

Operative vs. Conservative Management of Adult Patients with Distal Radius Fractures: A Systematic Review and Meta-analysis

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Abstract

Background: The distal radius is the maximum common site of fracture within the upper extremity. Dorsal articulations are frequent in distal radius fractures (DRFs) since fall on an outstretched hand is the common mechanism of injury and the dorsal cortex is much weaker at the distal radius end. This dorsal comminution makes the management difficult, and dorsal rim fractures sometimes develop all through dorsal comminution of DRF. **Aim:** This work aims to determine the efficacy and safety of operative vs. conservative management of adult patients with distal radius fractures. **Materials and Methods:** A systematic search was performed over different medical databases to identify orthopedic surgery studies, which studied the outcome of the Operative group versus the Conservative group of adult patients with distal radius fractures. Using the meta-analysis process, either with fixed or random-effects models, we conducted a meta-analysis on Disabilities of the Arm, Shoulder, and Hand (DASH) score, as a primary outcome, and on overall complications rate as a secondary outcome. **Results:** Seven studies were identified involving 14279 patients, with 4025 patients in the Operative group, and 10254 patients in the Conservative group. The meta-analysis process revealed a significant decrease in the mean DASH score in the Operative group compared to the Conservative group ($p=0.022$). On the other hand, we found a non-significant difference in overall complications rate in the Operative group compared to the Conservative group ($p>0.05$). **Conclusion:** To conclude, our meta-analysis implies that operative management of distal radius fractures helps to improve the medium-term DASH score as compared to non-operative treatment in adults, with no difference in overall complication rate. Also, we found that operative treatment is more effective but has greater drawbacks.

Keywords: Distal radius fractures; Operative; Conservative

Introduction

The distal radius is the maximum common site of fracture within the upper extremity. Dorsal articulations are frequent in distal radius fractures (DRFs), since fall on an outstretched hand is the common mechanism of injury and the dorsal cortex is much weaker at the distal radius end. This dorsal comminution makes the management difficult, and dorsal rim fractures sometimes develop all through dorsal comminution of DRF. ^[1] A distal radius fracture (DRF) is normally related to an ulnar styloid fracture (USF). In spite of a rationale that indicates a USF can also get worse prognosis for complete functional recovery, most research pronounced a negligible effect on outcomes. The short-term effects of surgically or non-surgically handled DRFs analyzing the have an impact on of an accompanying USF. The results revealed that USF patients had a higher pain score and lower function scores the effects showed there has been no

significant difference between the groups regarding the joint range of motion, grip strength, or patient associated scores. ^[2]

One in six fractures is a distal radius fracture. Nearly two-thirds of those fractures are displaced and need to be reduced. For displaced distal radius fractures handled with an adequate closed reduction, there may be no consensus whether or not those patients must be offered surgical procedure or now not. Each non-operative management with plaster immobilization and

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open reduction and internal fixation displays proper functional effects. Even though secondary displacement following closed reduction and plaster immobilization is ranging between 43% and 60% and increases with age, several global recommendations still advocate non-operative management for displaced DRFs with an adequate closed reduction. [3]

Several different immobilization techniques for the non-operative treatment of DRFs have been defined. These techniques include functional bracing, the immobilization of the wrist in the neutral and slightly extended role or in pronation or supination. [4]

This work aims to determine the efficacy and safety of operative vs. conservative management of adult patients with distal radius fractures.

Literature Review

Our review came following the (PRISMA) statement guidelines. [5]

Study eligibility

The included studies should be in English, a journal published article, and a human study describing adult distal radius fractures patients.

The excluded studies were non-English or animal studies or describing pediatric patients.

Study identification

Basic searching was done over the PubMed, Cochrane library, and Google scholar using the following keywords: Distal radius fractures, Operative, Conservative.

Data extraction and synthesis

RCTs, clinical trials, and comparative studies, which studied the outcome of the Operative group versus Conservative group of adult distal radius fractures patients, will be reviewed.

Outcome measures included the DASH score (as a primary outcome), and overall complications rate (as a secondary outcome).

Study selection

We found 450 records, 390 excluded based on title and abstract review; 60 articles are searched for eligibility by full-text

review; 23 articles cannot be accessed; 13 studies were reviews and case reports; 10 were not describing functional outcome; the desired procedure not used in 7 studies leaving 7 studies included in our meta-analysis.

