

Comparing Conservative Treatment of Distal Ulna Fractures with Operative treatment

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ABSTRACT

Objective: To compare the outcome of conservative treatment of distal ulna fractures with operative treatment

Study design: A randomized control trial

Place and duration: This study was conducted at Muhammad Medical College and Hospital Mirpurkhas from September 2021 to September 2022

Methodology: Patients with different types of ulnar fractures (base fractures, head fractures, and subchondral fractures) were divided into two groups based on a systematic approach that established the course of treatment for forearm fractures. The fractures of the distal radius in Group A were treated with plating osteosynthesis, while the fractures of the distal ulna were taken care of with a surgical procedure involving the implantation of an LCP Distal Ulna Plate (De PuySynthes, USA)

Results: A total of 120 patients were enrolled in the study, 8 of whom had to be excluded due to the development of carpal ligament damage symptoms. The 112 patients who remained were divided into three groups: 36 in group A, 42 in group B, and 34 in group C. The results of distal forearm fractures were initially treated with closed repositioning in local anesthesia and plaster fixation in 89 cases. In 10 cases, external fixation was primarily applied due to soft tissue conditions. The definitive surgical procedure was performed on average 10 days (3-19) from the injury. In group A, osteosynthesis of both bones was performed during one operation in 30 patients. In 7 cases, it was necessary to perform a two-phase procedure due to the state of the soft tissues.

Conclusion: Based on the study's results, osteosynthesis is the more successful treatment for sub-capital fractures, as it results in better early outcomes than a conservative approach. However, due to the low number of patients with this type of fracture, it is impossible to make definitive treatment recommendations

Keywords: distal ulnar fracture, osteosynthesis, conservative treatment

INTRODUCTION

A distal radius fracture is a very common injury among elderly individuals, accounting for 17% of all bones broken. The debate on whether this type of fracture should be dealt with conservatively or surgically is ongoing [1]. If the fracture line is located inside this area, it is classified as a distal radius fracture. These fractures are further divided into styloid process fractures, head fractures, and neck and distal diaphyseal fractures. Distal radius fractures are often associated with distal ulnar fractures, which can lead to instability of the distal radioulnar joint (DRUJ) and limit the forearm's range of motion [2]. The type of treatment for a fracture depends on many factors, such as the patient's age, lifestyle, type of break, severity, and how misaligned the break is. Closed reduction and casting immobilization is a low-cost option that does not require hospital admission but does not allow for anatomical reconstruction of the bone or joint cartilage [3]. Surgery is an option that can restore bone fragments, but it comes with risks, radiation exposure, and higher costs. In elderly patients, it has been reported that good outcomes have been achieved with fractures that can heal with mal-alignment of the distal end of the radius. It has also been found that mal-alignment does not affect the functional outcome in elderly patients [4, 5]. A prospective randomized open study is being conducted to compare the results of conservative and surgical treatment of distal ulna fractures associated with a distal radius fracture. The aim of the study is to evaluate and compare the outcomes of both types of treatment and to support the conclusions of other authors regarding the recommended regimens for these fractures.

METHODOLOGY

A randomized, open-label trial was conducted on patients with an initial unstable distal radius fracture according to the AO classification who had to undergo a surgical procedure and a fracture in the distal ulna. Exclusions from the study were those

with associated damage to the interosseous and capsular ligaments of the wrist, polytrauma patients (ISS > 16), associated injuries in the upper limbs, previous serious trauma of the affected or contralateral wrist, noncompliance, abuse of psychoactive drugs, periprosthetic fractures, and fractures of the pediatric skeleton. After signing the informed consent, the AO classification was used to identify the distal radius fracture type. The Fernandez classification was applied to determine the type of fracture of the distal ulna. Three Groups, A, B, and C, were created based on the results.

Since the literature sources indicate that this type of fracture of the processus styloideus does not necessitate surgical intervention, since the fracture line extends from the point of attachment of the distal radioulnar ligaments TFCC and does not lead to DRUJ instability, all patients with this fracture were classified in Group C [6]. This study tested the hypothesis that fractures of the distal radius and ulna do not affect the stability of the distal radio-ulnar joint (DRUJ) and do not require surgical intervention. Plating osteosynthesis was used to manage the distal radius fracture, while a more conservative approach was taken with the type of fracture of the ulna [7].

Patients with different types of ulnar fractures (base fractures, head fractures, and subchondral fractures) were divided into two groups based on a systematic approach that established the course of treatment for forearm fractures. The fractures of the distal radius in Group A were treated with plating osteosynthesis, while the fractures of the distal ulna were taken care of with a surgical procedure involving the implantation of an LCP Distal Ulna Plate (De PuySynthes, USA). Group B, on the other hand, managed the distal radius fractures with plating osteosynthesis and the distal ulna fractures conservatively [8]. A qualified individual who was not involved in the treatment of patients, data collection, or evaluation separated the subjects into even and odd numbers in the file to ensure randomization. This prevented any

subjective judgment or human error from affecting the assignment of subjects during the study.

