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Percutaneous Pinning Method and Our Results in Unstable Distal Radius Fractures

Stabil Olmayan Radius Distal Uç Kırıklarında Perkütan Çivileme Yöntemi ve Sonuçlarımız

Burak ŞENER[1], Mustafa Faik SEÇKİN[2], Şenol AKMAN[3], Adnan KARA[4], İrfan ÖZTÜRK[2]

[1]Mugla Sıtkı Kocman University. Orthopedics and Traumatology. Muğla. Turkey
[2]Istanbul Science University. Orthopedics and Traumatology. Istanbul. Turkey
[3]Orthopedics and Traumatology. Istanbul. Turkey
[4]Istanbul Medipol University. Orthopedics and Traumatology. Istanbul. Turkey

Öz

Distal radius kırıkları tüm vücut kırıkları arasında en sık görülen kırık tipidir. Bu kırıkların tedavisinde çeşitli cerrahi yöntemler tanımlanmış olmasına rağmen standart tedavi yöntemi tartışmalıdır. Stabil olmayan distal radius kırık tedavisinde kapalı redüksiyon ve perkütan çivileme yöntemi önerilmesine rağmen bu yöntemin tedavideki rolü belirsizdir. Bu çalışmanın amacı; kapalı redüksiyon ve perkütan çivileme yönteminin sonuçlarını prospektif olarak değerlendirmektir. Bu prospektif çalışmaya stabil olmayan distal radius kırığı bulunan 30 hastanın 30 el bileği dahil edildi. Hastaların 16'sı kadın, 14'ü erkekti. Ortalama takip süresi 13,1 ± 3,2 ay (aralık: 6-24 ay) dı . Ortalama hasta yaşı 49,63 ± 18,66 yıl (aralık: 20-85 yıl) idi. Kırıklar Frykman sınıflamasına göre değerlendirildi. Hastaların kontrol grafileri Steward kriterlerine göre değerlendirildi. Steward radyolojik kriterlerine göre; olgularımızın 6'sında mükemmel, 17'sinde iyi, 6'sında orta, 1'inde kötü sonuç alınmıştır. Gartland-Werley klinik değerlendirme kriterlerine göre; 30 hastanın 6'sında mükemmel, 17'sinde iyi, 6'sında orta, 1'inde kötü sonuç alınmıştır. Distal Radius kırıklarında kapalı redüksiyon ve perkütan çivileme yönteminin uygun redüksiyon sağlanabilen her hastaya uygulanabileceği, klinik ve radyolojik sonuçların diğer yöntemlere göre kabul edilebilir olduğu düşünülebilir.

Anahtar Kelimeler: Perkütan, Radius, Stabilizasyon

Abstract

Distal radius fractures are the most common type of fracture among all body fractures. Although various surgical methods have been described for the treatment of these fractures, the standard treatment method is controversial. Despite the recommendation of closed reduction and percutaneous pinning for the treatment of unstable distal radius fractures, the role of this method in treatment is uncertain. The aim of this study is to evaluate the results of closed reduction and percutaneous pinning method prospectively. Unstable distal radius fractures were included in this prospective study, involving 30 wrists. Sixteen patients were female and 14 were male. The mean follow-up time was 13.1 ± 3.2 months (range: 6-24 months). The mean patient age was 49.63 ± 18.66 years (range: 20-85 years). The fractures were evaluated according to Frykman classification. Patients follow-up X-rays were evaluated according to Steward criteria. According to Steward radiological criteria; in our cases, 6 were excellent, 17 were good, 6 were fair, and 1 was poor. According to Gartland-Werley clinical evaluation criteria; 6 of the 30 patients were excellent, 17 were good, 6 were fair, and 1 was poor.

Keywords: Percutaneous, Radius, Stabilization

Introduction

Distal radius fractures are the most common type of fractures among all body bone fractures. They make up about 8-15% of all fractures (1). 75-80% of these are stable non-articular fractures and are treated conservatively in the emergency department (2).

In selecting treatment methods, factors such as the type of fracture, age of the patient, lifestyle, associated health issues, compliance with treatment, and physical and mental capacity should be taken into consideration(3). The majority of these fractures can be treated conservatively. However, the clinical and functional unsuccessful results observed in the conservative treatment of complex type unstable fractures seen in young individuals with high-energy trauma have led to new approaches in treatment.

