Journal of Cardiovascular Disease Research

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 09, 2023

A Comparative Study of functional outcome of Distal Radius Fracture Treated with Closed Reduction and Cast vs. Open Reduction and Internal Fixation

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Abstract

Background and Objectives: Distal radius fractures, common in emergency rooms, exhibit a bimodal age distribution. Traditional treatments include manipulation, casting, and K-wires. Modern methods like JESS fixation and volar plating aim to restore alignment and early mobility. This study compares grip strength, a key recovery measure, between closed reduction and casting and open reduction with internal fixation (ORIF) after twelve months.

Material and Methods: This observational study analyzed grip strength in 232 distal radius fracture patients who underwent closed reduction and casting or ORIF. Assessments were done twelve months post-intervention.

Results: Statistical analysis ($P > 0.05$) revealed no significant difference in grip strength between ORIF and casting after twelve months, emphasizing grip strength's reliability in outcome assessment.

Conclusion: This study demonstrates the equivalence of closed reduction and casting to ORIF for distal radius fractures, with grip strength as a dependable metric for functional recovery. Beyond grip strength, treatment decisions should consider other factors due to the lack of significant differences in this specific outcome measure.

Key Words: Radius, Fracture Fixation, Hand Strength, Outcome Assessment, Health Care

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 09, 2023

Introduction

Distal radial fractures (DRF) are the most commonly encountered orthopedic fractures in adults [1]. They account for approximately one-sixth of all fractures [2]. These fractures typically result from high-energy trauma in younger patients and low-energy trauma, such as falls from a standing position, in older patients [3].

The management of DRF involves two main approaches: conservative and surgical [4]. The primary objective of treatment is to restore wrist function and preserve the mechanics of the radiocarpal and radioulnar joints to the greatest extent possible [5]. The choice of treatment depends on various factors, including age, gender, occupation, dominant hand, hobbies/sports involvement, bone quality, and comorbidities [6]. For instance, closed reduction with cast immobilization is not suitable for elderly patients due to their higher risk of displacement and potential for suboptimal functional recovery.

One way to assess the outcomes of DRF treatment is by measuring the Hand Grip Strength Ratio, which compares the strength of the non-dominant hand to the dominant hand [7]. Several factors influence grip strength, including hand dominance, gender, age, and nutritional status (height, weight, BMI), as well as overall hand length. This metric exhibits good inter-rater reliability and provides insight into individuals' hand utility.

Given the evolving treatment landscape, particularly the increasing inclination toward surgical interventions [8], this study aims to compare hand grip strength in patients with distal radial fractures who underwent closed reduction and casting versus those who received open reduction and internal fixation [9, 10]. The study endeavors to furnish valid and pertinent data regarding these treatment approaches.

Material and Methods

The primary objective of this study was to compare the hand grip strength in patients who had suffered distal radius fractures and were treated either through closed reduction and casting or open reduction and internal fixation. The research was conducted over a period of 3 years.

A total of 232 patients were included in this study. These patients were divided into two distinct groups based on the type of treatment they received: Group1 consisted of 109 patients who underwent conservative treatment, while Group 2 comprised 123 patients who underwent surgical intervention.

In Group 1, patients were subjected to hand immobilization using a Colles cast extending from below the elbow for a duration of 6-8 weeks. Conversely, in Group 2, various surgical techniques were employed, such as Open Reduction Internal Fixation using Locking Compression Plates, External Fixation, and K-WIRE. For cases where multiple bone fragments

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 09, 2023

made plate and screw fixation impractical, external fixation devices were utilized, either alone or in combination with additional wires, to secure the fracture.

After the surgical procedure, a splint was applied for a period of 2 weeks until the first follow-up appointment. At this point, the splint was removed and replaced with a removable wrist splint, which was worn for the subsequent 4 weeks.

The assessment of hand grip strength was conducted using a hand grip dynamometer. Patients were instructed to grasp the dynamometer with their elbow flexed at 90 degrees and the radioulnar joint positioned neutrally. The dynamometer was set at one of five specified settings (1, 1.5, 2, 2.5, and 3 inches). Patients were then asked to squeeze the dynamometer's handle with maximum force, without holding their breath, at each of these settings. Adequate rest periods were incorporated between successive attempts, and the recorded values were documented. This procedure was repeated for the opposite hand as well.

The DASH score, known as the Disabilities of the Arm, Shoulder, and Hand score, was employed as a means to evaluate functional impairment and symptomatology in patients with distal radius fractures who underwent different treatment modalities, specifically conservative and surgical approaches. The study involved a comparison of DASH scores between these two groups to assess the impact of treatment on the functional outcomes of the patients.

This standardized questionnaire, the DASH questionnaire, was utilized to gauge the functional status and symptoms of the study participants. Within this questionnaire, patients were presented with a series of inquiries intended to elicit information regarding their ability to perform various activities related to their upper extremities. These activities encompassed tasks such as lifting, carrying, gripping, dressing, and engaging in routine daily activities.

Patients were tasked with rating their capacity to perform each of these tasks on a scale that ranged from 0 to 5. A score of 0 signified no difficulty in performing the task, while a score of 5 indicated an inability to carry out the task. The collected responses were subsequently utilized to compute a single DASH score, which served as a numerical representation of the impact of the upper extremity condition on the patient's daily life and functional abilities.

