

To Compare Mean Dash Score at 12 Weeks in Distal Radius Fracture Patients Treated Operatively (ORIF Group) Versus Those Treated Non-Operatively (CAST Group)

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ABSTRACT

Aim: To compare wrist function by mean of DASH score at 12 weeks in distal radial fracture patients treated operatively (ORIF group) versus those treated non-operatively (CAST group).

Methodology: The randomized controlled trial was conducted at The Indus Hospital Karachi, which is a tertiary care hospital from 1st January 2017 to 30th June 2017 and the 12 weeks follow up was taken after the recruitment of the last patient and 96 patients were enrolled. Patients in the operative group were treated with a volar locking plate. Reduction and stabilization of fracture were done with the application of 2.7mm volar locking titanium distal radius anatomically contoured implants. Non-operative Treatment Protocol was that All patients were complete a six weeks immobilization in a splint. One repeated manipulation if needed was accepted in the first 3 weeks. Passive and active finger motion from the starting was encouraged. Formal physiotherapy in this group was started 6 weeks after the removal of the cast. In the twelfth week, the functional assessment was examined by a physiotherapist or orthopaedic resident in both the Cast group and ORIF.

Results: Thirty (31.3%) were in operative and 66(68.8%) were in non-operative group. No significant difference were found in age, height, weight, and BMI between both the groups (Mean: 42.7 vs 41.6 years, $p=0.644$; 156.5 vs 156.4 cm, $p=0.962$, 61.0 vs 59.5 kg, $p=0.557$, 24.9 vs 24.5, $p=0.395$ respectively). Moreover, distribution of gender, dominant hand, and injured hand was also similar in both the groups ($p=0.427$, $p=0.587$, and $p=0.673$). DASH score were found to be significantly lower in operative group as compared to non-operative cast group (median 17.5 vs 28.8, $p<0.0001$, mean 16.6 vs 27.9, $p<0.0001$).

Conclusion: At 12 weeks volar locking plates significantly produced better clinical and functional outcomes as compared with the treatment by Cast. The significantly anatomical reduction was more possible to be conserved in the operating group, but in the operative group, early mobilization achieved is the key to better achieving functional outcomes.

Keywords: Distal radius extra-articular fractures, DASH score, Wrist function

INTRODUCTION

Distal radius fractures show 1/6th of all fractures handled in the department of emergency¹, making ten to fifteen percent of all fractures². Cast immobilization and closed reduction have been the main support for these fractures' treatment however, it might cause cosmetic outcomes, poor functional outcomes and malunion in some patients³. Maintenance and restoration of anatomy relate to the functional outcome well. As a malunion result, the wrist residual deformity is unsightly. Moreover, it puts the indicator at a mechanical disadvantage because of interference with soft tissue function and normal bone alignment⁴⁻⁶. There is a common agreement that in younger patients there is a connection between good function and anatomy restoration⁷.

Several options of treatment are available including an internal fixation with "volar locking plates (ORIF)", open reduction, external fixator application, K wire fixation, plaster immobilization and closed reduction. Cast application and closed reduction are convenient and simple options. However, hospitalization is required by the volar locking plate's internal fixation process but it enables early functional rehabilitation. Considering the randomized controlled trials' lack it remains unclear whether ORIF leads to improved functional results than casting and closed reduction in younger patients, however, in a few studies it has been revealed that there isn't any substantial difference between the functional and subjective outcomes for the non-surgical and surgical treatment in patients more than sixty-five years old⁸. In the older patient further outcome of unsatisfactory radiology has no link with unsatisfactory functional result⁷, even the patients with high activity⁹. However, on the other side, it has been revealed by one research that surgical distal radius fracture fixation shows a major difference in functional results favouring ORIF as compared to ex

In this study, we evaluate largely younger people having distal radius fractures. Attaining better function of the wrist in this age population is very important because it determines their ability to work and their quality of life. If we have to find that in functionality (determined by the DASH score), surgical fixation achieves better results, our orthopaedic team would need to consider and re-evaluate changing practice in younger patients in favour of surgical intervention instead of generally used non-surgical casting.

MATERIALS AND METHODS

This randomized controlled trial was conducted at The Indus Hospital Karachi, which is a tertiary care hospital. The duration of the study was 6 months and the 12 weeks follow up was taken after the recruitment of the last patient. Institution Review Board (IRB) approval was acquired before the start of the study. The sample size was 96 patients, with sixty-six patients from the non-operative group and thirty patients from an operative group based on the Arora study⁸. The consecutive technique of non-probability was used for all patients who satisfy the inclusion criteria at The Indus Hospital, Karachi. Inclusion criteria were patients of age ranging from 18 to 65 years, patients of both genders male and female giving informed consent, distal radius extra-articular fractures (23 A2, 23 A3) that are radiologically confirmed and fractures less than 1 week old.

