fixation and limited open reduction-internal fixation and grafting, Arthroscopy-supported open reduction, Open reduction and internal fixation (plate-screw)". The complications that may occur following the surgical intervention are between 6-80%. The complications stated in literature are loss of motion, delayed bonding, nonunion, nerve compression, pain syndromes, complications of fixation material, osteomyelitis, malunion, tendon ruptures, tenosynovitis, scar formation, radio ulnar synostosis, dupuytren's contracture, arthritis, ligament injury. Today, radius distal fractures are generally subjected to surgical treatment thanks to the development of orthopaedic surgery. It hasn't been proved yet that surgical treatment is far superior to conservative treatment.

Key words: Distal Radius, Fracture, Surgical Treatment, Complication

1. INTRODUCTION

Distal Radius fractures are among the mostly seen orthopaedic traumas (Bradway JK, Amadio PC, Cooney WP, 1989:71 cited by Ay, Metin, & Bektas, 2005, Fernandez DL, 2000:523-7 as cited by Ay, Metin, & Bektas, 2005). Distal radius fractures constitute 8-15% of all fractures (Ekin A, Yaldiz K, Boya H, Turkyilmaz M, 1997: 117-21) Nearly 1/6 of the fractures treated in emergency room are distal radius fractures (Jupiter JB, 1995: 13-23 as cited by Kara, 2008). 75-80% of distal radius fractures are extra-articular stable fractures and conservative treatment is applied to them in emergency rooms. Distal radius fractures constitute nearly 20% of all fracture cases, 20% of all forearm fractures applying to emergency rooms. Its prevalence has been found to be 9/10.000 in males aged over 35, 36.8/10.000 in females. The fracture is mostly seen in physically active young cases aged between 15 and 25, and in cases leading a sedentary life aged between 55 and 70 (Kara, 2008).

Among the methods used in the treatment of these fractures, closed reduction and plaster cast are the treatment methods from which considerably positive results have been yielded. However, serious complications may occur if segmental and unstable fractures seen on the surface of joints are not treated appropriately (Bradway JK, Amadio PC, Cooney WP: 1989:839-47 as cited by Ay, Metin, & Bektas, 2005. Lowry KJ, Gainor BJ, Hoskins JS: 2000:789-91 as cited by Ay, Metin, & Bektas, 2005). For this reason, surgical treatment method is applied in most of the Distal Radius fractures (Hastings H 2nd, Leibovic SJ: 1993: 309-26 as cited by Ay, Metin, & Bektas, 2005; Hanel DP, Jones MD, Trumble TE: 2002: 35-56 as cited by Ay, Metin, & Bektas, 2005). Various surgical methods are administered. Due to the fact that conservative treatment is insufficient in complex fractures, it immobilizes the patients too long and different complications occur, wide range of surgical treatment methods are administered in these fractures (Omurcu DL, Palmer AK, 1999: 929-981 as cited by Turgut, 2011, Altissimi M, Antenucci R, Fiacca C, 1986: 202-212 as cited by Turgut, 2011.). Closed reduction and percutaneous wiring, external fixator application, open reduction and internal fixation, arthroscopy-assisted fixation are some of the surgical treatment methods (Altissimi M, Antenucci R, Fiacca C, 1986: 205: 202-212 as cited by Turgut, 2011, Tumia N, Wardlaw D, Hallet J. Aberdeen, 2003: 78-82 as cited by Turgut, 2011).

The purpose in treatment of Distal Radius fractures is to obtain a functional and painless wrist. In other words, no matter which methods are preferred, the basic requisite to be met is to bring radial length, radial inclination and palmar slope-which will ensure the anatomic repair of the surface of the distal radius joint- to the most appropriate level (Abe Y, Doi K, Kuwata N, Yamamoto H, Sunago K, Kawai S, 1998: 188-192 as cited by Kara, 2008).

While a cheap and easily applicable treatment methods like closed reduction and plaster cast are used less in time, expensive methods like plate-screw practice fixation method is now being used more. In plate screw osteosynthesis method, both the hospitalization period of patient will extend, and a surgical risk will be in question for the patient (Huseyin, 2010).

The reasons why ineffective results have been obtained from the protective methods in treatment of unbalanced intra-articular distal radius fractures are that the adequate anatomic correction can't be conducted and problems occur in sustaining the current condition when adequate anatomic correction is in question (Nana, A. D., Joshi, A., Lichtman, D. M. 2005: 159-171, as cited by Baris, 2007).

Some complications may occur in distal radius fractures after the surgical intervention. Complications of distal radius fractures that constitute the subject of the study range between 6% and 80%. The complications stated in the literature are; loss of motion, delayed bonding, nonunion, nerve compression, pain syndromes, complications of fixation material, osteomyelitis, malunion, tendon ruptures, tenosynovitis, scar formation, radio ulnar synostosis, dupuytren's contracture, arthritis, ligament injury. The most frequent incidence among them is seen in ligament injury, loss of motion and arthritis (Aro H, Koirunen J, Katevuo K, 1988: 217-225 as cited by Dursun, 2008; Kozin S.H, Wood M.B, 1993: 144-153 as cited by Dursun, 2008).