Statistical methodology

The pooling of data, Proportions (%), Odds Ratios (ORs), Standard Mean Differences (SMDs), with 95% confidence intervals (CI) were done, using MedCalc 18.11.3 (MedCalc, Belgium). According to heterogeneity across trials using the I²-statistics; a fixed-effects model or random-effects model were used in the meta-analysis process.

Results

The included studies published between 2011 and 2020. Regarding the type of included studies, 3 studies (out of 7 studies) were RCTs, 3 studies were retrospective cohort study, while 1 study was a prospective cohort study [Table 1]. [6-12] Regarding patients' characteristics, the total number of patients in all the included studies was 14279 patients, with 4025 patients in the Operative group, and 10254 patients in the Conservative group, while their average follow-up time was (12 months) [Table 1].

The mean age of all patients was (67 years) [Table 1].

A meta-analysis study was done on 7 studies that described and compared the 2 different groups of patients; with an overall number of patients (N=14279) [Table 2]. [6-12]

Each outcome was measured by:

Standard Mean Difference (SMD)

- For the DASH score.

Odds Ratio (OR)

- For overall complications rate.

Concerning the primary outcome measure, we found 6 studies reported the DASH score with a total number of patients (N=566). I² (inconsistency) was 67.2% with a highly significant Q test for heterogeneity (p=0.0094), so random-effects model was carried out; with overall SMD= -0.347 (95% CI=-0.645 to -0.0501). Using the random-effects model, the meta-analysis process revealed a significant decrease in the mean DASH score in the Operative group compared to the Conservative group (p=0.022) [Figure 1].

Table 1: Patients and study characteristics.

N	Author	Study Design	Number of patients			Age (Average years)	Follow-up time (Average months)
			Total	Operative group	Conservative group		
1	Arora et al. [6]	RCT	73	36	37	76.5	12
2	Tan et al. [7]	RCS	63	31	32	64	14
3	Bartl et al. [8]	RCT	149	68	81	75	12
4	Larouche et al. [9]	PCS	129	70	59	64.6	12
5	Toon et al. [10]	RCS	60	32	28	55	12
6	Mulders et al. [11]	RCT	92	48	44	60	12
7	DeGeorge Jr. et al. [12]	RCS	13713	3740	9973	75	---

*Studies arranged via publication year. RCT: A Randomized Controlled Trial. PCS: Prospective Cohort Study; RCS: Retrospective Cohort Study.

Table 2: Summary of outcome measures in all studies.

N	Author	Primary outcome DASH score				Secondary outcome Overall complications rate	
		Operative group	SD	Conservative group	SD	Operative group	Conservative group
1	Arora et al. [6]	5.7	11.1	8	9.3	13	5
2	Tan et al. [7]	9	12	28	22	7	20
3	Bartl et al. [8]	14	16.1	19	21.3	8	10
4	Larouche et al. [9]	10.9	14.7	11	11.9	---	---
5	Toon et al. [10]	16.2	17.4	16.1	17.7	1	0
6	Mulders et al. [11]	2.5	9.4	9.2	10.8	16	15
7	DeGeorge Jr. et al. [12]	---	---	---	---	1150	2356

Discussion

This work aims to determine the efficacy and safety of operative vs. conservative management of adult patients with distal radius fractures. The included studies published between 2011 and 2020. Regarding the type of included studies, 3 studies (out of 7 studies) were RCTs, 3 studies were retrospective cohort study, while 1 study was a prospective cohort study. Regarding patients' characteristics, the total number of patients in all the included studies was 14279 patients, with 4025 patients in the Operative group, and 10254 patients in the Conservative group, while their average follow-up time was (12 months).

The mean age of all patients was (67 years). A meta-analysis study was done on 7 studies that described and compared the 2 different groups of patients; with an overall number of patients (N=14279).