Exclusion criteria were patients not giving consent, distal radius complete articular fractures (23 C1, 23 C2, 23 C3) confirmed radiologically, distal radius partial articular fractures (23 B1, B2, B3) confirmed radiologically, dependent patients who needed help with daily activities, previous fracture of the same wrist, bilateral wrist and open fractures and ipsilateral limb injuries confirmed by history, examination and radiologically. Fractures in patients with open distal radius physis confirmed by history, examination and radiologically and fractures more than 1 week old were also excluded. Their fractures were initially be reduced under

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sedation (Midazolam, 2mg once, stat IV before the start of the procedure, followed by 1 mg. to be repeated if required during the manipulation) and analgesia (Nalbuphine according to patient weight, 0.1 mg /kg) in the emergency department.

The member of the team would open the envelopes sealed given by "the Clinical Research Unit (CRU) of Indus Hospital Research Center" that gives the research arm allocation after the fracture of the patient is immobilized with a "U-splint" by the orthopaedics team member. The SNOSE protocol would be followed by the envelopes i.e. they were numbered sequentially, opaque sealed envelopes. The research team member before opening this envelope would write the date, patient study identifier, and their signs on the envelope's front. Moreover, the envelope includes carbon paper that transfers the signature, date and patient identifier to the allocation paper of treatment inside.

The patients who fall in the operative treatment group (ORIF group A) were booked for surgery and those in the non-operative group (Cast group B) continued in splint immobilization. Patients in the operative group were treated with a volar locking plate. Under general anaesthesia, surgery was performed. Reduction and stabilization of fracture were done with the application of 2.7mm volar locking titanium distal radius anatomically contoured implants. No wrist immobilization with a cast was done. The supportive dressing was used along with a removable wrist splint. Immediately, an active digital motion range would be started. Sutures, 10 days after surgery were removed and also physiotherapy with passive and active wrist mobilization would be started on the removable splint. Non-operative Treatment Protocol was that All patients were complete a six weeks immobilization in a splint. One repeated manipulation if needed was accepted in the first 3 weeks. Passive and active finger motion from the starting was encouraged. Formal physiotherapy in this group was started 6 weeks after the removal of the cast. In the twelfth week, the functional assessment was examined by a physiotherapist or

orthopaedic resident in both the Cast group and ORIF. By using the DASH questionnaire functional subjective result was measured. Data were collected on two proformas. Proforma 1 will have injury information, date of trauma, gender, and age, and proforma 2 will be the DASH questionnaire administered at 12 weeks post-treatment. Data was analyzed and entered by using "SPSS version 21". For all the constant variable age, the mean was computed. Percentage and frequency were calculated for all categorical variables, injury hand, dominant hand, and gender. To check the difference in DASH score among the non-operative and operative groups, an "independent sample T-test" was applied. Moreover, p-value less than 0.05 were seen as significant.

RESULTS

There were 30(31.3%) patients in operative group and 66 (68.8%) in non-operative group. 65 (67.7%) were females and 31(32.3%) were males (Fig. 1). Almost all the patients had right dominant hand. No significant difference were found in age, height, weight, and BMI between both the groups (Mean: 42.7 vs 41.6 years, p=0.644; 156.5 vs 156.4 cm, p=0.962, 61.0 vs 59.5kg, p=0.557, 24.9 vs 24.5, p=0.395 respectively (Table 1). Moreover, distribution of gender, dominant hand, and injured hand was also similar in both the groups (p=0.427, p=0.587, and p= 0.673), showing that the randomization was successful and there were no differences in patients' characteristics between both the groups. Additionally distribution of dominant and injured hand is almost same in both genders (Table 2).

Furthermore, DASH score were found to be significantly lower in operative group as compared to non-operative cast group (median 17.5 vs 28.8, p<0.0001, mean: 16.6 vs 27.9, p<0.0001 (Fig-2).