Various surgical intervention methods and fixation materials have been described for the treatment of unstable fractures, but a standard treatment method has not been established. Surgical treatment alternatives include percutaneous pinning or external fixation after closed reduction, limited open or open reduction followed by pinning, internal fixation, some combinations of these procedures, and additional procedures such as grafting, arthroscopy-assisted reduction and stabilization (2).

In this study, patients with distal radius fractures treated prospectively with closed reduction and fixation with a plaster splint were followed up and the treatment outcomes were evaluated radiologically, clinically, and functionally.

	ORCID No
Burak ŞENER	0000-0002-5998-5807
Mustafa Faik SEÇKİN	0000-0002-5037-2772
Şenol AKMAN	0009-0001-5599-1476
Adnan KARA	0000-0001-8437-5405
İrfan ÖZTÜRK	0009-0000-9883-6786

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Adres / Correspondence : Mehmet Ferdi KINCI
Mugla Sıtkı Kocman University. Orthopedics and Traumatology. Muğla. Turkey
e-posta / e-mail : b.sener@yahoo.com.tr

Material and Method

Between September 2002 and June 2004, a total of 30 patients with unstable distal radius fractures who presented to the emergency department of the Orthopedics and Traumatology Clinic at Istanbul

University Health Sciences Şişli Etfal Training and Research Hospital were included in our study. Of these patients, 16 were female (54%) and 14 were male (46%), with a female-to-male ratio of 1.14. The average age was found to be 43.8 years (ranging from 14 to 79).

Among the cases, 16 were aged between 20-44 (52%), 10 were aged between 45-60 (33%), and 4 were above 60 years old (15%). There were 11 fractures on the right side (36%) and 19 on the left side (64%). According to the mechanism of injury, 4 fractures (13%) were caused by non-traffic accidents, 4 (13%) by falls from height, and 22 (74%) by falls while walking. . The mean follow-up time was 13.1 ± 3.2 months (range: 6-24 months). The mean patient age was 49.63 ± 18.66 years (range: 20-85 years). The fractures were evaluated according to Frykman classification. Patients follow-up X-rays were evaluated according to Steward criteria. According to Steward radiological criteria; in our cases, 6 were excellent, 17 were good, 6 were fair, and 1 was poor. According to Gartland-Werley clinical evaluation criteria; 6 of the 30 patients were excellent, 17 were good, 6 were fair, and 1 was poor. In this study, a cross-tabulation (Crosstabs) analysis was conducted to evaluate the relationship between clinical and radiological findings. Pearson Chi-Square test was applied to assess statistical significance. All analyses were performed using SPSS (IBM SPSS Statistics, version X). A p-value of <0.05 was considered statistically significant.

Patients who presented to the emergency clinic with wrist trauma underwent physical examination, followed by routine wrist AP and lateral X-rays. Using a purposive sampling method fractures of the distal radius up to 2.5 cm proximal to the wrist joint were classified as distal radius fractures based on the X-ray findings. Cases that were determined to be unstable according to LaFontaine et al.s criteria formed our study group. Fractures were evaluated using Frykmans classification, with 10 cases being Frykman type 1, 6 cases type 2, 2 cases type 3, 1 case type 4, 2 cases type 6, 2 cases type 7, and 7 cases type 8. (Table 1).

Table 1. Fracture types according to Frykman Classification

Tip	1	2	3	4	6	7	8
	10	6	2	1	2	2	7

Surgical Procedure:

Except for two patients, all patients were operated on as outpatient cases. The patients we couldnt treat as outpatients were those with hip fractures. Eight of our patients (26%) were operated on on the first day after the trauma, while 22 (74%) were operated on on the second day or later. The average time between the date of application and the date of operation was 4.56 (0-16) days. Following anesthesia consultations, general anesthesia was administered to 5 patients in good condition, while regional anesthesia was applied to 25 patients. Patients were placed in a supine position in the operating room. Following anesthesia administration, 2 grams of intravenous Sodium Cefazolin was prophylactically administered. After necessary cleaning and draping, traction was applied from the proximal fingers and forearm while the elbow was flexed at 90 degrees. After approximately half a minute of straight traction, the distal part was brought into flexion to reduce the fracture. The adequacy of reduction was checked with fluoroscopy. In patients where reduction was not adequate, the reduction maneuver was repeated. In patients where the desired reduction was achieved, two cross K wires were sent from the radial styloid proximally under fluoroscopy control, and if the fractures were considered unstable, one or more K wires were sent from the ulnar side. The ends of the wires were bent and a short arm circular cast was applied in neutral position. Patients who had post-operative wrist AP and lateral radiographs taken, were explained in detail about circulation monitoring, discharged on the same day, and called for circulation control the next day. Patients called for film and exercise control in the 1st, 2nd, 3rd week after the operation were called for radiographic control six weeks later. Patients with sufficient healing had their casts removed, and the K wires were removed. Early wrist and forearm pronation-supination exercises were started. Patients follow-up radiographs were evaluated according to Steward and colleagues radiological evaluation criteria (6). The Gardland-Werley clinical evaluation system was used for examining clinical outcomes (7).

