



Research Article

A Prospective Study on the Clinical Profile, Management, and Functional Outcomes of Distal Radius Fractures in Adults

Dr. Rajan Kumar¹, Dr. Solanki Animesh Mahendrakumar²

¹Assistant Professor, Department of Orthopaedics, Kamineni Institute of Medical Sciences, Nalgonda, Andhra Pradesh, India

²Assistant Professor, Department of Orthopaedics, Kamineni Institute of Medical Sciences, Nalgonda, Andhra Pradesh, India

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Abstract

Background: The distal radius fractures are one of the most frequent orthopedic injuries that people face in adulthood and are linked to high morbidity, particularly related to the functioning of the wrist and performing their daily activities. The fractures are as a result of high-energy trauma on the young people and low-energy falls in older populations especially in people with osteoporosis.

Aim: To prospectively evaluate the clinical profile, management strategies, and functional outcomes of distal radius fractures in adult patients.

Methodology: The study involved a potential observational study, carried out at the Department of Orthopaedics, Kamineni Institute of Medical Sciences, Nalgonda, during one year. One hundred and forty adult patients with fractures of the distal radius were studied. Demographic, mechanism of injury, fracture and treatment modalities, and functional outcome data were gathered and statistically analyzed using descriptive and inferential statistics.

Results: Most patients were between 31-45 years (34.3) of female gender (57.1). An extended hand fall was the cause of 62.9% of falls. The conservative treatment was conducted in 58.6% of patients, and 41.4 were subjected to surgery. The functional outcomes of the unstable fractures surgically treated were much more favorable compared to the conservative management of the unstable ones, with the treatment of the stable fractures providing satisfactory results.

Conclusion: The treatment planning of distal radius fractures should be individual. In unstable fractures, surgical intervention is better with superior functional results compared to conservative management, which is effective with stable injuries.

Keywords: Distal radius fracture, Functional outcome, Orthopaedics, Conservative treatment, Surgical management

1. Introduction

Distal radius fractures represent one of the most common injuries of the upper extremity in orthopedic practice and a major percentage of all fractures that present to emergency and trauma departments of all countries in the world [1]. These fractures are usually caused by a fall on an extended hand (FOOSH) causing an axial load and dorsal or volar displacement of the distal radius [2]. Distribution Epidemiologically, distal radius fractures exhibit a bimodal age distribution, with young

people being affected by a high-energy trauma as road traffic accidents and sports injuries, and older individuals, especially postmenopausal women being affected by low-energy falls due to osteoporosis and reduced bone mineral density [3].

The management of distal radius fractures has undergone a significant transformation in the last few decades. Historically, such injuries were treated in a conservative manner by closed reduction and immobilization in plaster cast [4].

This technique can still be used to treat stable and minimally displaced fractures, but it is commonly linked with the complications of loss of reduction, malunion and long-term immobilization resulting in joint stiffness [5]. Through the development of orthopedic surgical procedures and implant technology, a paradigm shift in the treatment of the orthopedic surgery has been observed where orthopedic surgery is becoming a standard treatment method especially in the case of unstable, comminuted, and intra-articular fractures [6]. In contemporary surgery, volar locking plate fixation, percutaneous pinning (Kirschner wires) and external fixation are all used with the goal of providing a stable fixation and early mobilization [7].

The main objective in the treatment of fractures of the distal radius is to restore the normal anatomical position both in terms of radial height, radial inclination and volar tilt and articular congruity. The attainment of these parameters plays an important role in maintaining the wrist biomechanics, preventing post-traumatic arthritis, and providing the best functional results. Early mobilization after stabilization has been reported to have a significant effect on range of motion, grip strength and overall patient satisfaction [8].

In spite of these developments, the best treatment option of the distal radius fractures is still an issue of debate among orthopedic surgeons [9]. The decision on the conservative or surgical management is related to various factors that include patient age, bone quality, fracture pattern, displacement, intra-articular involvement and patient functional needs. Although surgical intervention provides superior reduction of the anatomy as well as functional recovery in unstable fractures, it also presents the possibility of infection, hardware issues and higher health costs [10].

Moreover, mismanagement or late treatment of distal radius fractures may lead to a plethora of complications, such as malunion, non-union, chronic pain, loss of wrist movement, loss of grip strength, and functional disability [11]. The complications may severely affect the activities

of daily living and the overall quality of life especially among elderly patients [12].