Table 1: The treatment given to patients in operative-ORIF and non-operative (CAST) group

Variable	Operative –ORIF (n=30)			Non-Operative –CAST (n=66)			P value
	Mean±SD	Min-Max	Median (IQR)	Mean±SD	Min-Max	Median (IQR)	
Age in year	42.7±9.2	21–60	43 (35-50)	41.6±12.7	18-60	42.5 (33-54)	0.644†
Height (cm)	156.5±9.0	140–175	155.5 (152-162)	156.4±10.7	122-175	155 (151-165)	0.962†
Weight (kg)	61.0±11.8	35–87	61 (53.5-68.5)	59.5±11.7	42-83	58 (49.5-69)	0.557†
BMI	24.9±4.6	16.9-36.8	25.5 (21.8-27.8)	24.5 ± 5.3	16.1-38	23.9 (20.4-27.6)	0.395‡

†Independent sample T-test, ‡Mann-Whitney U test

Table 2: Patients variables

Variable	Gender		Total	P value
	Female	Male		
Dominant hand				
Right	61 (93.8%)	31 (100%)	92 (95.8%)	0.301
Left	4 (6.2%)	-	4(4.2%)	
Total	65 (100%)	31 (100%)	96 (100%)	
Injured hand				
Right	29(43.1)	13(43.3)	42(43.2)	0.981
Left	37(56.9)	17(56.7)	54(56.8)	
Total	66(100)	30(100)	96(100)	

Fig. 1: Frequency of gender in operative and Non-operative (CAST) group

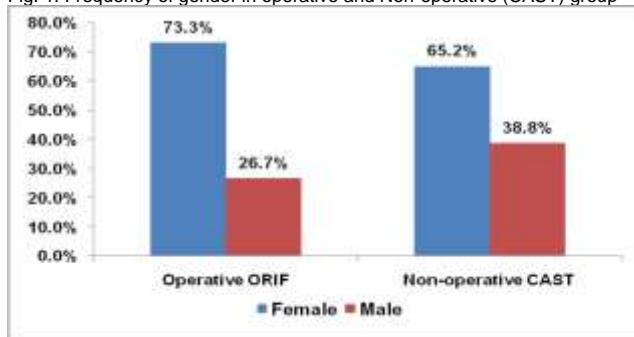
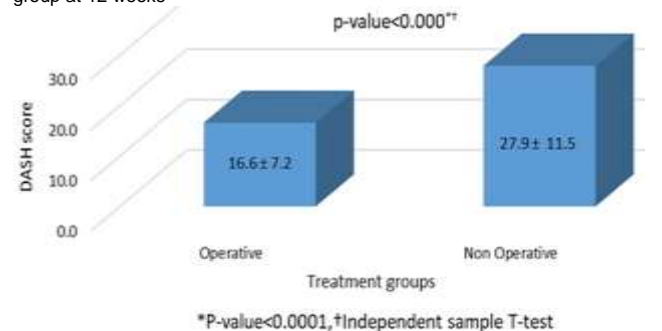


Fig. 2: Difference in dash score between the operative and non operative group at 12 weeks



DISCUSSION

Distal radius fractures constitute around 31.3% of all fractures handled in the department of emergency. In the orthopaedics emergency department, the most commonly seen injury is distal radius fractures because of increased industrialization and the number of cars on road. Range of fracture covers simple extra-articular fractures to intra-articular highly comminuted fractures¹¹. The fractures in the elderly population are resulting usually by low energy injuries and the fractures in young adults are resulting usually by high energy injuries. The majority of fractures are treated effectively with immobilization in a plaster cast and with closed reduction¹². It is accepted well that the disrupted radial anatomy restoration, normal hand mobilization, and maintenance of stable and accurate reduction are needed for good functional outcomes in fractures of distal radius¹³. The non-operative treatment rate in recent years has declined, similarly to the internal fixation rate and specifically "volar locking plate fixation" has exponentially increased¹⁴.

In males, the higher fracture rate correlates clearly with the male's lifestyle, particularly in our world. Moreover, in outdoor activities, the males are involved more and young males are enthusiastic more about life and also they are careless drivers. Usually, females have an inactive lifestyle and they are involved less in driving which is a common reason. Moreover, in the setup of Pakistan, the population of females works largely in the agricultural field or indoors and doesn't travel more often. The distal radius fracture incidence is bimodal, with the majority incidences in older (females predominantly) patients and young (male predominantly) patients. This fracture type in young adults is caused by high-energy trauma. More often, fractures in older adults are caused by low-energy trauma^{15,16}. Furthermore, it has been evaluated that a woman at fifty years of age has a 16.6 percent remaining risk of a lifetime of bearing fractures of the distal radius, however, a man has a remaining risk of a lifetime of just 2.9%¹⁷. The majority of patients in our study were females. 67.7% of patients (n=65) from a total of 96 patients were females and the male population is 32.3 percent patients (n=31) with a 3:1 female to male ratio. However, Herwig Drobotz provided the ratio of female to male is 1.6:1, which also support our study¹⁸. Another study done by Chuang Ma stated male to the female ratio is 1.1:1¹⁹.

