International Journal of Medical Science and Clinical Research Studies

ISSN(print): 2767-8326, ISSN(online): 2767-8342

Volume 02 Issue 01 January 2022

Page No: 56-72

DOI: https://doi.org/10.47191/ijmscrs/v2-i1-10, Impact Factor: 5.276

Evaluation of Functional Outcome of Unstable Distal Radial Fracture Treatment: A Comparison between Internal & External Fixations

S Ripon Kumar Ghosh[1], Nripen Kumar Kundu[2]

[1]Specialist, Department of Orthopedic Surgery, Asgar Ali Hospital, Dhaka, Bangladesh.

[2]Assistant Professor, Department of Orthopedics, Popular Medical College, Dhanmondi, Dhaka, Bangladesh.

ABSTRACT

Distal radial fracture is the most common fracture of upper extremity in all age group. In recent years, fixation with distal radial locking plate and external fixator both have become widely accepted modalities for treating unstable distal radial fracture. Purpose of this study was to evaluate the functional outcome of unstable distal radial fracture (AO/OTA 2.3B2 to C3) treated by internal and external fixations. Sample size was60 with (AO/ OTA 2.3-B2 to C3) fracture as per set criteria and was treated either by distal radial locking plate or by external fixator. Quick DASH Score was used for evaluation of functional outcome of surgery. Out of 60 patients, male (75%) were more than female (25%), maximum age incidence was found in 46-55 years age group (31.7%), right side involvement was 68.3% and left side was 31.7%. Over 66% incidence was due to RTA. Type of injury was 11.7% B2, 18.3% B3, 43.3% C1, 20.0% C2 and 6.7% C3. External fixation was 58.3% and internal fixation was 41.7%. Mean ± SD duration of operation was 39.14 ± 7.017 minutes in external fixation group and 92.80 ± 21.703 minutes in internal fixation group. Functional outcome was75.9% good and 17.2% excellent in external fixation group and 52.2% good and 34.8% excellent in fixation with distal radial locking plate group according to Quick DASH Score. Postoperative complication like soft tissue infection 34.3% and delayed union 25.7% and wrist stiffness 74.3% was in external fixation group and in internal fixation group, patients had suffered from soft tissue infection 32% and wrist stiffness 56%. No patient had non-union. Mean ± SD radiological union time in external fixation group was 16.53 ± 5.386 weeks and in internal fixation group was 16.67 ± 5.264 weeks. After 12 months of surgery both external fixation and locked volar plating provide good to excellent clinical outcomes.

KEYWORDS: Evaluation, Functional, Outcome, Unstable, Distal, Radial Fracture, Treatment.

ARTICLE DETAILS

Published On:
24 January 2022

Available on:
https://ijmscr.org

I. INTRODUCTION

In adult population distal radius fractures are the common fractures (Court-Brown and Caesar, 2006). According to recent studies, the total incidence of distal radius fractures is 24 and 32 per 10,000 people per year[1, 2]. Distal radius fractures are among the most common fractures of upper limb. It continues to exert therapeutic challenge. It comprises 15% of all extremity fractures[3]. Increasing incidence of these injuries may be attributed to an ageing population (Osteoporotic fractures) and the growing participation in outdoor pursuits (higher energy fractures) [4]. Two-third of these fractures are displaced and they require \ reduction[5]. According to AO/OTA classification, an inclusive, alphanumeric classification and has 27 different subgroups. Three different types (A—extra-articular, B—partial articular, and C—complete articular) are divided into 9 main groups and 27 different sub types depending on comminution and direction of displacement[6]. Since a large number of these fractures are managed non-operatively, the number of patients who undergo surgical management is considerable. Over the past 30 years, the surgical treatment of distal radius fracture has shifted from cast immobilization to enormous surgical options such as the use of external fixation and volar locking plates[7, 8, 9, 10]. The objective of the treatment for patients with distal radial fractures are to

restore the wrist anatomy, regain of pain free hand and normal wrist range of motion with the early return of normal activities to daily living[11].

Various published studies are available regarding comparative outcome between plating and external fixation. More rapid recovery of patient-perceived and objective wrist function was observed in volar locking in a study[12]. No complications regarding to extensor tendons was observed in volar plating compared to external fixator in a study[13, 14]. In another meta-analysis a better objective functional outcome was observed in patients treated with distal radial locking plate compared with external fixation in 3 and 6 months follow up[15]. Few studies have compared volar locked plating with external fixation, and there is still insufficient evidence regarding which gives the best outcome[16, 17, 18, 19]. Wilcke, Abbaszadegan, and Adolphson (2011)[12] noticed that, at 3 and 6 months, the volar plate group had better DASH (Disabilities of Arm, Shoulder and Hand) score but at 12 months the score was similar. There was no evidence to support one treatment method over other in one meta-analysis which included 46 papers, with 916 patients treated by external fixation and 603 by internal fixation[20]. In another meta-analysis, a better functional outcome was observed in patients with unstable distal radius fractures treated with a volar locking plate compared with external fixation at 3, 6 and 12 month follow-up[21].