Circulatory follow-up of patients should be carried out very well regarding these complications that occur after the surgery. If the patient is planned to be discharged on the day of surgery, s/he should be well-informed about circulation, and should be definitely examined by the surgeon after twenty four hours. Movement of fingers should be introduced early. The reflex should be evaluated in terms of dystrophia, appropriate treatment methods should be conducted in case of a complication (Sener, 2005).

2. TYPES OF DISTAL RADIUS FRACTURE

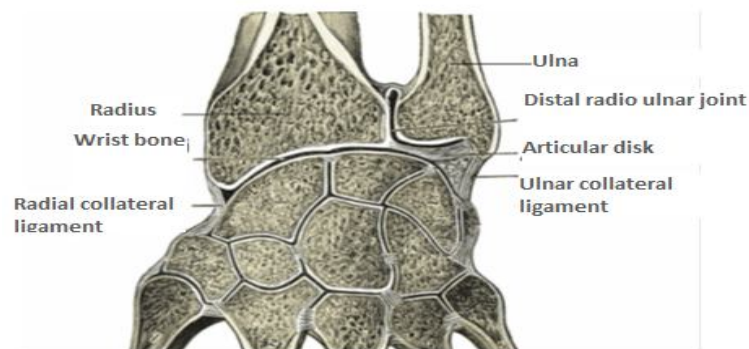


Fig. 1. Distal ulna anatomy (Baris, 2007: 12)

Ege stated in his study that distal radius fractures occur in two ways;

✓ Direct Trauma: It happens after a direct hit and crash towards the lower end of Radius.

✓ Indirect Trauma: When the elbow is in extension, forearm in pronation, wrist in dorsiflexion, it may occur after falling on open hand (Ege, R, 2002: 2337-2413as cited by Baris, 2007: 18). Distal radius axial resists 80% of overloads, ulna and triangular fibrocartilage complex resists 20% of them. This condition increases the importance of TFCC together with radius in injuries about radio carpal joint. An overload of 105-440 kg is necessary for distal radius to break (Ege, R, 2002: 2337-2413as cited by Baris, 2007: 18). Radius firstly breaks with a tensile strength on the palmar surface. Following the bending moments of fracture line, it leads to compression stress in dorsal, and results in disintegration of dorsal cortex. Metaphyseal bone crushes with the decrease in dorsal stability. Radio carpal palmar ligaments transmit the high tensile overload to palmar cortex. Intra-articular fractures that form as a result of shearing from distal radius fractures or compression are more unstable than metaphyseal extra-articular fractures that occur due to bending force. Therefore, accompanying ligamentous injuries are observed more in intra-articular fractures (Cooney WP, Linscheid, R.L, Dobyns, J.H., 563-1991: 601-631 as cited by Baris, 2007: 18). Different types of fractures occur according to the severity of falling, the position of wrist in pronation or supination, extension or flexion, patient's age or bone structure (Ege, R, 2002: 2337-2413as cited by Baris, 2007: 19).

After the description of distal radius fractures not extending to the joint by Abraham Colles in 1814, the definition of other types of distal radius fractures were made in the upcoming years (Chapman D.R, Bennett J.B, Bryan,W.J, Tullos, H.S. 1982: 509-512, Chidgey LK, Dell PC, Bittar E, Spanier S, Hermansdorfer JD, 1990:826 as cited by Sener, 2005). Distal Radius fractures were classified according to the surgeon who defines them, fracture mechanism, fracture anatomy and the location, moreover they were named as open and closed in accordance

with the relation of fracture hematoma with the external environment (Ege, R, 2002: 2337-2413 as cited by Baris, 2007: 19).

Types of Distal Radius fractures are as below:

2.1. Colles' Fracture

It is a fracture 2,5 proximal to the joint surface of radius located in dorsal region of distal part, and volar region of proximal part. Typical Colles' fracture is a kind of fracture opening to dorsal, being displaced and segmental and causing shortening in radius (Cooney WP, Linscheid, R.L, Dobyns, J.H, 1991: 563-585, 601-631, as cited by Baris, 2007, Calli I. 1981: 8, Sener, 2005), and it is the mostly seen type of fracture.

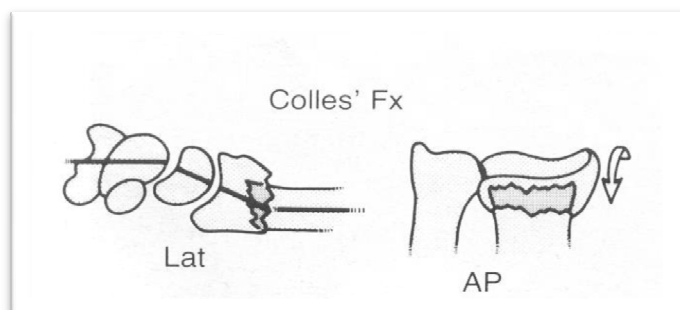


Fig. 2. Colles' fracture (Sener, 2005: 22)

2.2. Barton's Fracture

It is a kind of fracture extending to the joint surface of the wrist that may be accompanied by wrist subluxation (Fernandez DL, S. W. W. Distal radius fractures in: GreenD, HotchkissR, Pederson W, 2005: 646, Sener, 2005, Gultekin, 2007). It is the dorsal or volar rim fracture of surface of distal radius joint. In fact, it is a fractured dislocation or subluxation of distal radius displaced towards dorsal or volar together with hand and carpal bones. It is named as dorsal or volar Barton's fracture as depending on the fragment's direction of origin.