Since the number of distal radius fractures is high and a significant debate about the best management of this type of fracture persists, it is necessary to conduct in-depth clinical research to assess the outcomes of treatments and make evidence-based decisions [13-14]. Thus, the current research is expected to evaluate the clinical presentation, management, and functional outcome of distal radius fracture in adult patients, paying particular attention to the comparison of conservative and surgical management, and determining the factors affecting the treatment outcome [15].

2. Methodology

2.1 Study Design

This research was intended to be a prospective observational study to determine the clinical profile, management approaches, and functional outcomes of adult patients with distal radius fractures. A prospective design was used to enable a systematic gathering of clinical data, clinical treatment, and follow-ups across a specified time period, thereby obtaining accurate data and reducing recall bias.

2.2 Study Area

The research took place at the Department of Orthopaedics, Kamineni Institute of Medical Sciences, Nalgonda, Andhra Pradesh, India.

2.3 Study Duration

The research was conducted within a period of one year.

2.4 Study Participants

Inclusion Criteria

- Patients that are adults and are 18 years and older.
- Radiographically proven patients of distal radius fractures.
- Patients willing to take part and follow up visits in the study.

Exclusion Criteria

- Open fractures that are related to significant soft tissue trauma in patients.

- Pathologic fractures (malignancy, metabolic bone disease).
- Patients who have major injuries (e.g., polytrauma) that may disrupt the functional assessment.
- Patients who have missing follow up data or lost to follow up.

2.5 Sample Size

140 patients meeting the inclusion criteria were enrolled in the study. The sample size was chosen to be representative enough within the various age groups, fracture types, and treatment modalities, thus it became possible to analyze the clinical and functional outcomes meaningfully.

2.6 Procedure

A detailed clinical and radiological assessment was done on all patients who reported with suspected distal radius fractures. Clinical evaluation involved a detailed history and focus on the mechanism of injury, hand dominance, and comorbidity, and a comprehensive physical examination to determine the presence of deformity, swelling, tenderness, and neurovascular status, and baseline functional assessment. Radiological assessment was conducted with routine anteroposterior (AP) and lateral X-rays of the wrist to confirm the diagnosis and to assess the fracture quality by displacement, comminution, and intra-articular involvement. Fractures were classified based on these findings as per the extent of displacement, stability and intra-articular extension. Decision on treatment was made based on this and patients were treated either conservatively or surgically. The stable and minimally displaced fractures were treated with conservative management that included closed reduction under proper anesthesia and immobilization with plaster cast, proper alignment confirmed by radiographical method, and the immobilization was generally maintained between 4-6 weeks after which gradual mobilization and physiotherapy were started.

Conversely, patients with unstable, displaced, or intra-articular fractures were surgically treated using either open reduction and internal fixation (ORIF) with volar locking plates, percutaneous pinning with Kirschner wires, or external fixation when there was severe comminution. Strict sterility was observed in all surgical procedures and postoperative care involved immobilization, wound care and organized physiotherapy to ensure optimal functional recovery.

2.7 Statistical Analysis

All data obtained were then organized and inputted into a computer database and analyzed using the SPSS version 25.0 (IBM, USA). The summary of the demographic and clinical characteristics of the study population was done by descriptive statistical techniques such as the mean and standard deviation of continuous variables and the frequency and percent of categorical variables. The results were compared using inferential statistical procedures to compare the outcomes between patients treated conservatively and those treated surgically. Independent t-tests were used in the analysis of continuous variables and chi-square tests were used in categorical variables in order to establish the relationships between variables. A p-value of below 0.05 was taken as significant. Further, subgroup analysis was also done where necessary to determine the possible factors that might have affected the treatment outcomes and functional recovery.

1. Results

There were 140 adult patients with distal radius fractures. These findings were subjected to the analysis of demographic features, injury mechanisms, treatment options, functional outcomes, and complications. The results are tabulated and discussed below to give an in-depth picture of clinical trends and therapeutic efficacy.

