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Original Research Article

Comparison of hand grip strength in patients with distal radius fracture that are treated by closed reduction with cast versus open reduction and internal fixation

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ABSTRACT

Distal radius fracture are one of the most common fractures presenting at emergency rooms. It has bimodal age distribution. Historically, fractures were treated by manipulation and casting with or without K-wire. Modern techniques of JESS fixation and volar plating have been advocated to restore anatomical alignment and allow early mobilization. There is still debate on, which is the best method to manage these fractures. Grip strength is most used as an outcome measure of functional recovery of patients with distal radius fracture of which the most common tool is hand dynamometer. The study was observational study, which aimed to analyse the comparison of hand grip strength in patients with distal radius fractures that were treated by closed reduction and casting to open reduction and internal fixation twelve months post action. The result of this study indicates that the assessment of handgrip from open reduction internal fixation in the case of distal radius fracture with the results of statistical tests (P> 0.05), which mean there is no significant difference in the strength of hand between the internal fixation and casts after twelve months of action. Grip strength was found to be consistent and reliable outcome measure. It was found by evaluation of grip strength that the outcome of close reduction and casting, and open reduction internal fixation of distal radius fracture are equal and comparable.

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1. Introduction

Distal radial fractures (DRF) are the most frequently witnessed adult orthopaedic fracture.[1] DRF represents approximately one sixth of all fractures.[2] DRFs in younger patients are most commonly associated with high-energy trauma whereas in older patients it is commonly associated with low-energy trauma such as fall from standing position.[3]

The treatment of DRF includes conservative approach and surgical approach.[4] The main goal of treatment is restoration of wrist function and maintenance of radiocarpal and radioulnar joint mechanics at the maximum obtainable level.[5] The choice of treatment is dependent on factors such as age, gender, occupation, dominant hand, hobbies/sports, bone quality, and comorbidity, etc. For example, for elderly patients closed reduction with cast immobilization is inappropriate as they are at increased risk for displacement and prone to poor function recovery.[6]

Assessment of outcome of treatment of DRF can be done using Hand Grip strength ratio. It is the strength of the non-dominant divided by the dominant hand. Factors affecting grip strength include hand dominance, gender, age and nutritional status (height, weight, BMI) as well as total length. It has good inter-rater reliability and it reflects fairly well how much people can use their hands.[7]

The change in the treatment pattern specially inclination towards surgical intervention has necessitated the need to provide appropriate and valid data regarding

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outcome.[8] Thus, this study was undertaken with the aim to compare the hand grip strength in patients with distal radius fractures that are treated by closed reduction and casting to open reduction and internal fixation.[9]

2. Materials and Methods

The present study was conducted with the aim to compare the hand grip strength in patients with distal radius fractures treated by closed reduction and casting to those treated by open reduction and internal fixation.

2.1. Study duration

18 months from 10-01-2020 to 10-07-2022.

2.2. Sample size

58 samples.

The patients were categorized into two groups based on the treatment received:

Group I consisted of patients who were treated conservatively (n=25)

Group II consisted of patients who treated surgically (n=33)

In group, I patients, immobilisation of the hand, with a below, elbow colles cast was done for a period of 6-8 weeks.

In group II patients, the method of fixation included Open Reduction Internal Fixation by Locking Compression Plate, External Fixation and K-WIRE. Multiple bone pieces did not allow fixation with plates and screws, therefore in such cases, an external fixator with or without additional wires was used to secure the fracture.

After the surgery, a splint was placed for 2 weeks until first follow-up visit, at which splint was removed and exchanged with a removable wrist splint for 4 weeks.

Assessment of Hand grip strength was done using a hand grip dynamometer. Patient was asked to holds the grip dynamometer with the elbow flexed to 90° and the radioulnar joint in its neutral position. Dynamometer was set at one of five specified settings (1, 1.5, 2, 2.5, and 3 inches).

Patient was asked to squeeze the dynamometer's handle with maximum force (without holding their breath) at every setting. Adequate recovery time was given between bouts. The values were recorded, and the test was repeated on the opposite hand.