Concerning the primary outcome measure, we found 6 studies reported the DASH score with a total number of patients (N=566). Using the random-effects model, the meta-analysis process revealed a significant decrease in mean DASH score in Operative group compared to Conservative group (p=0.022), which came in agreement with Chen et al., [13] Ochen et al., [14] Song, Yu, and Li [15] and Lee et al. [16]

Chen et al. reported that the dash score became used in 7 researches and the PRWE score was used in four researches. Differences suggested that wrist function was better amongst patients in the operative group. [13]

Ochen et al. reported that a total of 23 specific research had been included, consisting of 8 RCTs and 15 observational studies, that described 2254 unique patients. Among the studies that presented sex data, 1769 patients were women [80.6%]. Overall weighted mean age was 67 years). The RCTs included 656 patients (29.1%); observational research, 1598 patients (70.9%). the overall pooled impact estimates the confirmed a significant improvement in medium-term (<1 year) dash score after operative treatment in comparison with non-operative treatment (MD, =5.22; P=.005). [14]

Song, Yu, and Li reported that three articles have been screened out to assess the dash scores. The conservative treatment achieved significantly higher dash rankings when in comparison with operative treatment at three months (mean difference, 7.03; P<0.01). [15]

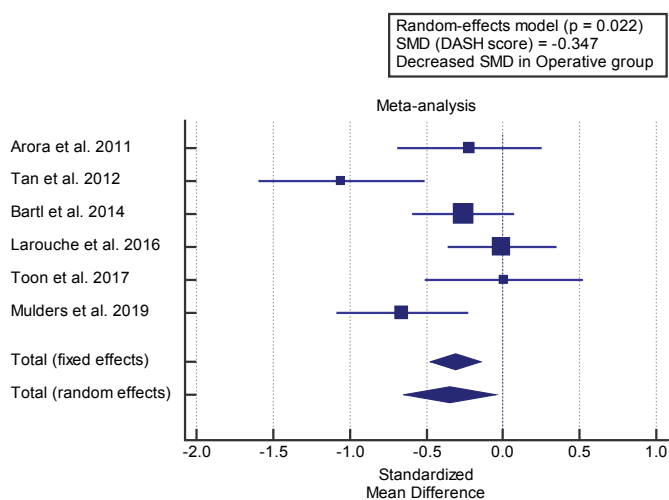


Figure 1: Forest plot demonstrating (DASH score).

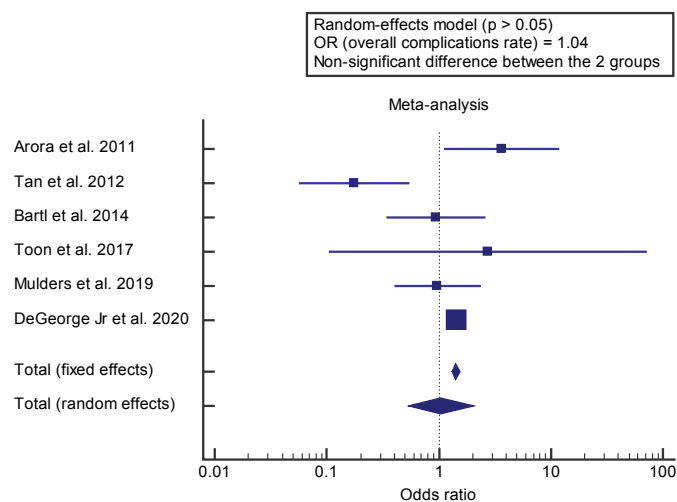


Figure 2: Forest plot demonstrating (overall complications rate).

Concerning the secondary outcome measure, We found 6 studies reported overall complications rate with a total number of patients (N=14150). I² (inconsistency) was 72% with a highly significant Q test for heterogeneity (p=0.0031), so random-effects model was carried out; with overall OR= 1.04 (95% CI=0.529 to 2.05). Using the random-effects model, the meta-analysis process revealed a non-significant difference in overall complications rate in the Operative group compared to the Conservative group (p>0.05) [Figure 2].

Lee et al. reported that, over the study period, all patients exhibited significant improvements in their wrist flexion-extension range, supination-pronation range, DASH score, and modified Mayo wrist score [16].