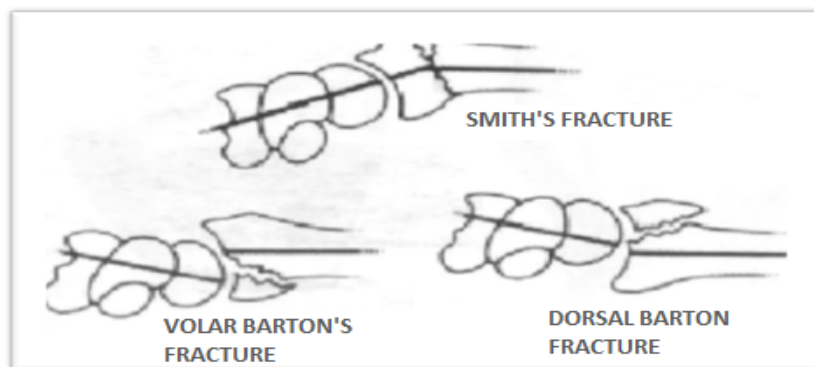


Fig. 3. Barton's and Smith's fractures (Sener, 2005, 23)

2.3. Smith's Fracture

It is the extra-articular fracture in 1 cm or 2 cm proximal from the surface of joint in which distal part is in volar, proximal part is in dorsal. It is also referred as Reverse Colles' Fracture (Fernandez DL, S. W. W. Distal radius fractures in: GreenD, HotchkissR, Pederson W, 2005: 646).

2.4. Chauffer's Fracture

It is the fracture of radial styloid (Fernandez DL, Scott W. Wolfe, Distal radius fractures in: GreenD, HotchkissR, Pederson W, 2005: 646 as cited by Dursun, 2008: 35) Dislocation of styloid happens in two ways:

- Dislocation of styloid towards proximal and scapholunate dislocation
- Radial styloid keeps its position with carpal bones and proximal part results in union to ulnar.

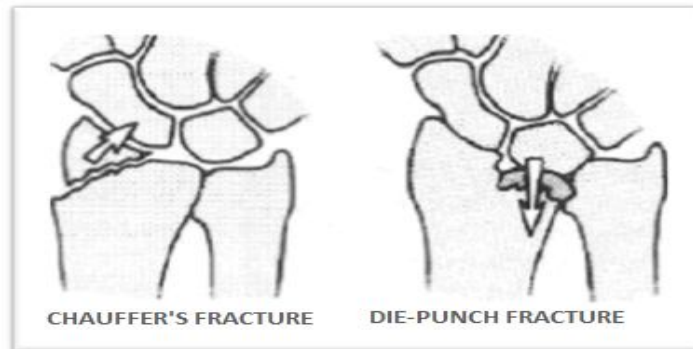


Fig. 4. Chauffer's Fracture and Die-punch fracture (Gultekin, 2007: 21)

2.5. Overload on lunate or Die-Punch fracture

It is the displaced fracture of medial articular surface of radius. Scheck named this fracture (Fernandez DL, Scott W. Wolfe, Distal radius fractures in: Green D, Hotchkiss R, Pederson W, 2005: 646 as cited by Baris, 2007, Dursun, 2008: 35).

The classifications below are used for distal radius fractures:

- **Frykman Classification:** Frykman made classification by taking into account the ulnar styloid process, radio ulnar and radio carpal fractures. In this classification, the degree of shortening and fragmentation in distal fragment is not stated (Cooney WP, Dobyns JH, Linscheid RL. 1980: 613-619 as cited by Baris, 2007. Multi segmental fractures are higher type within this classification system. Healing of the fractures with high numbers is complicated and has poorer prognosis. The pathology in radio ulnar joint is disregarded in distal radius fractures and permanent pain complaint can be observed in the distal radio ulnar joint if not fixed. The disadvantages of the classification are that the displacement direction of the fractured fragments does not contain any information regarding the degree of fragmentation. It doesn't lead concerning the treatment and prognosis (Weber S.C, Szabo R.M. 1986: 157-165, Gartland JJ Jr, Werley 1951: 895-907 as cited by Dursun, 2008: 36; Sener, 2005).
- **Fernandez Classification:** Fernandez manifested a classification system which examines trauma mechanism and it is preferred due to the fact that it contains accompanying ligamentous lesions, subluxation, fractures of adjacent carpal bones. According to this classification; bending fractures, compression fractures, shearing fractures (Barton, radialstyloid fracture), Avulsion fractures and the combination of these four fractures are concerned and they are unstable (Fernandez DL, Scott W. Wolfe, 2005: 646, Hanel DP, Jones MD, Trumble TE, 2002: 35-56 as cited by Dursun, 2008:37, Baris, 2007: 24-27, Sener, 2005).
- **Melone Classification:** Charles P. Melone classified the distal radius fractures in 1984, and put the fractures into 4 types. Diaphysis, radialstyloid region dorsal medial facet and volar medial facet. This classification system places great emphasis on medial lunate facet of distal radius (Medialcomplex) (Trumble, T. E., Culp, R. W., Hanel, D. P., 1999: 465-480, 1999 as cited by Baris, 2007:24-27). He categorized the fractures as 4:
 - 1) Diaphysis
 - 2) Radialstyloid region
 - 3) Dorsal medial facet
 - 4) Volar medial facet (Melone CP 1984; 15: 217, MeloneCPJr: 1986:103-111 as cited by Sener, 2005).
- **AO/ASIF Classification:** It is the mostly used classification in terms of containing all fracture types, fracture stability and treatment options, and being a prognostic guide. 3 main groups, 9 main and 27 subgroups exist in AO classification for Distal Radius fractures.

