

# Comparative Study between Volar Locked Plate versus Conservative Treatment in Unstable Distal Radius Fractures in Elderly Patients

Zeyad Alameer AbdAlkader<sup>1</sup>, MBBCh; Hany Zaky Saeed<sup>2</sup>, MD and Mohamed A Omar<sup>3</sup>, MD

Department of orthopedic surgery, Faculty of Medicine for Girls, Al-Azhar University, Egypt. Al Helal hospital Cairo, Egypt.

1. Resident doctor at the department of orthopedic surgery, Al Helal hospital, Cairo.

2. Professor at Department of Orthopaedic Surgery, Al-Azhar Faculty of Medicine for Girls, Cairo

3. Lecturer at Department of Orthopaedic Surgery, Al-Azhar Faculty of Medicine for Girls, Cairo

Corresponding author: Zeyad Alameer Abd Alkader, Mbbch  
Email: zyaad90@yahoo.com  
Mobile: 00201151421161

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## Abstract

### Background

Fractures of the distal radius are one of the most common orthopedic fractures in older populations. Decision making for distal radius fractures in active elderly patients (aged 65 years and above with independent lifestyle) can be difficult.

**This prospective study aims** to compare the clinical and radiological outcomes of the management of articular and extra-articular unstable distal radial fractures with volar locked plates versus conservative treatment in elderly patients.

### Patients and methods

The study included 40 patients with distal radial fractures admitted to Al-Zahraa University Hospital and Al-Helal hospital within the period between June 2019 and September 2020. The cases were divided into two groups each of 20 patients according to the management as follows; group A that included the cases who underwent treatment with conservative treatment and group B that included the cases who underwent fixation by volar locked plate. The follow-up included radiological assessment and functional assessment (Range of motion of the wrist and (DRUJ), grip strength, Mayo wrist score, and DASH score).

### Results

In this study, The grip strength values at 3 and 6 months in the volar locked plate group were statistically significantly higher as compared with the conservative treatment group. The radial height and volar tilt values were statistically significant difference higher in the volar locked plate group as compared with the conservative treatment group at both 3 and 6 months. The mean Quick dash score at 3 and 6 months in the conservative treatment group was higher as compared with the volar locked plate group, but it didn't reach a statistically significant value. The mean mayo score at 3 and 6 months in the conservative treatment group was lower as compared with the volar locked plate group, but it didn't reach a statistically significant value.

### Conclusion

No superiority was detected regarding the different radiological and functional outcomes for the volar locked plate technique over the conservative management except for the grip strength, radial height, and volar tilt

### Keywords

Distal Radius Fracture, Cast Immobilization, Volar Locked Plating, Functional Outcome, Conservative Distal Radius.

## Introduction

Fractures of the distal radius are the most common fracture of the upper extremity, it represents approximately one-sixth of all fractures treated in emergency [1]. The incidence of distal radius fractures is expected to increase by 50% by the year 2030 as the population in industrial countries continues to age and life expectancies increase. Osteoporosis contributed to an estimated 397000 wrist fractures in 2005, accord-

ing to the National Osteoporosis Foundation [2].

These fractures occur usually in old osteoporotic women more than men and due to low-energy falls. It is unusually associated with radiocarpal and distal radioulnar joints injury [3].

Some of these fractures are caused by severe high-energy trauma resulting in intra-articular involvement comminution[3].

Treatment of such fractures is difficult as these fractures are usually unstable, difficult to reduce anatomically, and associated with a high rate of complications [4].

Closed reduction and Immobilization in plaster cast remains the most accepted method in the treatment of minimally displaced or impacted extra-articular distal radial fractures (stable fractures) [5]. For unstable distal radius fractures in the elderly closed reduction and casting is the traditional most option [6].

External fixation is used for unstable distal radial fractures. It provides a way to maintain axial alignment through ligamentotaxis to neutralize external forces during healing. However, it has many complications as Infection, loosening of pins, loss of reduction, and permanent stiffness [7].