Distal radial fracture is the common fracture of upper extremity in both young and adult age groups. Controversy remains regarding the optimum method to fix unstable varieties. Distal radial locking plating and external fixator remain two principle treatment modalities. External fixator causes less surgical trauma but chance of loss of reduction is more, whereas a better functional outcome with distal radial locking plate has been observed. There is scarcity of studies to compare these techniques. So, the study is rational to evaluate and compare the outcome of these two procedures systematically. In this quasi experimental study, we had compared and assessed radiological and functional outcome of unstable distal radial fracture stabilized with a distal radial locking plate and external fixator. It may help the surgeons of Bangladesh to take decision about the treatment modality and to improve outcome in patients with distal radial fracture. So the purpose of this study is to determine functional outcome in patients with unstable distal radial fracture (AO/ OTA 2.3-B2 to C3) treated with distal radial locking plate versus external fixator.

Research Question:

Is functional outcome of distal radial locking plating better than fixation with external fixator in unstable distal radial fracture?

Hypothesis:

Null Hypothesis: Functional outcome of distal radial locking plating is not better than fixation with external fixator in unstable distal radial fracture.

Alternate Hypothesis: Functional outcome of distal radial locking plating is better than fixation with external fixator in unstable distal radial fracture.

Objectives

General Objective:

To evaluate the functional outcome of unstable distal radial fracture (AO/OTA 2.3B2 to C3) treated by internal and external fixations.

Specific Objectives:

1. To get acquainted about pain, tingling and difficulty in sleeping of the patient groups.
2. To evaluate the ability of daily household activities and recreational activities of the respondents.
3. To learn about limitation of daily and social activities.
4. To find out the complications associated with both groups.
5. To identify any difference in time for radiological union in both groups.

Limitations

- Small sample size.
- Time constrain causes short follow-up period to evaluate very late post-operative complications.
- Single centered study.
- Sample size not representing whole country scenario.
- Some patients could not come for follow up timely.
- Sample was taken purposively. So there may be chance of bias which can influence the results.

II. METHODOLOGY

Study design: Quasi Experimental Study.

Place of study: Department of Orthopedics and Traumatology, Chattogram Medical College Hospital, Chattogram.

Study period: From June 2017 to July 2019.

Study population: All adult patients undergoing surgery for unstable distal radial fracture.

Sampling technique: Purposive type of non-probability sampling technique. Following approval by the Ethical and Research Committee of Chattogram Medical College Hospital. Patients were purposively allocated into external fixation group and internal fixation group by consecutive numbering. Odd numbers were allocated to external fixation group and even numbers were allocated to internal fixation group.

Sample size:

To observe outcome the sample size will be determined by the following formula:

Where,

$Z \propto$ = 1 tailed Z value at a definite level of significance. $Z \beta$ = 1 tailed Z value at a definite power. P1 = Prevalence of grip strength at 3 month of patient undergoing fixation with distal radial locking plate. P2 = Prevalence of grip strength

at 3 month of patient undergoing fixation with external fixator in this study,

$Z\alpha$ = 1.96 at 95% Confidence level. $Z\beta$ = 0.85 at 0.80 power. P1 = 72% (Wilcke, 2011). P2 = 46% (Wilcke, 2011) So, n = 52 in each group. Due to possibility of dropout, adding 10%, n = 57 in each group. Due to time constraints, 60 (35 in external fixation group and 25 in internal fixation group) patients was included in this study.

Selection criteria:

Inclusion criteria: Patients age between 18 to 65 years with AO/OTA 2.3-B2 to C3 fractures. Patients fit for anesthesia. Fracture duration less than 1 week.

Exclusion criteria: Open fracture of distal radius. Pathological fractures. Polytrauma patient. Patients Unwilling to give written consent.