AO Type A fractures are extra-articular fractures. They are formed by bending forces. A part of joint surface sustained its integrity with metaphysis. Classically known Colles' and Smith's fractures are within this group.

AO Type B fractures are partially intra-articular fractures. They are formed by shearing forces. Chauffer's fracture, volar or dorsal Barton's fractures are within this group.

AO Type C fractures are high energy and multi segmental fractures. The integrity (continuity) of any part of joint no more exists (Orbay, J. L., Badia, A., Indriago, I. R., 2001: 204-211 as cited by Baris, 2007: 24-27, Ay, Metin, & Bektas, 2005: 17-18).
- **Rayhack's Classification:** It is a simple classification method. The classification is made according to the difference between extra-articular/intra-articular and stable/unstable (Atabek, 2004:27).
- **Mayo Clinic Classification:** It is similar to Rayhack's classification. Type 1 is extra-articular. Radio-scapoid is affected in Type 2, radio-lunate in Type 3 and radio-scapolunate joint in Type 4. Each fracture can be distinguished as displaced, non-displaced, reducible or irreducible. It defines the place of intra-articular fracture in detail (Atabek, 2004:27). The classification goes under sub-

groups according to whether the fracture can be reducible or irreducible in Mayo classification. Mayo Classification is;

- Extra-articular
- . Non-displaced
- . Displaced
- . Stable, Nonstable (Sener, 2005).

➤ **Other Classifications:**

- ✓ Watson- Jones classified distal radius fractures as; a- Closed, b- Open, c- Segmental (Watson-Jones R., 1962 cited by Sener, 2005, Atabek, 2004: 27). Campbell suggested surgical treatment only in open fractures (Ellis J. Smith, 1965: 724-727 as cited by Sener, 2005, Atabek, 2004: 27).
- ✓ In Gartland-Werley classification, distal radius fractures are classified in accordance with the relation between displacement and joint (Gardland JJ Jr, Werley WC, 1951: 895-907 as cited by Sener, 2005, Atabek, 2004: 27).
- ✓ In universal classification, types of fractures and their treatments are suggested (Sener, 2005:30).

3. TREATMENT METHODS OF DISTAL RADIUS FRACTURES

The first thing to do in distal radius fractures is to make the assessment of both the fracture and the patient. Whether the fracture is separated and whether it is open or closed should be ascertained. The treatment should be planned by categorizing the patients as physiologically young and active, and physiologically old and inactive. Intra-articular fractures and the degree of displacement are also important in planning the treatment (Atabek, 2004:18-28). In selecting the treatment for patients with distal radius fractures, patient's age, job, functional condition and daily activities play an important role. Patient's physiological condition and general state of health should be carefully examined in addition to chronological age. Surgical treatment can be regarded in the first place for young and active patients in order to have good results. The purpose for this patient group should be to repair the shape of distal radius and the displacement on joint surface anatomically. The fundamental principle is the most appropriate reduction of fracture pieces and determination of this reduction (Sener, 2005:30-33).

➤ **Conservative Treatment**

Fractures with no sign of displacement can be treated with simple immobilization methods. Plaster splints, circular plaster cast (lime or plastic lime) and wrist guards can be used. 2 or 3 weeks of immobilization period is adequate (Atabek, 2004:18-28).

➤ **Closed Reduction**

Although lots of different methods have been defined, reduction can be maintained by applying force against the traction and fracture mechanism. Due to the need for an assistant, traction method with finger trap has been developed as an alternative to manual traction. Knowing the fracture mechanism helps reduction.

The distension applied to soft tissues (periosteum and tendons) in concave part of angulation is the basis of reduction. Maintaining the ensured reduction is the most important objective of the conservative treatment. After ensuring adequate reduction, the patient is followed up with weekly radiographies. The plaster cast is removed after a six-week immobilization and rehabilitation is introduced (Atabek, 2004:18-28).