Results

According to the evaluation criteria of Gardland Werley Clinic, excellent results were obtained in 6 out of 30 patients (20%), good results in 17 patients (57%), moderate results in 6 patients (20%), and poor results in 1 patient (3%) (Table 2).

Table 2. Clinical results according to Gartland-Werley Classification

RESULTS	Number of Fractures
Excellent	6
Good	17
Fair	6
Bad	1

According to the radiological evaluation criteria of Steward and colleagues, excellent results were obtained in 6 of our cases (20%), good results in 17 (57%), moderate results in 6 (20%), and poor results in 1 (3%) (Table 3). A significant association was found between clinical and radiological findings (Pearson Chi-Square: 90.000, p<0.001). Given the sample size (n=30), the cross-tabulation analysis provided meaningful results.

We identified tendon adhesion, a complication that can be seen during the treatment of distal radius fractures, in 1 case (3%). In this case where we believe that tendon adhesion occurred as a result, the K wires were removed in the 3rd week, intensive finger movements were applied, and a response to treatment was achieved. Reflex sympathetic dystrophy developed in 10 of our cases (34%). These patients, who responded well to physiotherapy, had a reduction in their complaints. In one case (3%) where sufficient reduction was not achieved due to a late application, malunion occurred. The functional results of this patient were also determined to be poor. The rate of complications leaving no disability in our cases was determined to be 40%.

Table 3. Radiological Evaluation Results

RESULTS	Number of Fractures
Excellent	6
Good	17
Fair	6
Bad	1

Discussion

The treatment of distal radius fractures, along with the increased life expectancy and quality of life, has become of great importance. These fractures, usually treated conservatively, are now more commonly treated surgically to improve functional outcomes after a fracture (8). In particular, intra-articular fractures affecting the wrist joint are mostly seen in young and active individuals who are more exposed to high-energy trauma, often in young and middle-aged individuals (8). In our study, the average age of our patients was determined to be 43.1, supporting the literature. These fractures, more commonly affecting the dominant extremity, resulted in significant loss of workforce (9,10). In our study, different from other case series, fractures were more commonly found in the non-dominant side. It can be thought that the reason for this is related to the low number of patients in our study. Additional injuries such as shoulder dislocation, elbow fractures, or wrist and metacarpal fractures can occur as a result of high-energy trauma along with fragmentary intra-articular fractures of the distal radius (11). In our study, additional lesions were present in 3 of our patients at the time of referral. An ipsilateral femur intertrochanteric fracture was detected in two patients, and an ipsilateral medial malleolus fracture detected in one patient. In the treatment of distal radius fractures, the most important factors affecting the outcome are the inability to provide appropriate radial inclination and palmar inclination, the presence of radial shortening, or intra-articular fracture. Depalma et al. reported poor results when there was dorsal angulation of more than 5 degrees or more than 3 mm shortening in the radius after reduction (12). Biomechanical studies on cadaver forearms have reported that a 2.5 mm shortening in the distal radius or an increase in dorsal angulation after reduction significantly increases axial load on the ulna (13). An increase in ulnar loading can lead to post-traumatic arthritis and chronic pain on the ulnar side of the wrist. Post-traumatic arthritis following distal radius fractures is one of the most important complications. Frykman et al. reported that this condition is not only valid for the radiocarpal joint but also for the radioulnar joint (5). Knirk et al. showed that in cases where there is more than 1 mm step-off on the joint surface, post-traumatic arthritis can occur in 90% of cases (9). As a result of our study, we did not encounter posttraumatic arthritis in any of our patients with follow-up periods ranging from 6 months to 24 months. Consequently, there is a close relationship between the quality of reduction in distal radius fractures and functional outcomes. The findings we obtained in our study also showed that there is a significant relationship between reduction quality and our clinical outcomes. According to the radiographic evaluation criteria of Steward et al., the results of our 6 patients who scored 0 points were excellent according to the Gardland-Werley functional evaluation criteria, the functional results of our 17 patients who scored 1 point were good, the functional results of our 6 patients who scored 2 points were fair, and the functional result of our 1 patient who scored 3 points was determined to be poor. According to Steward et al.s radiographic evaluation criteria, the best result is 0 points and the worst result is 3 points. The only case with a poor functional result was a patient with a Frykman type 1 distal radius fracture who underwent closed reduction due to general condition deterioration 16 days after the fracture.