Parameter	Frequency (n)	Percentage (%)
Age (years)		
18–30	30	21.4
31–45	48	34.3
46–60	40	28.6
>60	22	15.7
Gender		
Male	60	42.9
Female	80	57.1

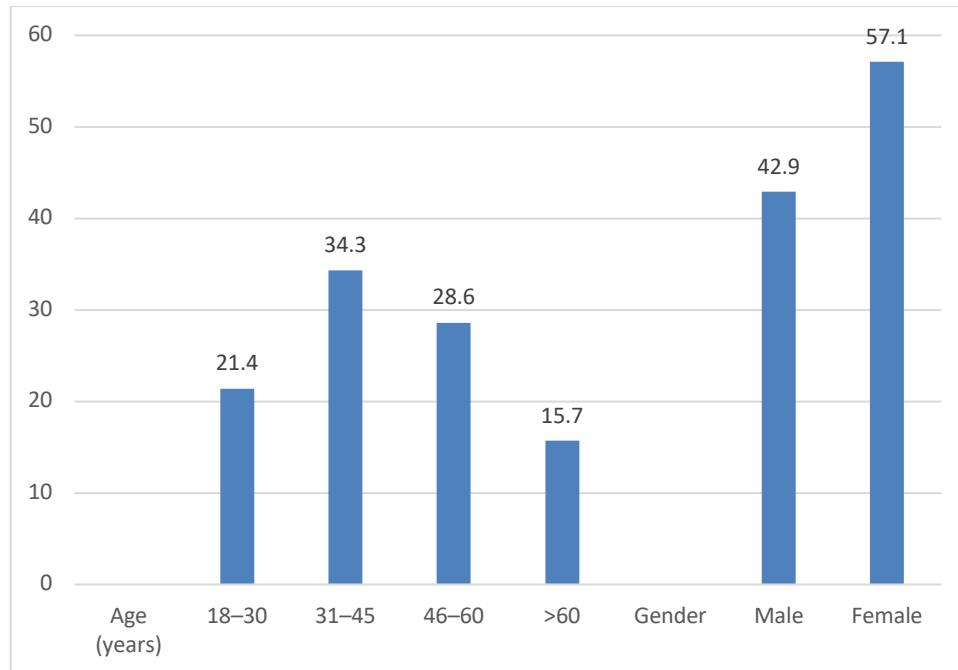


Figure 1: Demographic Characteristics of Study Participants

Table 1 depicts the demographics of the study population. Most patients were aged 31-45 years (34.3%), then 46-60 years (28.6%), which shows that middle-aged population is more affected by the distal radius fracture. The proportion of younger adults (18-30 years) was 21.4% and that of older patients (above 60 years) was 15.7%. In terms of gender distribution, females were on the majority

(57.1) as opposed to males (42.9). This observation can be explained by the fact that females have less bone mineral density and are more vulnerable to osteoporotic fractures, especially peri-menopausal and post-menopausal. On the whole, the statistics indicate distal radius fractures are more prevalent in the middle-aged adults and women.

Mechanism	Frequency (n)	Percentage (%)
Fall on outstretched hand	88	62.9
Road traffic accidents	30	21.4
Sports injuries	12	8.6
Others	10	7.1