➤ **Surgical Treatment:** The surgical treatment is indicated if radial shortening less than 2 mm, intra-articular displacement more than 2 mm and dorsal angulation more than 15 degrees exist following the closed reduction basically. Even though there are various surgical methods, field of application for each of them is different. The methods used today are specified below:

- a) Closed reduction and percutaneous pinning
- b) Closed reduction and external fixation
- c) Percutaneous pinning in addition to closed reduction and external fixation
- d) Grafting in addition to closed reduction and external fixation
- e) Closed reduction and external fixation and limited open reduction-internal fixation and grafting
- f) Arthroscopy-supported open reduction
- g) Open reduction and internal fixation (plate-screw)

a) Closed Reduction and Percutaneous Pinning: It is relatively simple method that can be successfully applied in metaphyseal fractures not related to joint, simple intra-articular fractures and in patients with good quality of bone. Double intrafocal nailing is a successful method especially in non-segmental extra-articular fractures, but it can be applied in intra-articular fractures at certain situations. The procedure is carried out after the closed reduction under general anesthesia. Immobilization is ensured with plaster cast after the surgery. The nails are removed after 5-6 week period, immobilization is completed and rehabilitation is introduced (Mittelmeier W, Braun C, Schafer R. 2001: 8 as cited by Atabek, 2004:18-28, Sener, 2005:33). The methods applied are specified below:

- ✓ Bohler's method
- ✓ Charnley's method

- ✓ Cave's method
- ✓ Compare method
- ✓ Ralston method
- ✓ Ege method (Sener, 2005:33).

b) Closed Reduction and External Fixation: Basically it is ensuring the reduction with ligamentotaxis by obtaining distraction via the nails passing through radius and 2nd metacarpus. Nails are placed with 30-45 degree angle on frontal plain to metacarpus basis and object and with 8-12 cm proximal to wrist on the same plain to radius object. There are different fixators. The surgery is completed following the control graphy by fixing the fixator at the desired level after the reduction. Bandage or wrist splints can be used after the surgery. Active and passive finger movements are immediately introduced and the fixator is removed at the 6th week (Atabek, 2004:18-28, Sener, 2005:33).

c) Percutaneous Pinning in Addition to Closed Reduction and External Fixation: After the external fixation, fractured fragments are fixed to Radius object with the Kirschner nails passed through the radialstyloid and dorsomedial part separately with a simple or complex method.

d) Grafting in addition to closed reduction and external fixation: Retinaculum is longitudinally opened by entering through the dorsal with a transverse cut of 2 cm following the reduction and external fixation, and articular surface is found. In fluoroscopy control, articular surface is gently graphitized in the way articular surface will be in anatomic position and lifted. The fixator is clinched by distracting it carefully. If disharmony continuous in the joint, open reduction is initiated (Atabek, 2004:18-28, Sener, 2005:33).

e) Closed reduction and external fixation and limited open reduction-internal fixation and grafting: Following the external fixator practice, dorsal medium line is entered with longitudinal cut and extensor retinaculum is opened on Lister's tubercule, and EPL is excluded to radial. It is passed under the 4th compartment with a sharp dissection, and reached to extensor tendons and joint capsule. Radial extensor tendons are passed under the same plain, extensor tendons and EPL are excluded and joint capsule is opened transversely. This approach makes the joint be displayed very well. Grafting is carried out if needed following the reduction of fractured segments and it is fixed with K-wires. Extensor retinaculum, joint capsule and skin are closed. Post-operative immobilization is applied for three weeks and rehabilitation is slowly introduced after the wires are removed (Green DP. Hotchkiss R.N, Pederson W.C. 1999: 929-985 as cited by Atabek, 2004:18-28).

f) Limited Open Reduction: It provides alignment, length and syloid reduction are ensured with closed reduction. If the intra-articular reduction can't be ensured due to metaphyseal subchondral bone and soft tissue interposition, this technique is applied (Green DP. Hotchkiss R.N, Pederson W.C. 1999: 929-985, Duncan SF, Weiland AJ., 2001: 14-24 as cited by Atabek, 2004:18-28, Sener, 2005:33).

g) Arthroscopy-supported reduction: It can be used to control the reduction in distal radius fractures related to the joint. The most appropriate time for arthroscopy-supported reduction is 3-7 days after the fracture. If it is applied together with external fixation, fixator is placed at first. It is entered into the joint through 3-4 portals with scope, 6U is used for portal irrigation and the procedure is carried out through 1-2 or 4-5 portals. Reduction is stabilized with K-wires under fluoroscopic control, and the last control is carried out arthroscopically (Culp RW, Osterman AL. 1995:739-748, Wolfe SW, Easterling KJ, Yoo H.H. 1995:706-714, Edwards CC 2nd, Haraszi CJ, McGillivray GR, Gutow AP. 2001:41 as cited by Atabek, 2004:18-28, Sener, 2005:33).

h) Open Reduction: Open reduction may be necessary in some conditions with broad surgical approach. These are;

- ✓ Instable shearing type marginal fractures
- ✓ Irreducible complex intra-articular fractures
- ✓ Radio carpal fractured dislocation
- ✓ Loss of early reduction (metaphyseal or intra-articular)
- ✓ Soft tissue lesions with the fracture
- ✓ Ipsilateral forearm and elbow fractures (Atabek, 2004:18-28, Sener, 2005:33, Ay, Metin, & Bektas, 2005).