3. Results

The study included 58 patients belonging to two groups.

Group 1- 25 patients who had been treated conservatively

Group 2- 33 patients who had been treated operatively.

The mean DASH score amongst subjects in group 2 was greater than the DASH score in group 1 subjects [(30.36 ± 11.725) vs (23.36 ± 13.561)]. The difference in the mean DASH score of the study subjects belonging to two groups was statistically non-significant (p value >.05).

The hand grip strength of the group 2 subjects was significantly greater than the hand grip strength of the group 1 subjects [(60.00±11.113) vs (57.16±17.700) pounds] (p value <.05).

4. Discussion

The rate of complications in Distal Radius fractures has been reported to vary from 6% to 80%. It can arise due to fracture itself or as a complication of treatment. [$TurnerRG2007$] So, there arises the need to explore the effective treatment modalities for the appropriate management of Distal Radius fractures.

In the present study, comparison of the hand grip strength in patients with Distal Radius fractures that are treated by closed reduction and casting to open reduction and internal fixation has been done.

Age and gender have been reported to be important factors affecting functional outcome one year after Distal Radius fracture treatment.[10] In the present study, the age of the participants in group 1 was 43.7±16.718 years and in group 2 was 37.9±15.050 years. There was no statistically significant difference in the mean age of the subjects belonging to 2 groups (p value >.05). Also, there was no significant difference between two groups based on the proportion of male and female subjects (p value >.05). This non-significant difference shows that the two groups were comparable to each other.

Hand grip strength test measures the maximum isometric strength of the hand and forearm muscles.[11] It reflects fairly well how much people can use their hands.[12] Low grip strength is a predictor of adverse outcomes, such as disability, mobility problems, falls, or mortality.[13] The results of the present study showed thatthe hand grip strength of the group 2 subjects was significantly greater than the hand grip strength of the group 1 subjects [(60.00±11.113) vs (57.16±17.700) pounds] (p value <.05). Indicating towards better functional outcome in patients treated operatively compared to those treated non-operatively. These finding were in agreement with the findings of Arora R et al. (2011), they also reported significantly better hand grip in patients of operative group as compared to non-operative group.[14] Karagiannopoulos C et al. (2013) also reported better hand grip in surgically treated DRF patients of DRF compared to non-surgically treated DRF patients.[15] Saving J et al. (2019) reported both DASH as well as hand grip strength to be better in Volar plating group as compared to non-operative group.[16] In contrast, Hidayat AY et al. (2020) reported non-significant difference in the hand grip strength between surgically and non-surgically treated group.[17]

Egol KA et al. (2010) has documented that diminished grip strength in non-operative group does not seem to limit functional recovery in one year.[18] Similar finding has been

Table 1: Comparison of mean DASH score of study participants belonging to group 1 and group 2

DASH score	Mean	Standard Deviation	F value	P value $^{\Omega}$
Group 1	23.36	13.561	.668	.417
Group 2	30.36	11.725		

$^{\Omega}$Independent 't' test.

Table 2: Comparison of mean grip strength (pounds) of study participants belonging to group 1 and group 2

Grip Strength	Mean	Standard Deviation	F value	P value $^{\Omega}$
Group 1	57.16	17.700	4.541	.037*
Group 2	60.00	11.113		

$^{\Omega}$Independent 't' test. *p value <.05 was considered statistically significant.

reported in the present study.

5. Limitations of the Study

The limitation of the study lies in its cross-sectional design which did not allow comparison of various parameters before and after the treatment which could be helpful in evaluating the effectiveness of the treatment.

6. Conclusion

It can be concluded that:

1. There is no significant difference in the DASH score between DRF patients treated conservatively and surgically.
2. The hand grip strength of surgically treated DRF patients was significantly greater compared to those treated conservatively.
3. There is no significant difference in the range of motion between DRF patients treated conservatively and surgically.

7. Source of Funding

None.

8. Conflict of Interest

None.

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