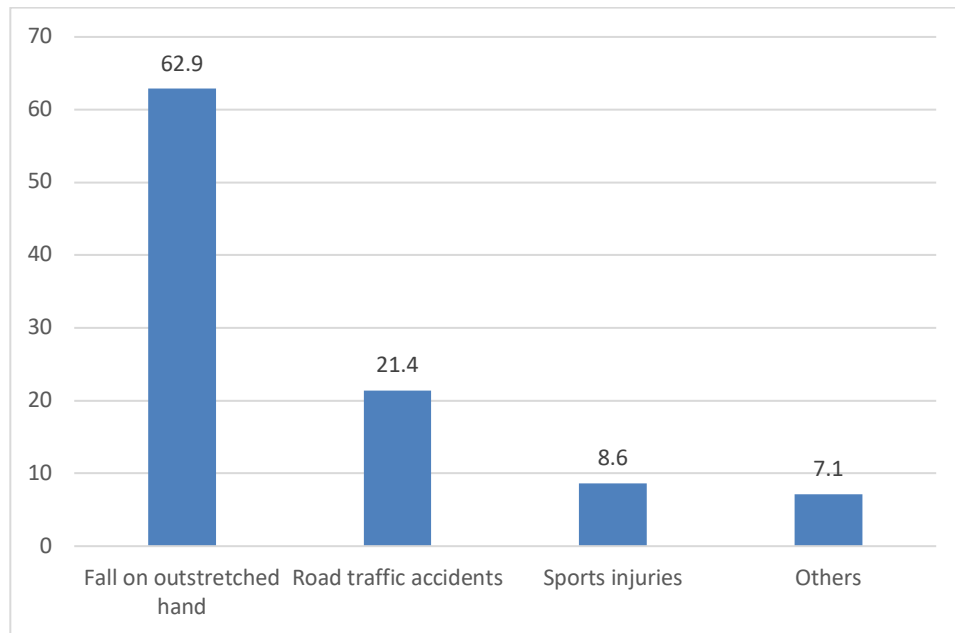


Figure 2: Graphical Presentation of Mechanism of Injury

Table 2 illustrates the different pathways of injury that cause distal radius fractures. Fall on an outstretched hand (62.9%), was the most prevalent cause of injury, making it the most important mechanism, particularly in low-energy trauma. High-energy trauma, especially among younger people, had a significant

contribution to road traffic accidents (21.4% of cases). A smaller proportion of cases was made up of sports-related injuries (8.6%), and other causes (7.1%). These results underline that low-energy falls are the most common cause, but high-energy trauma can significantly contribute to the occurrence of distal radius fractures.

Treatment	Frequency (n)	Percentage (%)
Conservative	82	58.6
Surgical	58	41.4

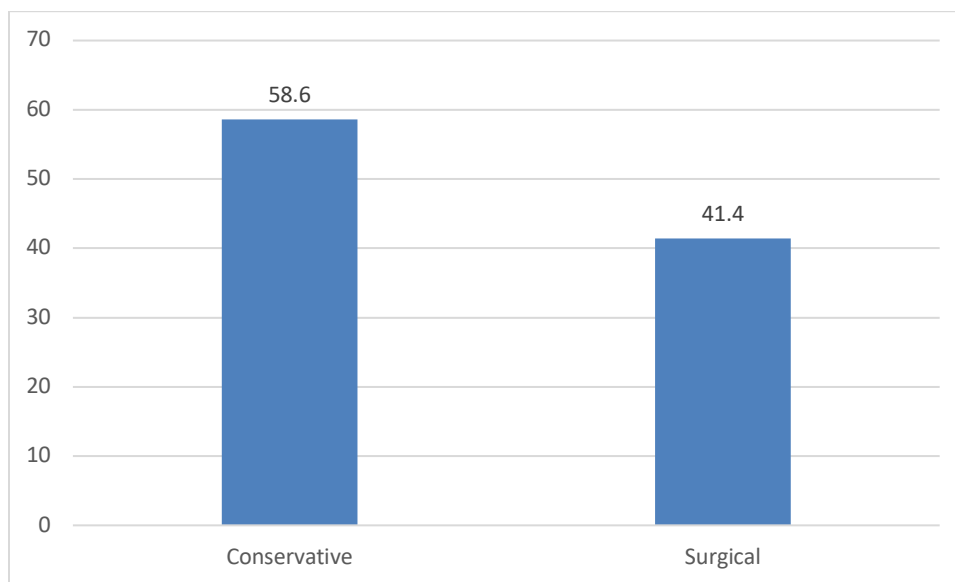


Figure 3: Graphical Presentation of Treatment Modalities

Table 3 provides the presentation of the distribution of the treatment methods applied in the study population. Most of the patients (58.6) were treated through conservative treatment with 41.4% having surgery. The increased percentage of conservative management indicates that a good portion of fractures was either stable or slightly moved hence could be

treated non-operatively. Nonetheless, the significant percentage of surgically treated cases indicates the existence of unstable, displaced, or intra-articular fractures which need surgical repair. This distribution demonstrates the need to plan a unique approach to treatment depending on the fracture characteristics and patient-specific aspects.