Surgical techniques applied in this method are:

- a) Volar Locking Plate Practice
- b) Double Plate (Dorso- Lateral) Practice

4. COMPLICATIONS

The complications possible to occur are; loss of motion, delayed bonding, nonunion, nerve compression, pain syndromes, complications of fixation material, osteomyelitis, malunion, tendon ruptures, tenosynovitis, scar formation, radio ulnar synostosis, dupuytren's contracture, arthritis, ligament injury. The most frequent incidence among them belongs to ligament injury, loss of motion and arthritis (Dursun, 2008: 80-83).

4.1. Nerve injury

Nerve injury is relatively frequent in distal radius fractures. It ranges between 0% and 17%. Median nerve, radial and ulnar nerve injuries are the most frequent seen injuries respectively (Mack, G.R.; McPherson, S.A.; Lutz, R.B. 1994: 141- 146 as cited by Dursun, 2008: 80-83). The incidence risk for carpal tunnel syndrome is high in patients with segmental fracture and on whom closed reduction is tested several times (Mack, G.R.; McPherson, S.A.; Lutz, R.B. 1994: 141- 146 as cited by Dursun, 2008: 80-83). Excessive wrist flexion should be

avoided in plastering, on the other hand the pressure on carpal tunnel is indispensable, and this results in median nerve compression (Jones KG: Colles' fracture. J Arkansas, 1976: 244-247, Ege R., 2000; 126 as cited by Dursun, 2008: 80-83) Median nerve lesion is a frequently observed complication in distal radius fractures (Sener, 2005: 34). Despite being an acute compartment syndrome, nerve contusions and tensile injuries are the frequent reasons for medial nerve lesion, and these cases do not require emergency surgical intervention (Mack, G.R.; McPherson, S.A.; Lutz, R.B. 1994: 141- 146 as cited by Sener, 2005: 34). Sensory examination should be carried out before and after the reduction in emergency room. If the median nerve sense has been moderately affected when the patient applies, it should be followed-up. In case the fracture requires surgery, nerve exploration should be made even if there is no loss of sense. If progressive loss of sense and intensive pain are in question, compartment syndrome should be considered (Mack, G.R.; McPherson, S.A.; Lutz, R.B, 1994: 141- 146 as cited by Askar, 2010).

4.2. Reflex Sympathetic Dystrophy

If increased pain, swelling, limitation of movement of joint, change in skin color and temperature, paresthesia and common osteopenia exist during the phase of healing, reflex sympathetic dystrophy should be considered. It has been stated that one of the reasons for reflex sympathetic dystrophy is median nerve compression (Stein AH, 1962: 713-720). No matter what the treatment method is in order to prevent reflex sympathetic dystrophy in patients with distal radius fractures, finger movements should be introduced early. If plaster cast or splint is applied to the patient as a treatment, the distal of plaster cast should be absolutely ended in metacarpophalangeal joint. Therefore, the patient can start finger movements early. Finger movements are very important. Thanks to this movement, tendon adhesions are prevented and soft tissue swelling is reduced. Diagnosis is established with the clinical examination and bone scintigraphy. There are such treatment methods as physical therapy, TSAD and stellate ganglion blockage (Askar, 2010).

4.3. Open injury

Even though radius open injury alone is rare, distal radius ulna open injury is more frequent. Gustillo Anderson type 1 open fractures are observed more particularly in wrist volar. IV antibiotics and tetanus prophylaxis must be definitely performed. Injuries result from high energy traumas. When open fracture type increases more, the number of extra interventions that may be necessary also increases (Ege R., 2000: 126 as cited by Dursun, 2008:80-83).

4.4. Skin injury during manipulation

Distal radius fractures are more frequent in population ageing. The skin is thinner in elderly and can be traumatized during the fracture manipulation. This means that the closed fracture is brought to open. So it should be paid attention (Omurcu DL, Palmer AK., 1999: 81 as cited by Dursun, 2008:80-83).

4.5. Compartment syndrome

It is a rare complication. Young males are at higher risk, as they are subjected to high energy trauma. Compartment syndrome can be observed within 54 hours after the injury. The patient should be well informed regarding the pain while being discharged from hospital after the intervention. S/he should be warned about on-going pain, neurological changes, color changes. Abnormal pain and pain in passive extension movement are the findings of compartment (Aro H, Koirunen J, Katevuo K, 1988: 217-225, Omurcu DL, Palmer AK., 1999: 81). It should be approached with suspicion while establishing a diagnosis, bandage or plaster cast should be loosened in any little suspicion, the plaster cast should be removed if necessary by taking into account the sliding risk of fracture. If symptoms continue, the compartment pressure should be measured and fasciotomy should be carried out if required. Volar fasciotomy is enough for many conditions (Omurcu DL, Palmer AK. 1999: 81, Watson- Jones R., 1962).