The most important criterion determining the prognosis in distal radius fractures is controversial. According to the study by Gartland et al., the average palmar tilt should be 11 degrees, and the average radial deviation should be 23 degrees (7). On the other hand, Aro et al. reported that radial shortening is the most important factor affecting the outcome in distal radius fractures. More than 3 mm of shortening negatively affects the results regardless of angulation or step-off on the joint surface (14). In our cases, it was found that the prognosis depends on multiple factors. These factors include intra-articular step-off along with radial shortening. It was observed that the deterioration of palmar inclination did not affect the prognosis as negatively as intra-articular step-off or radial shortening. Another factor that negatively affects the prognosis of patients is the presence of an ulna styloid fracture along with a radius fracture. According to Knirk et al., a non-union styloid fracture has a negative impact on the prognosis(9). However, according to Pogue et al.s experimental study, the presence of an ulna styloid fracture along with a distal radius fracture does not cause a significant change in the total contact surface

of the joint and therefore generally does not show clinical symptoms (15). According to our cases, based on the clinical results of Gardland-Werley, it was determined that patients with Frykman type 1 fractures (those without ulna styloid fractures) had one excellent, seven good, one fair, and one poor result, while patients with Frykman type 2 fractures had three excellent, two good, and one fair result. Although the number of cases is small, in our opinion, the presence of a styloid fracture did not cause a significant change in functional outcomes.

Treatment of distal radius fractures today should be planned according to the stability of the fracture. LaFontaine and colleagues have identified criteria that determine the stability of the fracture. An unstable fracture must have at least three of the following criteria: 1) Dorsal angulation of more than 20 degrees when the fracture occurs, 2) Dorsal metaphyseal fragmentation, 3) Intra-articular extension into the radiocarpal joint, 4) Associated ulnar styloid fracture, 5) Patient age over 60 years (16). Percutaneous pinning and casting for unstable distal radius fractures is a widely used method with good functional outcomes in appropriate cases. DePalma and colleagues reported excellent results in 52.7%, good results in 25%, and fair to poor results in 17.8% of intra-articular fractures treated with percutaneous pinning and casting (12).

One of the other treatment methods applied to unstable distal radius fractures is closed reduction and external fixation. Similar results are obtained when comparing the closed reduction and casting method with the external fixation treatment method. Jenkins et al. compared the external fixation method with the casting method and observed reduction loss in all cases treated with the casting method. However, no reduction loss was detected in the patient group treated with the external fixation method (17). When comparing closed reduction and percutaneous pinning with closed reduction and external fixation method, according to Clancey et al., percutaneous pinning is the most suitable treatment method for minimally displaced intra-articular fractures, but they recommend the external fixation method for intra-articular fractures with more than two pieces (18). According to DePalma et al., the superiority of the percutaneous pinning method over the external fixation method is that nail route infections are less common and complications such as hand dysfunction due to fixation in the metacarpal region are not observed (12). Additionally, in our countrys conditions, percutaneous pinning and casting method is relatively more cost-effective and better in terms of patient comfort compared to closed reduction and external fixation method. Due to these advantages, in our study, patients were treated with percutaneous pinning and casting method. Knirk et al. recommended closed reduction and external fixation method in the treatment of intra-articular distal radius fractures due to the possibility of reduction loss with percutaneous pinning method (9). In the cases we followed in our study, reduction loss was not observed with the percutaneous pinning method.

Conclusion

Between September 2002 and June 2004, in patients treated with closed reduction and percutaneous pinning method at the Şişli Etfal Training and Research Hospital of Health Sciences University; it is considered an effective treatment method due to the short surgical time of the method we used and its applicability to all distal radius fractures that can be reduced closed. For this technique to be successful, the fracture should be operated on as early as possible. This study demonstrated a significant relationship between clinical and radiological findings, suggesting that these assessments are consistent and can be used together in patient management. Future studies with larger patient cohorts are recommended to confirm these findings.

Conflict of interest statement

None

Ethics Committee Approval: This study had local ethical committee approval of the Bakırcay University (2024/1592) and was conducted in accordance with the Helsinki Declaration of 2013

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