The minimum patient age in this study was eighteen years and the maximum patient age was sixty-five years. In this study, the mean patient age was 41.6±12.7 years in the non-operative group and 42.7±9.2 years in the operative group. In our study, the fractures of the distal radius were common mostly in the second and third decades. In old age patients, the other studies show higher fracture incidence, but since our study did not include the old age population thus it cannot be compared to our study. The average patient age as per Francesco Franceschi revealed was 60.1±10.3 years²⁰. Sharma and Bartl conducted another international research that showed mean patient ages respectively 48.1 and 74.4 years²¹. The common fracture side in our study was 41(43.2%) right side fracture cases and 54(56.8%) left side fractures. Whereas in Chere McCamley's study, 90.9% of hand dominance cases were reported²², and another research done by Chuang Ma reported 55.17% of left-hand cases. However, in our research almost all the sample patients had right-hand cases (95.8%).

The DASH score is a 30-item upper-extremity specific outcome, validated questionnaire that evaluates "upper extremity disability" on symptoms and physical function. Jointly it was developed by the "American Academy of Orthopaedic Surgeons (AAOS)" and "Institute for Work & Health". If more than 3 items are missing the DASH must not be scored.

Any joints in the upper limbs could be assessed by using DASH. The score basically ranges from zero points, showing no prominent functional disability, to hundred points showing complete disability. Moreover, 4 items and 2 optional modules are incorporated in the questionnaire of DASH. The first examines

function in the worker's upper limb whose daily living needs a high physical activity level whereas the 2nd is produced to examine function in people engaged in performing arts or in athletics.

The questionnaire of "Disabilities of the Arm, Shoulder and Hand (DASH)" is a questionnaire reported by a patient that was produced to measure activity limitation and physical symptoms related to any joint condition of the upper extremity. The outcome measure of DASH has undergone extensive responsiveness, validity and reliability testing and it has been usually used to examine dysfunction of the upper extremity in several different musculoskeletal disorder^{23,24}. From zero to a hundred a score is yielded by questionnaires; higher scores show greater disability. At baseline, at three months the questionnaire was finished. Here scores are presented with the scores of baseline subtracted.

The mean DASH score in our study was significantly found to be lower in the operative group in contrast with the non-operative cast group (16.6 vs 27.9, p<0.0001). Moreover, notable differences were found in mean scores of DASH between the genders (female vs men: 26.6 vs 19.8, p=0.006). But some international studies were selected to evaluate the scores of DASH^{8,12,21}. Significant higher score of DASH was achieved by the conservative treatment when compared with the operative treatment ("mean difference, 7.03; 95% CI, 2.33 to 11.74; P<0.01"). Whereas in Chere McCamley's study reported a score of DASH observed at twelve months in both group cast and volar locking plates were 13.4 and 15.0 respectively²².

CONCLUSION

At 12 weeks volar locking plates significantly produced better clinical and functional outcomes as compared with the treatment of Cast in "distal radius extra-articular fractures (23 A2, 23 A3)" evaluated by a questionnaire of DASH score. The significantly anatomical reduction was more possible to be conserved in the operating group, but in the operative group, early mobilization achieved is the key to better achieving functional outcome

Conflict of interest: Nothing to declare

REFERENCES

1. Das AK, Sundaram N, Prasad TG, Thanavelu SK. Percutaneous pinning for non-comminuted extra-articular fractures of distal radius. *Indian J Orthop* 2011;45(5):422-6.
2. Yangyang RY, Makhni MC, Tabrizi S, Rozental TD, Mundanthanam G, Day CS. Complications of low-profile dorsal versus volar locking plates in the distal radius: a comparative study. *J Hand Surg Am* 2011;36(7):1135-41.
3. Gofton W, Liew A. Distal radius fractures: nonoperative and percutaneous pinning treatment options. *Orthop Clin North Am* 2007;38(2):175-85.
4. Fernandez DL. Correction of post-traumatic wrist deformity in adults by osteotomy, bone-grafting, and internal fixation. *J Bone Joint Surg Am* 1982;64(8):1164-78.
5. Fernandez DL. Radial osteotomy and Bowers arthroplasty for malunited fractures of the distal end of the radius. *J Bone Joint Surg Am* 1988;70(10):1538-51.
6. Fernandez DL, Jupiter JB. Fractures of the distal radius: a practical approach to management: Springer Science & Business Media; 2002.
7. Arora R, Gabl M, Gschwentner M, Deml C, Krappinger D, Lutz M. A comparative study of clinical and radiologic outcomes of unstable colles type distal radius fractures in patients older than 70 years: nonoperative treatment versus volar locking plating. *J Orthop Trauma* 2009;23(4):237-42.
8. Arora R, Lutz M, Deml C, Krappinger D, Haug L, Gabl M. A prospective randomized trial comparing nonoperative treatment with volar locking plate fixation for displaced and unstable distal radial fractures in patients sixty-five years of age and older. *J Bone Joint Surg Am* 2011; 93(23):2146-53.
9. Nelson GN, Stepan JG, Osei DA, Calfee RP. The impact of patient activity level on wrist disability after distal radius malunion in older adults. *J Orthop Trauma* 2015;29(4):195-200.
10. Wei DH, Poolman RW, Bhandari M, Wolfe VM, Rosenwasser MP. External fixation versus internal fixation for unstable distal radius fractures: a systematic review and meta-analysis of comparative clinical trials. *J Orthop Trauma* 2012;26(7):386-94.