Outcome	Conservative (%)	Surgical (%)
Excellent	28	52
Good	42	34
Fair	20	9
Poor	10	5

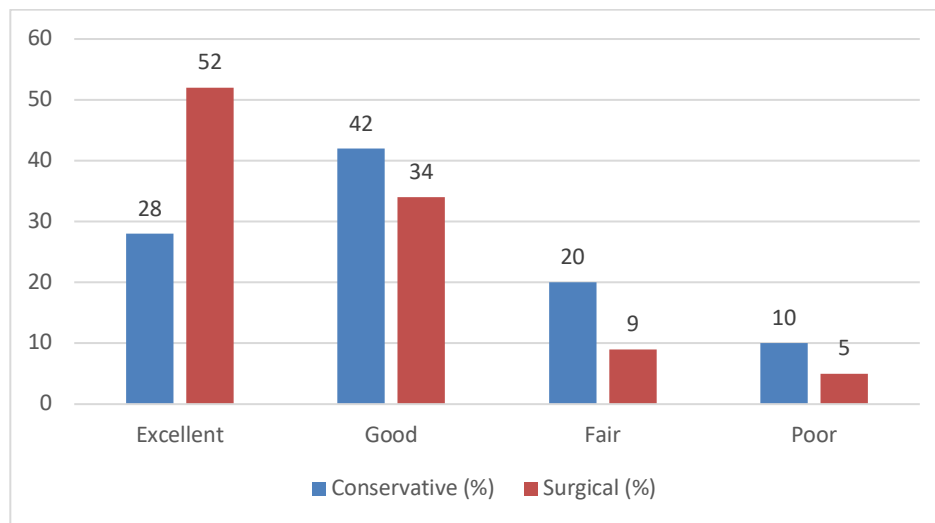


Figure 4: Graphical Presentation of Functional Outcome at 6 Months

Table 4 compares both the functional outcomes of conservatively and surgically treated patients in 6 months follow-up. The percentage of good results was higher in the surgical group (52) than in the conservative group (28), showing that there is better functional recovery after surgical intervention in selective cases. Likewise, good results were found in 42% of conservative cases and 34% of the surgical cases, which indicates that conservative treatment gives promising results, especially in

stable fractures. Nonetheless, fair and poor results were more prevalent in the conservative group (20% and 10% respectively) than in the surgical group (9% and 5%), which suggests rather poor results in certain conservatively treated cases. In general, these results imply that conservative therapy can be effective in stable fractures whereas surgical therapy can produce a better functional outcome in unstable and complex fractures.

Complication	Frequency (n)	Percentage (%)
Malunion	20	14.3
Joint stiffness	18	12.9
Infection	7	5.0
Hardware-related issues	5	3.6

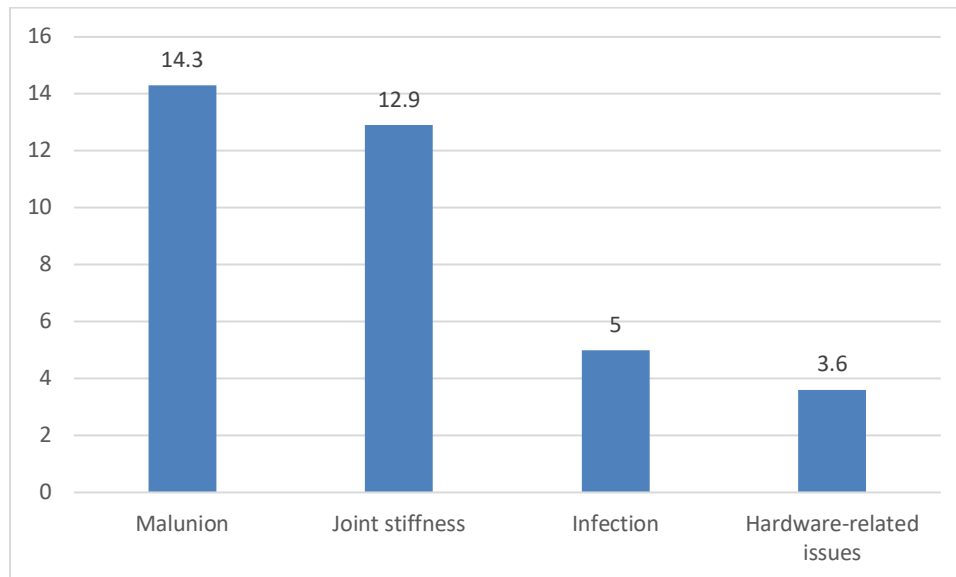


Figure 5: Graphical Presentation of Complications Observed

Table 5 summarizes the complications that were experienced during the study. Malunion (14.3%) was the most frequent complication, then joint stiffness (12.9), which implies problems with the correct position, as well as the long-term immobilization. The incidence of infection was 5.0 % and was mainly linked to surgical intervention, whereas complications related to hardware (3.6) were not very common. These results demonstrate that despite the fact that both treatment options are usually safe; complications like malunion and stiffness are more frequently related to conservative treatment, but surgical treatment is characterized by a low risk of infection and implant-related complications.