4.6. Complications arising from the plaster cast

If plaster cast must be applied to the oedematous arm with instable fracture, the patient should be warned against increased pain, nerve compression and compartment syndrome (Aro H, Koirunen J, Katevuo K, 1988: 217-225, Kozin S.H, Wood M.B., 1993: 144-153, Omurcu DL, Palmer AK., 1999: 81). While splint practice reduces this risk, it also negatively affects the stability of the fracture. Post-traumatic swelling will go down within days and weeks.

4.7. Loss of reduction

Increasing age, dorsal fragmentation, angulation degree to dorsal are the factors affecting the displacement risk. It has been showed that the instability risk is 6 times more than the ones with dorsal fragmentation, and it is 5 times more in fractures with 5-10 degree angulation to dorsal than the ones with angulation to volar. The technique for operation is also important. Percutaneous K hand approach is the operation technique which increases the displacement risk most particularly in elderly patients (Omurcu DL, Palmer AK, 1999: 81).

4.8. Infection

The infection risk is always in question for the operated fractures. In patients with infection observed, it has been determined that 62% is soft tissue infection and 38% is osteomyelitis. While soft tissue infections can be treated with oral antibiotics, surgical intervention is required for osteomyelitis (Omurcu DL, Palmer AK. 1999: 81).

If K-wire is applied, subcutaneous procedure of wires reduces the infection risk. Authors utter that keeping the wires for more than 8 weeks increases the infection risk (Aro H, Koirunen J, Katevuo K, 1988: 217-225, Kozin S.H, Wood M.B. 1993: 144-153).

4.9. Neurological complications

It has been indicated that median nerve (22%), radial nerve (11%) and ulnar nerve (6%) are respectively the most frequently seen stiffness among the neurological complications of distal radius fractures. The injury risk of sensory branch of radial nerve is high when K-wire fixation is applied. This branch passes through brachioradialis and extensor carpi radialis longus (Mack, G.R.;McPherson, S.A.; Lutz, R.B, 1994: 141- 146 as cited by Dursun, 2008:81).

4.10. Tendon rupture

Extensor pollicis longus tendon is the mostly ruptured tendon. Extensor tendon ruptures are observed more in displaced fractures in comparison to non-displaced fractures. Tendon ruptures which occurred after multiple K-wire practice have been stated in literature (Kozin S.H, Wood M.B.,1993: 144-153, Aro H, Koirunen J, Katevuo K, 1988: 217-225 as cited by Dursun, 2008: 80-83).

4.11. Nerve complications and complex regional pain syndrome

Complex regional pain syndrome is reflex sympathetic dystrophy (Omurcu DL, Palmer AK. 1999:81 as cited by Dursun, 2008:82.) Its typical findings are increased pain, swelling, limitation of movement in joint, regional vasomotor changes and (Turgut, 2011: 28-29) paresthesia at healing phase. It may lead to loss of function in hand and upper extremity. It may result in loss of function in hand and the whole extremity. Type 1 pain syndrome is observed more in elderly people particularly in women and individuals with psychological disposition. The more severe the fracture is, the more this syndrome is observed. Pressure increase in plaster cast triggers this syndrome for patients receiving non-operative treatment. External fixator application with excessive distraction also increases the risk (Mack, G.R.; McPherson, S.A.; Lutz, R.B. 1994: 141- 146 as cited by Dursun, 2008:82).

4.12. Arthrosis

Radiographic arthrosis finding is seen in 65% of the patients with intra-articular distal radius fractures within 6-7 years. Rate of incidence for arthrosis in patients recovering with radio carpal disharmony is 91%. Joint aliasing with 2 mm and more poses risk for arthrosis. Moreover, authors have suggested that extra-articular reduction and radial length are not so important if serious radial shortening does not exist (Knirk JL, Jupiter JB. 1986: 59 as cited by Dursun, 2008:82).

4.13. Nonunion/Delayed Bonding

It is a rare complication. It generally occurs in elderly patients and the ones with other diseases. In case fracture fragments are excessively distracted during the external fixator practice in multi segmental distal radius fractures, bonding can be observed (Askar, 2010: 49-50). If a finding for radiographic bonding isn't seen on the fracture line within 4 months, i.e. absence of trabecular bridge between the fracture ends, it is called delayed bonding; if there is no radiographic finding within 6 months, it is called nonunion. Nonunion is not such a frequently seen condition in distal radius (Turgut, 2011: 28-29, Aro H, Koirunen J, Katevuo K, 1988: 217-225). Open fracture, segmental fracture, infection, soft tissue interposition, devascularization of condyles and pathologic lesions are risk factors for nonunion (Aro H, Koirunen J, Katevuo K, 1988: 217-225 as cited by Dursun, 2008: 80-83). Diagnosis is established after ascertaining the movement following the lateral graphies in dorsiflexion and volar flexion. BT supports the diagnosis and works in planning the surgery. Wrist arthrodesis or grefonage together with internal fixation are among the surgical options. Bone grafting is necessary as shortening in radius and alignment disorder can be fixed with bone grafting (Aro H, Koirunen J, Katevuo K, 1988: 217-225 as cited by Dursun, 2008: 80-83).