Results

The study encompassed 232 patients, divided into two groups: Group 1, consisting of 109 conservatively treated patients, and Group 2, which comprised 123 patients treated operatively. In this current investigation, the participants in group 1 had an average age of 41.5 years with a standard deviation of 17.25 years, while those in group 2 had an average age of 39.2 years with a standard deviation of 16.77 years. It's noteworthy that there was no statistically significant disparity in the mean ages between the two groups, as evidenced by a p-value

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 09, 2023

exceeding 0.05. Additionally, when considering the gender distribution, there was no significant difference observed between the two groups, with a p-value greater than 0.05. The absence of a statistically significant difference in age and gender distribution between the two groups indicates that these groups can be considered comparable in terms of these demographic characteristics (Table 1).

Table 1: Demographic variables of study patients

Parameter	Group 1	Group 2	p value
Age (Mean ± SD)	41.5±17.25	39.2±16.77	0.67
Gender			
Male (n)	50	65	0.81
Female (n)	55	59	

The mean DASH score for subjects in Group 2 was observed to be higher compared to subjects in Group 1. However, it's important to note that the difference in the mean DASH scores between the two groups was statistically non-significant (p value >.05) (Table 2).

Table 2: DASH Scores of Study Groups

Parameter	Group 1	Group 2	p value
DASH Score	27.50±14.20	33.80±12.90	0.37

Regarding hand grip strength, Group 2 exhibited significantly greater hand grip strength compared to Group 1 (p value <.05) (Table 3 and Figure 1).

Table 3: Comparison of grip strength of study participants

Parameter	Group 1	Group 2	p value
Grip Strength	55.80 ± 16.50	61.25 ± 12.30	0.39

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 09, 2023

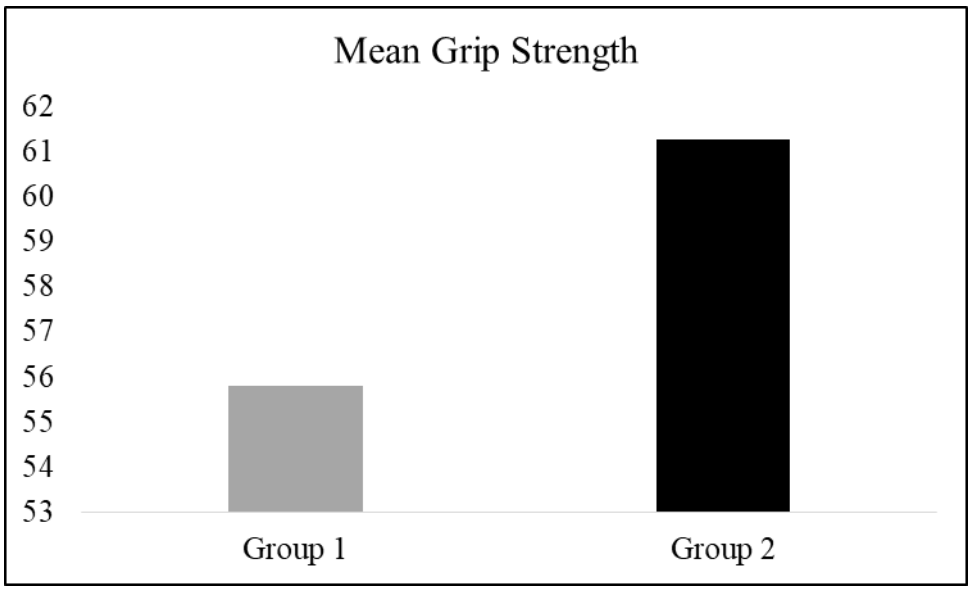

Figure 1: Comparison of grip strength between the two groups

Discussion

The incidence of complications in Distal Radius fractures varies widely, ranging from 6% to 80%, which can result from either the fracture itself or treatment-related issues. Consequently, there is a compelling need to explore effective treatment approaches for managing Distal Radius fractures.

In this current investigation, we conducted a comparative analysis of hand grip strength in patients with Distal Radius fractures who underwent closed reduction and casting versus those who underwent open reduction and internal fixation.

It's worth noting that age and gender have been identified as significant factors influencing functional outcomes one year post-treatment for Distal Radius fractures [12]. The hand grip strength test, assessing the maximum isometric strength of hand and forearm muscles [13], serves as a reliable indicator of individuals' hand functionality [14]. Reduced grip strength is a predictor of adverse outcomes, encompassing disability, mobility issues, falls, and even mortality [15].

Our study's findings demonstrate that the hand grip strength of subjects in group 2 was significantly higher than that of subjects in group 1. This suggests better functional outcomes

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in patients treated with operative methods compared to those treated non-operatively. These results align with the conclusions drawn by Arora R et al. (2011), who also reported significantly superior hand grip strength in the operative group compared to the non-operative group [16]. Similarly, Karagiannopoulos C et al. (2013) found that surgically treated DRF patients exhibited better hand grip strength than their non-surgically treated counterparts [17]. Saving J et al. (2019) observed both better DASH scores and hand grip strength in the Volar plating group compared to the non-operative group [18]. Conversely, Hidayat AY et al. (2020) reported no significant difference in hand grip strength between surgically and non-surgically treated groups [19].

It's important to note that Egol KA et al. (2010) documented that diminished grip strength in the non-operative group did not appear to limit functional recovery within one year [20]. This finding corresponds with the results of our present study.

Conclusion

In conclusion, the study found no significant difference in the DASH score between conservatively and surgically treated DRF patients. However, surgically treated DRF patients exhibited significantly greater hand grip strength compared to those treated conservatively. Importantly, there was no significant difference in the range of motion between the two treatment groups.

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