There has been a trend toward open reduction and internal fixation of unstable distal radial fractures for its reliability, low complication rate, and the ability to allow the more rapid return of motion and function [8].

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## Patient and Methods

### Study design:

This is a prospective randomized controlled study that was conducted to compare the clinical and radiological outcomes of the use of volar locked plates in fixation of articular and extra-articular unstable distal radial fractures versus conservative treatment in elderly patients.

### Study location (settings) and duration:

Orthopedic surgery department, Al-Zahraa Hospital, and Al Helal Hospital Cairo, Egypt from June 2019 to September 2020.

### Study subject:

The study included 40 patients with distal radial fractures admitted to Al-Zahraa Hospital and Al-Helal Hospital.

The cases were divided into two groups each of 20 patients according to the management as follows:

- Group A: the cases underwent treatment with conservative treatment.
- Group B: the cases underwent fixation by volar locked plate.

### Inclusion criteria:

Patients above 60 years old with fracture distal radius with radiographic evidence of one of the following:

1. Distal radial fractures with radiographic evidence

of more than 15 degrees of angulation in any plane.

2. Greater than 2 mm of articular step-off.
3. Greater than 2 mm of shortening.
4. Fractures with severe comminution

### Exclusion criteria:

1. Open fractures.
2. Neglected distal radius.
3. Same-side upper limb injury that affected the overall functional outcome.

### Patients consent:

Written informed consent was obtained from all participants (or relatives) before inclusion in the study, explaining the value of the study, plus the procedures that were commenced

### Ethical consideration:

- The whole study design was approved by the Ethics committee, Faculty of Medicine (For Girls) Al-Azhar University.

- Confidentiality and personal privacy were respected in all levels of the study.

- Patients feel free to withdraw from the study at any time without any consequences.

- Collected data was not and will not be used for any other purpose.

## Methods

All patients were subjected to the following:

### 1. Investigation:

#### a) Radiological

- Plain X-rays AP and Lateral views of the affected forearm

- CT scan in cases where the involvement of the articular surface is suspected.

### Group (A): Technique of closed reduction and casting

\* The fracture reduction was carried out in the emergency room (causality) immobilization and below the elbow-slab has been done after acceptable reduction obtained.

\* Post-reduction X-ray was done.

\* The patients were admitted for 24 hours under observation.

## Group (B): an operative technique by volar locking plate

### Anesthesia:

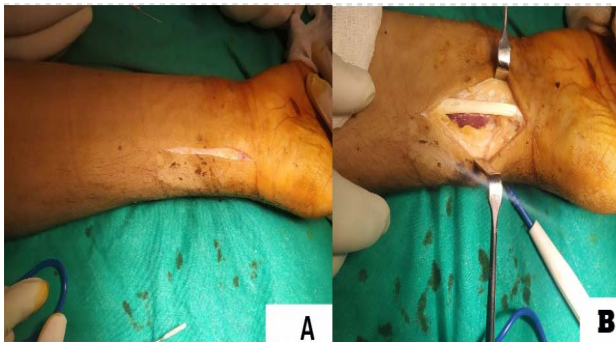
All patients were anesthetized by general anesthesia.

### Operative technique:

\* Tourniquet was applied.

### Surgical Approach

We used the modified Henry approach between the radial artery and flexor carpi radialis muscle (FCR) tendon (Figure 1). The FCR tendon is retracted medially protecting the median nerve while the radial artery with its surrounding fat is retracted laterally. Then, the flexor pollicis longus (FPL) tendon is retracted medially by blunt dissection. The pronator quadratus is released in an L-shaped fashion from both the distal and radial side of the radius and elevated subperiosteally from the radius in a volar direction to expose the distal radius.