A total of 120 patients were enrolled in the study, 8 of whom had to be excluded due to the development of carpal ligament damage symptoms. The 112 patients who remained were divided into three groups: 36 in group A, 42 in group B, and 34 in group C. The sample size was 67 women and 45 men, with an average age of 51 (range 24 – 85 years). Most injuries (58.24%) were caused by low-energy indirect mechanisms such as falls from a standing height, which affected only women over 49 years old, resulting in fractures in an osteoporotic bone field. The remaining injuries (41.76%) were caused by higher-energy indirect mechanisms, mostly due to sporting activities and traffic accidents.

In all cases, 67% of the injuries were to the dominant limb and 33% to the non-dominant limb. All distal radius fractures were treated with the AO principles-based plate osteosynthesis technique. For group A, the LCP Distal Ulna Plate implant was used to treat all distal ulna fractures regardless of the tension. This implant was chosen to avoid using different surgical treatments for different types of fractures. The downside is that it requires a more extensive surgical approach for the ulna styloid process fractures, whereas a traction cerclage or positioning screw would be more suitable.

All patients who underwent surgery were required to wear a plaster cast for 4-6 weeks afterwards. Group A patients, who mainly had type 23-C3 and 23-C2 distal radius fractures, with a high chance of carpal ligament damage, were only required to wear the cast for four weeks, despite having ORIF. Group B patients with distal ulna fractures were kept in a cast for six weeks. Those with head and sub-capital ulna fractures were kept in a cast for three weeks. After being taken out of the cast, physical therapy of the wrist was started, and a full active load was allowed 10-12 weeks post-surgery, depending on the healing rate.

The postoperative outcomes were evaluated at regular intervals of 2 weeks, 6 weeks, 3 months, 6 months, 12 months, 18 months, and 24 months, with an average follow-up period of 24 months (6-36 months). Eighty percent of the patients were followed for at least 18 months. The evaluation included a range of active wrist and forearm motion, presence of wrist pain, hand muscle

strength, and stability of the DRUJ by clinical tests such as the Ulnar ballottement test, Ulnar piano key sign test, Ulnar fovea test, and Ulnar carpal stress test, and functional status of the limb such as self-care, routine daily activities, specific activities, and loading.

The range of motion of the injured wrist was measured six weeks after surgery and compared to the range of motion of the uninjured limb. Radiographic images were used to assess the distal radius's reposition, the joint surfaces' congruence, and the signs of fracture healing and osteoarthritis. After the clinical condition stabilized, the Mayo Wrist Score and Quick Disability of the Arm, Shoulder, and Hand Questionnaire were used to evaluate the functional outcome of the treatment [9, 10, 11].

RESULTS

The results of distal forearm fractures were initially treated with closed repositioning in local anesthesia and plaster fixation in 89 cases. In 10 cases, external fixation was primarily applied due to soft tissue conditions. The definitive surgical procedure was performed on average 10 days (3-19) from the injury. In group A, osteosynthesis of both bones was performed during one operation in 30 patients. In 7 cases, it was necessary to perform a two-phase procedure due to the state of the soft tissues. The types of fractures are outlined in Table 1. Types of fractures in the files regarding the distal radius and ulna are outlined in Table 2. The early radiographic and functional results of the individual groups are summarized in Table 3.

Table 1: Demographic data

Patient Characteristics	Value
Gender	
Male	45
Female	67
Cause of Injury	
Low-energy indirect mechanisms	47
higher-energy indirect mechanisms	65
Limb	
Dominant Limb	75
Non-Dominant Limb	37

Table 2: The types of fractures in the files regarding the distal radius and ulna were categorized according to the AO Classification for the radius fracture and the Fernandez Classification for the ulna fracture.

	The number of patients	Fractures of the Distal Radius				Distal Ulnar Fractures			
		A3	C1	C2	C3	Tip Fracture	Base Fracture	Ulna Head Fracture	Ulna Subcapital Fracture
Group A	36	5	0	7	24	0	16	14	6
Group B	42	7	4	12	19	0	34	1	7
Group C	34	9	3	5	17	34	0	0	0

Table 3: Radiology Results

		X-Ray Results from Repositioning of Distal Radius Fracture		Functional Results		
		radial inclination	radial tilt	Mayo Wrist Score	ROM %	Quick Disability of the Arm, Shoulder and Hand Questionnaire
Group A	Base	24.2	12.1	93.4	97.1	3.6
	Head + subcapital	24.6	13.5	89.2	91.6	5.4
Group B	Base	19.5	8.9	79.6	93.5	17.3
	Head + subcapital	19.1	9.0	63.4	77.2	24.4
Group C	BaseBase	19.7	8.9	61.3	98.6	2.3