11. Hanumantharaya G, Sundaresh K. Functional and radiological outcome of percutaneous pinning in the management of extra-articular distal radius fractures. *Int J Orthop* 2017; 3(3): 992-5.
12. Sharma H, Khare GN, Singh S, Ramaswamy AG, Kumaraswamy V, Singh AK. Outcomes and complications of fractures of distal radius (AO type B and C): volar plating versus nonoperative treatment. *J Orthop Sci* 2014; 19(4):537-44.
13. Bolmers A, Luiten WE, Doornberg JN, Brouwer KM, Goslings JC, Ring D, et al. A comparison of the long-term outcome of partial articular (AO Type B) and complete articular (AO Type C) distal radius fractures. *J Hand Surg Am* 2013; 38(4):753-9.
14. Chung KC, Shauver MJ, Birkmeyer JD. Trends in the United States in the treatment of distal radial fractures in the elderly. *J Bone Joint Surg Am* 2009;91(8):1868-73.
15. Karl JW, Olson PR, Rosenwasser MP. The Epidemiology of Upper Extremity Fractures in the United States, 2009. *J Orthop Trauma* 2015; 29(8):e242-4.
16. MacIntyre NJ, Dewan N. Epidemiology of distal radius fractures and factors predicting risk and prognosis. *J Hand Ther* 2016;29(2):136-45.
17. Lameijer CM, Ten Duis HJ, Dusseldorp IV, Dijkstra PU, van der Sluis CK. Prevalence of posttraumatic arthritis and the association with outcome measures following distal radius fractures in non-osteoporotic patients: a systematic review. *Arch Orthop Trauma Surg* 2017; 137(11):1499-513.
18. Drobetz H, Koval L, Weninger P, Luscombe R, Jeffries P, Ehrendorfer S, et al. Volar locking distal radius plates show better short-term results than other treatment options: A prospective randomised controlled trial. *World J Orthop* 2016;7(10):687.
19. Ma C, Deng Q, Pu H, Cheng X, Kan Y, Yang J, et al. External fixation is more suitable for intra-articular fractures of the distal radius in elderly patients. *Bone Res* 2016;4:16017.
20. Franceschi F, Franceschetti E, Paciotti M, Cancilleri F, Maffulli N, Denaro V. Volar locking plates versus K-wire/pin fixation for the treatment of distal radial fractures: a systematic review and quantitative synthesis. *Br Med Bull* 2015;115(1):91-110.
21. Bartl C, Stengel D, Gebhard F, Bruckner T, ORCHID SG. The treatment of displaced Intra-articular distal radius fractures in elderly patients: a Randomized Multi-center Study (ORCHID) of open reduction and volar locking plate fixation versus closed reduction and cast immobilization. *Dtsch Arztebl Int* 2014; 111(46): 779.
22. McCamley C, Tamblyn P, Watts A. Fractures of the Distal Radius: A Randomized Controlled Trial of 180 Patients Comparing Volar Locking Plates and Alternative Fixation Methods 2016.
23. SooHoo NF, McDonald AP, Seiler JG, 3rd, McGillivray GR. Evaluation of the construct validity of the DASH questionnaire by correlation to the SF-36. *J Hand Surg Am* 2002; 27(3):537-41.
24. Wilcke MT, Abbaszadegan H, Adolphson PY. Evaluation of a Swedish version of the patient-rated wrist evaluation outcome questionnaire: good responsiveness, validity, and reliability, in 99 patients recovering from a fracture of the distal radius. *Scand J Plast Reconstr Surg Hand Surg* 2009;43(2):94-101.