4. Discussion

The current prospective trial assessed the clinical picture, the management plan, and the functional performance of distal radius fractures in 140 patients aged over 18 years during one year (P. M. Simic et al., 2006) [15]. The results of the current study present valuable information on demographics, injury mechanisms, and management, and effect on functional recovery, and are mostly in line with current orthopedic literature (J. S. Souer et al., 2008) [16].

Most of the patients in this study were aged between 31 and 45 years, meaning that, distal radius fractures are not restricted to the elderly

population, but are also common amongst active middle-aged populations (J. Vasenius, 2008) [17]. The preponderance was found to be on the female side and this is explained by the fact that they have a lower bone mineral density especially in the peri-menopausal and post-menopausal women, hence are more prone to fragility fractures (David H. Wei et al., 2009) [18]. The same demographic trends have been documented in past researches highlighting the contribution of osteoporosis and age-related alterations in the bones as some of the most critical risk factors.

Injury mechanism analysis showed that falls on an outstretched hand were the most frequent cause of fracture of the distal radius, and the majority of cases were comprised of falls on an outstretched hand. This observation is similar to that of the rest of the world, with low-energy falls being one of the major causes, particularly in the elderly (T. C. Wong et al., 2010) [19]. Nonetheless, a significant percentage of cases was also linked to road traffic accidents, which represents the role of high-energy trauma, especially in younger people. This pattern of two indicates the different etiology of distal radius fracture in the different age groups.

Considering management, conservative management was used more often in patients, which means that numerous fractures were not displaced or were stable to a large extent. Older

techniques, such as closed reduction and casting are still a good and cost-efficient procedure in such fractures. Nevertheless, the results of the study indicate clearly that surgical management had better functional outcomes especially in cases of unstable, displaced or intra-articular fractures. Surgically treated patients reported increase in anatomics, proper wrist positioning and earlier mobilization, which are decisive to successful functional recovery.

Six months functional outcome analysis indicated a much greater percentage of the patients in the surgical arm attained excellent functional outcomes than those treated conservatively. Even though conservative treatment yielded satisfactory results in stable fractures, there was a greater rate of fair and poor outcomes, probably because of the loss of reduction, long-term immobilization, and inability to restore anatomical parameters.

These findings were also supported by the analysis of complications, malunion and stiffness of the joint were more prevalent in the patients treated conservatively, mainly because of the incorrect positioning and late mobilization (T. W. Wright et al., 2005) [20]. Conversely, surgical management was linked to a comparatively less number of complications despite the presence of risks like infection and hardware problems in a minuscule percentage of cases. These complications, though, were treatable and were not of much concern to overall outcomes.

In general, the findings of this study highlight the significance of personalized treatment planning according to the fracture characteristics, the age of the patients, bone quality, and functional needs. Although conservative management is still suitable in the case of stable fractures, surgical intervention could be highly advised in complex fractures which are unstable to provide enhanced anatomical and functional results. Early diagnosis and the choice of appropriate treatment and structured rehabilitation are important to reduce complications and increase the quality of life of a patient.

5. Conclusion

Distal radius fractures are still a leading orthopedic issue, which requires a multifaceted and tailored approach to treatment to help reach the best clinical and functional results. The results of the current study underline the fact that conservative treatment remains to be effective and practical in the case of stable, minimally displaced fractures, and it provides satisfactory recovery with minimum intervention and low cost. Surgical management, however, in unstable, displaced or intra-articular fractures, is better because it offers better anatomical reduction, fracture stability and early mobilization, which all leads to better wrists and patient satisfaction. Another key aspect of the study is the fact that improper or late management may cause complications like malunion, stiffness, and functional impairment, and, therefore, timely and correct clinical decision-making is vital. In addition, early diagnosis, correct fracture pattern classification, and choice of the suitable treatment modalities, and the systematic rehabilitation strategies are also significant in improving the recovery process and reducing disability in the long-term. In general, the treatment of distal radius fractures must be customized based on the nature of fractures, the age of patients, bone quality and functional needs in order to achieve the optimal results and the quality of life among the patients.

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