ROM: The range of active motion of the affected wrist and forearm compared to the unaffected limb

Group A: Group A patients who underwent surgery for distal radius and ulna fractures saw a total consolidation within 12 weeks. Those whose fractures were located in the base of the processus styloideus ulnae had better functional outcomes (ROM 97.1%, Mayo Wrist Score 93.4 points, QDASH 3.6 points) compared to those who had head or sub-capital fractures (ROM

91.6%, MWS 89.2 points, QDASH 5.4 points), which is consistent with the severity of the distal ulna fracture.

Group B: All patients experienced a distal radius fracture within 12 weeks. For base fractures of the processus styloideus ulnae, 15 cases resulted in consolidation without dislocation, 6 cases resulted in consolidation with dislocation, and 21 cases resulted in non-consolidation. These individuals had a poorer functional outcome (ROM 93.5%, Mayo Wrist Score 79.6 points, QDASH 17.3 points) compared to patients with a fracture of the head and sub-capital ulna who experienced a full consolidation of the fracture within the

same time period. X-rays of each patient with a fracture of the ulnar head showed incongruence of the DRUJ, and 3 patients (50%) had a disturbance of the axial orientation of the distal ulna due to malposition during healing. Those with a sub-capital fracture experienced both of these consequences of malposition healing and obtained the worst result in the whole set (ROM 77.2%, Mayo Wrist Score 63.4 points, and QDASH 24.4 points).

Group C: Group C achieved the best functional result in the set [ROM 98.6%, Mayo Wrist Score 61.3 points, and QDASH 2.3 points].

DISCUSSION

No patients experienced any negative outcomes regarding the failure of the distal radio-ulnar osteosynthesis, loss of reposition, early or late infection, Sudeck'salgodystrophy syndrome, or iatrogenic nerve, vessel, and tendon injury. Additionally, the radiographic results revealed that bone quality does not significantly affect the outcome of osteosynthesis. However, for patients over 50 years old, healing of osteoporotic bone was slower than those with normal-quality bone. In group A, 7 patients had irritation of the soft tissue near the distal part of the ulnar bandage post-operatively, so the osteosynthesis material was extracted. After this was done, all the patient's symptoms improved [13].

To determine the effect of a distal radius fracture combined with a distal radial injury on DRUJ stability and function, removing the influence of dorsal angulation and proximal dislocation of the fractured radius fragments is necessary, which are the most frequent causes of instability in the DRUJ. Through performing an anatomical reposition and ORIF of the distal radius fracture, this effect is eliminated, allowing the impact of the distal ulna fracture on the stability and function of the DRUJ to be accurately evaluated. According to the criteria for acceptable reposition of a distal radius fracture established in a study, the X-ray results demonstrate that a very satisfactory reposition of the distal radius fracture was achieved in all groups [12]. Nevertheless, the effect of the distal radius fracture on the functional outcome following a distal forearm fracture cannot be completely removed since wrist injury is often complex and difficult to interpret. Taking into account the similar distribution of individual types of distal radius fractures and their surgical outcomes in all groups, it can be assumed that the contribution of this fracture to the functional result is similar in all groups. The kind of distal ulna fracture determines the difference in the result and the method of treatment employed [14].

The results of this RCT found that when a distal radius fracture was treated, the accompanying fracture of the ulna styloid process did not affect the functional outcome. No posttraumatic DRUJ instability or biomechanics disorder was detected in any patients. This confirms previous research that fractures of the middle and distal third of the ulna styloid process do not require surgical treatment, as the fracture line does not damage the attachment site of the distal radioulnar ligaments. However, it is recommended to examine DRUJ stability after osteosynthesis of the distal radius fracture when a styloid process fracture of the ulna is present, as it is impossible to predict the possibility of injury to the distal radioulnar ligaments with just a static X-ray image [15].

CONCLUSION

Based on the study's results, osteosynthesis is the more successful treatment for sub-capital fractures, as it results in better early outcomes than a conservative approach. However, due to the low number of patients with this type of fracture, it is impossible to make definitive treatment recommendations. It has been

suggested by other authors that in the case of stable and nondisplaced fractures of the neck and distal diaphysis of the ulna, a conservative approach should be used, while surgical treatment should be considered for displaced or comminuted fractures since these can lead to restriction of range of motion of the forearm and the development of early posttraumatic DRUJ osteoarthritis.

Recommendations: Based on the study's results, it is recommended to consider osteosynthesis for treating sub-capital fractures of the ulna, as it has a better outcome than conservative treatment.

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