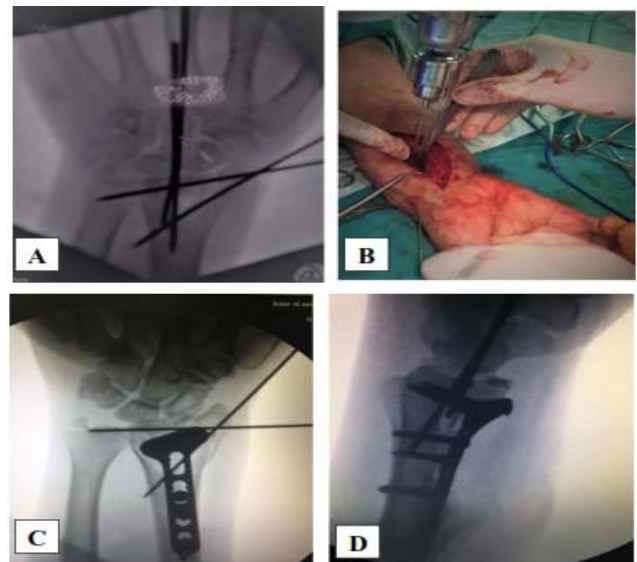
**Figure 1:** A: Palpate FCR tendon then Incise of skin B; incise tendon sheath

### Reduction technique:

1. Open reduction of the fracture is obtained and maintains this reduction by 2 mm k-wires and confirmed reduction by using an imaging intensifier.
2. Below elbow-splint was done.

### Post-operative care:

- Immediate Postoperative x-rays were taken both in PA and Lateral, and fracture reduction was confirmed.
- Patients were discharged with the active finger, elbow, and shoulder exercises after one day with routine post-operative instructions, and followed up after two weeks.



**Figure 2:** A: fixation by k wires. B: insertion of the first screw. C&D: Distal screws don't penetrate the joint and parallel to it.

### Follow Up:

All patients were followed up regularly postoperatively and outcome assessment conducted at 2 weeks, 4 weeks, 6 weeks, 3 months, and 6 months

### Methods of assessment of the result:

#### A. Functional assessment:

##### 1. Range of motion of the wrist and (DRUJ):

The ranges of the following movements will be measured using a goniometer.

- Dorsiflexion.
- Palmer flexion.
- Radial deviation
- Ulnar deviation.
- Supination.
- Pronation.

##### 2. Grip strength:

It will be measured using a dynamometer. This provides an objective measurement of one aspect of hand function

##### 3. Assessment of Mayo wrist score:

Scoring was done as per the Mayo wrist score which included subjective and objective criteria.

##### 4. DASH score:

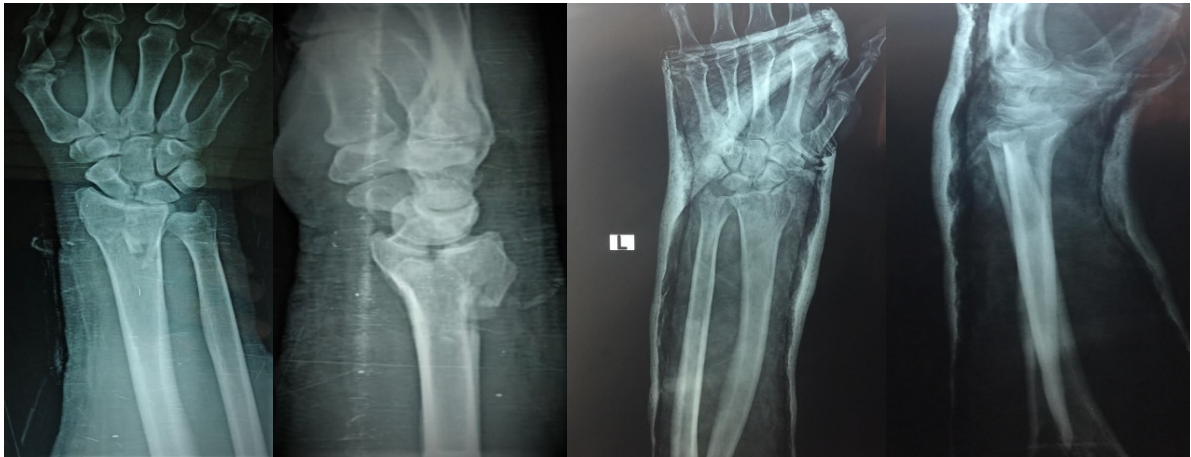
Subjective evaluation of the results was also made by using the disabilities of arm, shoulder and hand questionnaire (DASH)

#### B. Radiological assessment

All cases were evaluated by x-rays with P-A, lateral,

and oblique views immediately postoperatively, and at periods of 2, 4, 12 weeks, and thereafter at 6 months

for healing, the position of hardware, radial height, volar tilt, and osteoarthritic changes.