4.14. Malunion

Abnormal radial inclination and length values disrupt the functions of distal radius joint, and result in limitation of movement, pain and deformity (Turgut, 2011: 28-29). Shortening of distal radius causes impaction of ulnar head on carpal bones, lesion of triangular fibrocartilage complex and ulnocarpal arthrosis (Aro H, Koirunen J, Katevuo K, 1988: 217-225 as cited by Dursun, 2008: 80-83). It can be seen in intra-articular and extra-articular fractures. Malunion in extra-articular distal radius fractures is frequently accompanied by loss of radial inclination degree and radial shortening. It may occur in the fractures with and without extension to the joint. Malunion directly affects the biomechanics of radio carpal and distal radio ulnar joints (Askar, 2010: 49-50). Extra-articular malunion of distal radius results in abnormal alignment of distal radio ulnar joint. Pain and reduced rotation movement of forearm are caused by arthrosis of distal radius joint. BT should be performed in order to evaluate the distal radio ulnar joint. Among the operative treatment options there are; ensuring the length of distal radius, fixing the dorsal angulation of radius, excision or shortening of distal ulna, DRUJ ligamentary construction, wrist arthrodesis or arthroplasty (Dursun, 2008: 80-83).

4.15. Tendon Complications

Tendon rupture, tenosynovitis, tendon adhesions and trigger finger, rupture and impingement are the late complications. Observing tendinitis as a result of dorsal plating is frequent. Fractured condyles, callus-related adhesions, plate-screw based interaction contribute to the rupture of extensor pollicis longus tendon (Benson EC,

DeCarvalho A, Mikola EA., 2006: 218-222 as cited by Turgut, 2011). Moreover, extensor tendon irritation and rupture can be seen as depending on the usage of long screw which is not suitable for volar approach. Due to the fact that the flexibility is high in flexor tendons and it diverges by covering the plate from the side of pronator quadratus in distal radius, ruptures are observed less in comparison to extensor tendons (Ay, Metin, & Bektas, 2005).

Symptoms generally retrograde with the removal of the material. Tendinitis isn't observed in dorsal following the plating from volar, but even unscrewing from dorsal following the volar plating can lead to tendinitis. Trigger finger was observed at 2% rate. Tendon adhesions can be seen in the area of injury. Adhesions can benefit from tendolysis (Dursun, 2008: 80-83).

Tendon ruptures rarely occur. They mostly occur 8 weeks after the trauma but they can be observed following the union of fracture. Injury in extensor pollicis longus tendon is the most frequent one. This complication occurs due to disintegrity of tendon caused by the friction at Listertubercule level of formed callus tissue or vascular insufficiency in tendon sheath in minimal displaced fractures (Cooney WP, Dobyns JH, Linscheid RL. 1980:9 as cited by Huseyin, 2010: 49-50). Direct stitching of tendon is generally impossible. M.extensor indicis proprius transfer is generally conducted (Dobyns JH, Linscheid RL, 1948: 271-352. 1948 as cited by Huseyin, 2010: 49-50)

5. TENOSYNOVITIS

Another lesion that can be regarded as a complication is the development of tenosynovitis. The tendons of the first dorsal compartment are frequently affected in the presence of tenosynovitis (Huseyin, 2010: 49-50) (De Quervain disease).

6. SHOULDER-HAND SYNDROME

It is a clinical picture characterized by feeling of discomfort on the area of shoulder or a burning pain, and also pain, swelling and paleness of hands and fingers, bright, smooth and dystrophic appearance on the skin of hand, osteoporotic appearance on bones in wrist and around in graphy. It is also stated that it can be related to median nerve neuropathy following the flexion of wrist during the treatment with plaster cast and not using the hand (Askar, 2010: 49-50).

7. CONCLUSION

Distal radius fractures are the ones that are frequently seen over the middle ages. These fractures which were generally treated with conservative methods in the past are treated with surgical methods today more frequently thanks to the development of orthopaedic surgery. As in every fracture, the best possible reduction should be carried out if particularly the joint is not affected in distal radius fractures (Sener, 2005).

It has been proven today that the surgical treatment is superior to conservative treatment. There are no functional differences between percutaneous pinning and volar plate practice being among the surgical methods. We have the opinion that a good functional result should be aimed rather than an anatomic restoration in distal radius fractures. As based on these results, we find the opinion that 'All fractures of distal radius deserve the attempt for Closed Reduction and immobilization' correct. We are of the opinion that Closed Reduction and plaster cast treatment should be performed on all patients with distal radius fractures in order to shorten the surgical duration and to bring the cost to a reasonable level as much as possible. Pinning should be the first option by taking into account that surgical risks can be reduced in cases that cannot be deducted with Closed Reduction. The practice of volar locking plate that enables the perfect anatomic restoration can be the primary option in professions in which the functional condition of hand is more important (Askar, 2010).

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