Our result came in disagreement with Mulders et al., [3] Barai et al., [17] and Ju et al. [18]

Mulders et al. reported that age was 62 years and 79% was female. Fractures were classified according to the AO/OTA classification as follows: AO/OTA type A (49%), AO/OTA type B (3%), AO/OTA type C (48%). After 12 months the median DASH score was 15. Forty-six (40%) patients underwent subsequent surgery due to a secondary displacement or symptomatic malunion. No significant differences in DASH scores between patients who were treated non-operatively and patients who received subsequent surgery were found. [3]

Barai et al. reported that, out of the 229 patients whom we contacted, 128 patients responded. The response rate was 56%. Most people of the patients belonged to the conservative group (n=87, 75%), while one-quarter of the patients have been in the ORIF group (n=29, 25%). dash score was higher in the ORIF group (median=12.1, 95% Confidence Interval 5.6–25) than the conservative group (median=6, 95% confidence interval 1.7–16.4). This difference between the groups was statistically significant (unadjusted P=0.017, Wilcoxon test). [17]

Ju et al. reported that, of 59 articles diagnosed, 8 studies with a total of 440 patients in the surgical organizations and 449 within the control groups were included in the evaluation. No significant differences in DASH rating, VAS ache score, grip strength, wrist extension, pronation, or supination, and ulnar deviation had been noted among the groups. [18]

Concerning the secondary outcome measure, we found 6 studies reported overall complications rate with a total number of patients (N=14150). Using the random-effects model, the meta-analysis process revealed a non-significant difference in overall complications rate in Operative group compared to Conservative group ($p>0.05$), which came in agreement with Ochen et al., [14] Ju et al., [18] Chen et al., [13] Song, Yu, and Li, [15] Lee et al. [16] and Sato and Nasu. [19]

Ochen et al. reported that a total of 23 unique studies were included, consisting of 8 RCTs and 15 observational studies that described 2254 unique patients. Among the studies that presented sex data, 1769 patients were women [80.6%]. Overall weighted mean age was 67 years). The RCTs included 656 patients (29.1%); observational studies, 1598 patients (70.9%). The overall pooled effect estimates the showed no difference in complication rate was observed (RR, 1.03; $P=0.87$). [14]

Ju et al. reported that meta-analysis additionally observed that internal fixation resulted in better functional outcomes, supination, restoration of anatomic volar tilt and radial inclination, and fewer surgical complications than external fixation. Randomized patients with intra-articular DFRs to receive either external fixation or ORIF and observed no

differences in clinical or radiological outcomes or complications between the two techniques. [18]

Chen et al. reported that complications happening after treatment have been subdivided into minor and major according to a demonstrated complication checklist developed by way of McKay and colleagues. 20 complications now not requiring surgical treatment (i.e., superficial wound infections, complicated regional pain syndrome [CRPS], steroid injection, and physiotherapy) or further investigations (i.e., electromyography) inside the studied populations were graded as minor. 11, 14, 20, 21 major complications included deep infections, nerve or tendon injury, and hardware loosening or failure that caused reoperation. Complications stated by way of the included research. No significant difference in minor complications was determined among the operative and nonsurgical groups ($P=0.78$). [13]

Song, Yu, and Li reported that the databases had been derived from seven qualified studies that included a total of 523 patients in which 269 cases adopted conservative remedy while 253 cases followed operative remedy. overall, as compared with the conservative treatment- treated the distal radius fracture, operative treatment plans resulted in significantly better radiographic ($P<0.05$), however, no significant differences in the functional outcomes and complication rate had been found among the two strategies. [15]

Lee et al. reported that, when they compared the clinical outcomes at the final follow-up, they found that the clinical outcomes were not affected by the presence or absence of ulnar styloid process fracture. No significant differences were observed when we compared the conservative and operative treatment groups. [16]

Sato and Nasu reported precise results and found no correlations among radiographic and functional results. Those results indicate that DRUJ incongruence may have little efficacy in combined DRFs and DUFs. Potential headaches exist regarding plate fixation of DUFs, making non-intervention a good choice. [19]

Conclusion

To conclude, our meta-analysis implies that operative management of distal radius fractures helps to improve the medium-term DASH score as compared to non-operative treatment in adults, with no difference in overall complication rate. Also, we found that operative treatment is more effective but has greater drawbacks.

Competing Interests

The authors declare that they have no competing interests. All the listed authors contributed significantly to the conception and design of study, acquisition, analysis, and interpretation of data and drafting of the manuscript, to justify authorship.

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