**Figure 3:** Radiographic case examples in conservative group prereducion and postreducion AP and lateral views.



**Figure 4:** Radiographic case examples in VLP group preoperative and postoperative AP and lateral views

### Statistical analysis of data

The data collected were coded, processed, and analyzed using Windows ® version 22 of the SPSS (Statistical Package for Social Sciences) (IBM SPSS Inc, Chicago, IL, United States).

Using the Shapiro Walk test the data were tested for normal distribution. Qualitative data are expressed as relative frequencies and percentages. The same Chi-square test (Š2) and Fisher have been used as shown to calculate the difference between the qualitative variables. Quantitative data were expressed as mean  $\pm$  SD (Standard deviation Independent t-test samples were used to compare two separate groups of normally distributed variables (parametric data) while Mann Whitney U was used for non-normally distributed data (non-parametric data).

Paired samples t-test or Wilcoxon signed-rank test

were used to test the significance between two different time points in parametric and non-parametric quantitative data respectively.

### Level of significance:

Significance test results are quoted as two-tailed probabilities.

For all the above-mentioned tests, the level of significance was tested, expressed as the probability of (p-value) and the results were explained as follows:

- Non-significant if the p value is  $> 0.05$
- Significant if the p-value is  $\leq 0.05$ .
- Highly significant if the p value  $< 0.001$ .
- P: probability.
- Continuous data expressed as mean $\pm$ SD.
- Qualitative data are expressed as number (percentage)

- Continuous data expressed as median (range)
- T= independent samples t-test
- P1: significance between 3 and 6 months values in the two groups
- $\chi^2$ : chi-square test
- z= Mann Whitney U test

- Group B: the cases underwent fixation by volar locked plate.

The mean age of the cases in the group underwent conservative treatment was  $67.01 \pm 5.09$  years and there were 50% males and 50% females while the mean age of the Volar Locked Plate group was  $65.5 \pm 3.79$  years and there were 70% males and 30 % females in the group with no statistically significant difference between the two groups regarding the age and sex distribution.

## Results

The study included 40 cases with DRF who were divided into two groups each of 20 patients according to the management as follows:

- Group A: the cases underwent treatment with conservative treatment.

Associated comorbidities in the two groups were DM, HTN, cardiac diseases, and combined DM and HTN with no significant difference between the two groups.

**Table 1:** comparison of the demographic data and clinical history between the two study groups

	Groups		Test of significance
	Group A (Conservative treatment group) (N=20)	Group B (Volar Locked Plate group) (N=20)	
Age (years)	67.01 ± 5.09	65.5 ± 3.79	t= 1.855 P = 0.123
Sex			
Males	10 (50%)	14 (70%)	$\chi^2$ = 1.667 P =0.197
Females	10 (50%)	6 (30%)	
Associated comorbidities			
Cardiac	1 (5%)	1 (5%)	$\chi^2$ = 1.133 P =0.230
DM	1 (5%)	4 (20%)	
HTN	5 (25%)	4 (20%)	
DM and HTN	3 (15%)	3 (15%)	

Table (2) shows that the dominant hand was affected in 50% of the cases in group A and in 65% of the cases in group B. the median score of Fernandez classification in group A was 2 with a range between 1

and 3 while in group B the median score was 3 with a range between 1 and 5, there was no statistically significant difference between the two groups.

**Table 2:** comparison of the criteria of the fracture between the two study groups

	Groups		Test of significance
	Group A (Conservative treatment group) (N=20)	Group B (Volar Locked Plate group) (N=20)	
Dominant hand	10 (50%)	13 (65%)	$\chi^2$ = 0.921 P =0.337
Affected side			
Right	9 (45%)	12 (60%)	$\chi^2$ = 0.902 P =0.342
Left	11 (55%)	8 (40%)	
Fernandez classification	2 (1-3)	3 (1-5)	z= -1.811 P = 0.071

In the table (3) The grip strength at 3 months in group A was  $18.25 \pm 4.12$  kg which was statistically significantly lower as compared with grip strength in group B ( $22.50 \pm 5.87$  kg) (p=0.011).

5.243 kg) (p=0.015).

The grip strength at 6 months in group A was  $27.50 \pm 4.482$  kg which was statistically significantly lower as compared with grip strength in group B ( $32.30 \pm$

The grip strength at 6 months in the contralateral hand in group A was  $76.35 \pm 6.683$  kg which was statistically significantly lower as compared with grip strength in the contralateral hand in group B ( $81.70 \pm 3.97$  kg) (p=0.004).

**Table 3:** analysis of the grip strength in the two study groups

	Groups		Test of significance	P-value
	Group A (Conservative treatment group) (N=20)	Group B (Volar Locked Plate group) (N=20)		
Grip strength in Kg at 3 months	18.25± 4.12	22.50± 5.87	t= - 2.637	0.011*
Grip strength in Kg at 6 months	27.50 ± 4.482	32.30 ± 5.243	z= - 2.522	0.015*
P1	< 0.001*	< 0.001*		
Grip strength (%) in the contralateral at 6 months	76.35 ± 6.683	81.70± 3.975	t= - 3.077	0.004*

In the table (4) The radial height at 3 months in group A was  $8.80 \pm 2.167$  mm which was statistically significantly lower as compared with radial height in group B ( $11.30 \pm 1.59$  mm) ( $p=0.001$ ).

The radial height at 6 months in group A was  $9.78 \pm 2.30$  mm which was statistically significantly lower as compared with radial height in group B ( $11.90 \pm 1.71$  mm) ( $p=0.021$ ).

The volar tilt at 3 months in group A was  $7.65 \pm 2.64$  mm which was statistically significantly lower as compared with volar tilt in group B ( $11.65 \pm 2.30$  mm) ( $p=0.001$ ).

The volar tilt at 6 months in group A was  $8.95 \pm 2.76$  mm which was statistically significantly lower as compared with volar tilt in group B ( $12.20 \pm 2.55$  mm) ( $p=0.005$ ).

**Table 4:** analysis of the range of radiological data in the two study groups

	Groups		Test of significance	P value
	Group A (Conservative treatment group) (N=20)	Group B (Volar Locked Plate group) (N=20)		
Radial height (mm) at 3 months	$8.80 \pm 2.167$	$11.30 \pm 1.59$	t= -3.832	0.001*
Radial height (mm) at 6 months	$9.78 \pm 2.30$	$11.90 \pm 1.71$	z= - 2.434	0.021*
P1	0.197	0.363		
Volar tilt at 3 months	$7.65 \pm 2.64$	$11.65 \pm 2.30$	t= -3.244	0.001*
Volar tilt at 6 months	$8.95 \pm 2.76$	$12.20 \pm 2.55$	t= -2.931	0.005*
P1	0.125	0.327		

In the table (5) The mean quick dash score at 3 months in group A was  $16.36 \pm 2.83$  which was higher as compared with group B ( $14.77 \pm 2.27$ ), but it didn't reach a statistically significant value.

The mean quick dash score at 6 months in group A was  $11.37 \pm 2.43$  which was higher as compared with group B ( $9.98 \pm 3.01$ ), but it didn't reach a statistically significant value.

The mean mayo score at 3 months in group A was  $65.50 \pm 11.48$  which was lower as compared with group B ( $69.25 \pm 4.83$ ), but it didn't reach a statistically significant value.

The mean mayo score at 6 months in group A was  $82.25 \pm 6.58$  which was lower as compared with group B ( $85.25 \pm 5.35$ ), but it didn't reach a statistically significant value.

**Table 5:** analysis of quick dash and Mayo scores in the two study groups

	Groups		Test of significance	P value
	Group A (Conservative treatment group) (N=20)	Group B (Volar Locked Plate group) (N=20)		
Quick dash at 3 months	$16.36 \pm 2.83$	$14.77 \pm 2.27$	t= 1.120	0.169
Quick dash at 6 months	$11.37 \pm 2.43$	$9.98 \pm 3.01$	t= 1.037	0.188
P1	< 0.001*	< 0.001*		
Mayo score at 3 months	$65.50 \pm 11.48$	$69.25 \pm 4.83$	t= - 1.776	0.105
Mayo score at 6 months	$82.25 \pm 6.58$	$85.25 \pm 5.35$	t= - 1.532	0.129
P1	< 0.001*	< 0.001*		

In the table (6) The flexion angle in group A increased from  $32.50 \pm 4.29$  at three months to  $48.70 \pm$

$5.44$  at 6 months while in group B the flexion angle increased from  $34.35 \pm 3.67$  at three months to  $50 \pm$

4.59 at 6 months there was no statistically significant difference between the two groups at both 3 and 6 months.

The extension angle in group A increased from 33.60± 5.33 at three months to 52.15± 4.76 at 6 months while in group B the extension angle increased from 34.85± 4.02 at three months to 52.90± 4.80 at 6 months there was no statistically significant difference between the two groups at both 3 and 6 months.

The supination angle in group A increased from 59.15± 7.19 at three months to 77.65± 5.34 at 6

months while in group B the extension angle increased from 61 ± 4.91 at three months to 79.25± 4.06 at 6 months there was no statistically significant difference between the two groups at both 3 and 6 months.

The pronation angle in group A increased from 66.60± 5.56 at three months to 83.90± 4.38 at 6 months while in group B the extension angle increased from 67.50± 6.17 at three months to 85.25 ±3.79 at 6 months there was no statistically significant difference between the two groups at both 3 and 6 months.

**Table 6:** analysis of range of motion in degrees in the two study groups

	Groups		Test of significance	P value
	Group A (Conservative treatment group) (N=20)	Group B (Volar Locked Plate group) (N=20)		
<b>Flexion at 3 months</b>	32.50± 4.29	34.35± 3.67	t= - 1.463	0.152
<b>Flexion at 6 months</b>	48.70 ± 5.44	50 ± 4.59	z= - 0.816	0.420
<b>Extension at 3 months</b>	33.60± 5.33	34.85± 4.02	t= - 0.837	0.408
<b>Extension at 6 months</b>	52.15± 4.76	52.90± 4.80	t= - 0.496	0.623
<b>Supination at 3 months</b>	59.15± 7.19	61 ± 4.91	t= -0.950	0.348
<b>Supination at 6 months</b>	77.65± 5.34	79.25± 4.06	t= - 1.066	0.293
<b>Pronation at 3 months</b>	66.60± 5.56	67.50± 6.17	t= -0.484	0.631
<b>Pronation at 6 months</b>	83.90± 4.38	85.25 ±3.79	t= -1.041	0.305

In the table (7) The radial deviation in group A increased from 10.45± 2.43 at three months to 19.15± 2.87 at 6 months while in group B the radial deviation increased from 11.80± 2.78 at three months to 20.85± 3.31 at 6 months there was no statistically significant difference between the two groups at both 3 and 6 months.

The ulnar deviation in group A increased from 13.55± 3.21 at three months to 24.35± 4.87 at 6 months while in group B the ulnar deviation increased from 15.25± 2.65 at three months to 25.10± 4.19 at 6 months there was no statistically significant difference between the two groups at both 3 and 6 months.

**Table 7:** Analysis of the range of motion in degrees in the two study groups

	Groups		Test of significance	P value
	Group A (Conservative treatment group) (N=20)	Group B (Volar Locked Plate group)(N=20)		
<b>Radial deviation at 3 months</b>	10.45± 2.43	11.80± 2.78	t= -1.632	0.111
<b>Radial deviation 6 months</b>	19.15± 2.87	20.85± 3.31	t= -1.734	0.091
<b>Ulnar deviation at 3 months</b>	13.55± 3.21	15.25± 2.65	t= -1.828	0.075
<b>Ulnar deviation at 6 months</b>	24.35± 4.87	25.10± 4.19	t= -0.522	0.605

**Table (8)** shows that all the cases with conservative treatment had a length of hospital stay of 1 day (the cases returned home on the same day) while the length of hospital stay ranged from 3 to 4 days with a

highly significant difference between the two groups. The incidence of complications was 15% in each group.

**Table 8:** Analysis of the outcomes and complications in the two study groups in the two study groups

	Groups		Test of significance
	Group A (Conservative treatment group) (N=20)	Group B (Volar Locked Plate group) (N=20)	
Hospital stay	1 (1-1)	4 (3-4)	$z = -5.891$ $P < 0.001^*$
Complications			
No complications	17 (85%)	17 (85%)	$\chi^2 = 1.338$ $P = 0.313$
Complex regional pain syndrome	2 (10%)	1 (5%)	
Malunion	1 (5%)	0 (0%)	
Superficial infection	0 (0%)	2 (10%)	

## Discussion

Distal radius fractures (DRF) are the most common orthopedic injuries: a distal radius fracture is one out of six fractures presented at emergency departments. Nearly two-thirds of these fractures are displaced and need reduction[9].

Treatment choice depends on many factors, including age, lifestyle, associated medical conditions, compliance, functional requirements, limb dominance, type of fracture, severity, and alignment of fractures, soft tissue condition, and concurrent fractures [10-11].

Several options have been described for distal radius fractures, such as percutaneous pinning and casting [12], and external fixation [12-13]; the most selected option is Open Reduction Internal Fixation (ORIF) using the volar locking plate technique [13].

This study aimed to compare the clinical and radiological outcomes of the management of articular and extra-articular unstable distal radial fractures with volar locked plates versus conservative treatment in elderly patients.

The study included 40 cases with DRF who were divided into two groups each of 20 patients according to the management as; group A where the cases underwent treatment with conservative treatment and group B that included cases who underwent fixation by volar locked plate

In this study, The mean age of the cases in the group underwent conservative treatment was  $67.01 \pm 5.09$  years and there were 50% males and 50% females while the mean age of the Volar Locked Plate group was  $65.5 \pm 3.79$  years and there were 70% males and 30 % females in the group with no statistically significant difference between the two groups regarding the age and sex distribution.

Also, there was no statistically significant difference in the associated risk factors and chronic diseases between the two groups. The median score of Fernandez's classification in group A was 2 with a range between 1 and 3 while in group B the median score was

3 with a range between 1 and 5, there was no statistically significant difference between the two groups.

Zengin et al. (2019) showed that there was no statistically significant difference between the two patient groups regarding the periods of follow-up, gender, age, and type of fracture. They listed 27 fractures as C1, 9 as C2, and 13 as C3[15].

Saving et al. included 140 patients who were randomly assigned a plaster splint (n=72) or a volar locking plate fixation (n=68) for non-operative treatment. The two groups had identical baseline characteristics [16].

In this study, the values of each flexion, extension, supination, and pronation angles were higher in the volar locked plate as compared with the conservative treatment group at 3 and 6 months after the correction of fractures, but there was no statistically significant difference between the two groups.

Similar findings were reported by Zengin et al., who showed higher in the volar locked plate patients compared to the cast group at 6 weeks after the DRF fixation, the flexion-extension arch, and the supination-pronation arch, but there was no statistically significant difference in either [15]. The same results were also previously reported by Egol et al. [17].

In this study, The grip strength at 3 and 6 months in the volar locked plate were statistically significantly higher as compared with the conservative treatment group ( $p = 0.011$  and  $0.015$  at 3 and 6 months respectively). Also, the grip strength at 6 months in the contralateral hand in the conservative group was  $76.35 \pm 6.683$  kg which was statistically significantly lower as compared with grip strength in the contralateral hand in the volar locked plate group ( $81.70 \pm 3.97$  kg) ( $p=0.004$ ).

This was comparable with Zengin et al. who showed that statistically significantly higher grip strength values were found in the VLP group compared to the cast group [15].

In older people, grip strength may be comparatively



more necessary to restore as these people begin with a weaker wrist. A small percentage decrease in grip strength can eliminate the minimum grip strength needed to allow for daily personal care and activities such as cooking and carrying foodstuffs.

Regarding the radiological findings in our study, the radial height and volar tilt were statistically significant difference higher in the volar locked plate as compared with the conservative treatment group at both 3 and 6 months.

Zengin et al. showed that all parameters were found to be better in the VLP group except the ulnar variance (radial height, inclination and volar tilt, articular step-off). Those results were statistically significant, except for the ulnar variance [15].

Saving et al. also found that volar flexion and pronation were better for the volar locking plate group at 3 months and 12 months, compared to the non-operative treatment group with a statistically significant difference between the two groups. In the same study, the authors showed that at 3 and 12 months, in the volar locking plate group, dorsal tilt, radial shortening, and radial inclination were better compared to the non-operative treatment group [16].

Sharma et al. The volar tilt and radial height recorded substantial decreases from the immediate post-operative period to 12 post-operative months in AO type B and C fractures treated with a volar locking plate [14].

In this study, the mean quick dash score at 3 and 6 months in the conservative treatment group was higher as compared with the volar locked plate group, but it didn't reach a statistically significant value.

Also in this study, the mean mayo score at 3 and 6 months in the conservative treatment group was lower as compared with the volar locked plate group, but it didn't reach a statistically significant value.

This agreed with Testa et al. who showed that the at 3 months follow up, the mean quick dash score in the ORIF with locked plate group was  $22.15 \pm 24.95$  while in the conservative treatment group was  $29.39 \pm 17.96$  with no significant difference between the two groups ( $p=0.44$ ) [18].

This was also agreed with Zengin et al., who showed that the volar locked plate patients' QDASH score was lower than those in the cast group but the difference was not statistically significant (VLP  $11.7 \pm 8.0$ ; plaster cast  $17.6 \pm 14.2$ ;  $p = 0.8$ ) [15].

Testa and his colleagues found a significant difference in complications incidence: 7.7% in the surgical

group, and 25.3% in the conservative group. In the conservative group, there was a loss of reduction in 12 (13.2%) patients within one week of cast application; 5 (5.5%) reported post-traumatic arthritis (PA); 2 (2.2%) had a post-healing deformity, and 2 (2.2%) patients had finger edema. In the ORIF group complications were: 3 (3.3%) cases of chronic wrist pain, and 2 (2.2%) cases of surgical incision pain. One case (1.1 %) required removal of the plate [23].

Complex regional pain syndrome was the most common complication in this study, which could be explained due to associated arthritis. The literature points out that fractures of the distal end of the radius with the distal radial articular surface's persistent articular step-off have an increased risk of radiocarpal arthritis [24-25].

Prevention of this fracture is possible by treating osteoporosis with diet and drugs, including vitamin D, calcium, bisphosphonate medications, and recombinant human parathyroid hormone (PTH) [19-20]. Osteoporotic bone presents challenges for both conservative and surgical management of DRF, and goals of care should be discussed with the patient before deciding on the treatment method [21].

In fact, in patients with decreased bone density, a trabecular bone deterioration was found, especially in early postmenopausal years, and subsequent lower bone strength [22].

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## Conclusion

### From these results, we can conclude that:

- Distal radial fractures are a common type of fractures that affect the elderly.
- Indirect trauma like falls on an outstretched hand is the most common cause of distal radial fractures.
- No superiority was detected regarding the different radiological and functional outcomes for the volar locked plate technique over the conservative management except for the grip strength, radial height, and volar tilt.

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