Study procedure: A questionnaire was prepared considering the key variables like age, sex, occupation, side, mechanism of injury, type of fracture, type of procedure, duration of operation, post-operative complications, ability of household and recreational activities, limitation of daily and social activities, pain, tingling, difficulty in sleep, time for radiological union and functional outcome of surgery which were verified by the guide. Purposive type of non-probability sampling technique was used as according to availability of the patients and strictly considering the inclusion and exclusion criteria. Total 60 patients were divided into two groups, external fixation group (35 patients) and internal fixation group (25 patients). Aims, objectives, procedures, risks and benefits of the study were explained to the patients. They were encouraged for voluntary participation. They were also assured about the secrecy of information and records. Written informed consent was taken from each patient. After proper counseling and anesthesia fitness patients were operated. Follow up was given at 2nd week, 6th week, 12th week, 6th month and 12th month. Lost to follow up was, 2 patients at 2nd follow up, 6 patients at 3rd follow up, 7 patients at 4th follow up and 8 patients at 5th follow up.

Surgical procedure: Pre-operative assessment and preparation: All patients were allocated purposively into two groups. External fixation group and internal fixation group. Through history was taken, proper physical examinations was carried out and necessary investigations carried out. All patient were kept fasting for at least 6 hours prior to surgery. No prophylaxis for thromboembolism was used in any patient. On arrival of the patient at the operation theatre, an intravenous access line was established by a wide bore cannula (18G). Vital signs were monitored in non-invasive method and recorded. All patients received a single dose of inj. Cefuroxime 1.5gm preoperatively.

Procedure for External fixation:

1. A 2 to 3 cm incision was made over the dorso radial aspect of index metacarpal base and blunt dissection with scissors was used to expose the metacarpal.
2. Care was taken to preserve and reflect the branches of the dorsal radial sensory nerve.
3. Then a soft tissue protector was placed on the metacarpal and 3mm self-tapping half was inserted at 30 to 40 degree angle dorsal to the frontal plane of the hand and forearm and pin position and length was confirmed with fluroscopy.
4. Again a 4cm skin incision was made 8 to 10 cm proximal to the wrist joint and just dorsal to the midline. The superficial branches of the lateral ante brachial cutaneous nerve and radial sensory nerve was exposed with blunt dissection, the latter of which exits in the mid forearm from the investing fascia between the brachioradialis and extensor carpi rarialis longus.
5. Two 3mm half pins, 1.5 cm apart were inserted through a soft tissue protector between the radial wrist extensors at a 30 degree angle dorsal to the frontal plane of the forearm.
6. The pin was just perforate the medial cortex of radius and pin position and length was confirmed with fluroscopy.
7. The external fixator frame was applied. Irrigation and closer of the incisions was done with 3.0 proline sutures.

Procedure for distal radial locking plating:

1. An 8 cm incision was made on the radial border of Flexor Carpi Radialis tendon. The V-shape of the distal part of the incision provides better access to the articular surface.
2. The incision was carried through the flexor carpi radialis tendon sheath. The tendon sheath was opened.
3. The forearm fascia on the radial border of flexor carpi radialis was incised.
4. The forearm fascial incision was made along the radial side of flexor carpi radialis tendon to secure the palmer cutaneous branch of Median nerve, which arises near the ulner side of flexor carpi radialis tendon.
5. The index finger of the surgeon was then swept under the Flexor Pollicis Longus muscle to gain rapid exposure to the Pronator Quadratus.
6. An L-shaped incision was made over the radial border of the pronator quadratus to prevent pull of pronator quadratus from radius.
7. The pronator quadratus can be reattached after plate fixation to the brachioradialis, which was inserted into radial styloid.
8. After full exposure of the fracture site, the haematoma and fibrinous material was removed from the fracture site.
9. For ease of fracture reduction, an osteotome was inserted into the fracture, over the dorsal cortex, to completely disimpact the distal radial fragment.
10. Fracture reduction was facilitated through ligamentotaxis by applying traction to the fingers. The assistant distracted the fracture while, the surgeon reduced manually.

11. The fracture was provisionally fixed with K-wire when needed.
12. For dorsal comminuted fractures, the surgeon had used manual pressure to mould the dorsal fragments into anatomical reduction.
13. The specially designed plate simulating the distal radial end contour, which will provide maximum support to the distal screws onto the subchondral bone.
14. A screw was placed in the central distal hole and then the remaining screws are placed. A half threaded lag screw was then inserted to engage the dorsal metaphyseal fragment.
15. When the distal fracture fragment is being reduced into anatomic position, it is important for an assistant to apply traction continually to the fingers of the operatively treated hand to maintain the radial height. Then rest of the proximal screws was fixed.
16. If compression needed, instead of locking screw a cortical screw may be given into the non-threaded part of combi-hole and then rest of the proximal holes were fixed with locking screws.
17. In comminuted impacted fractures, the distal fragments must be disimpacted sufficiently to gain access for proper reduction.
18. For displaced radial styloid fractures, a number 15 knife blade was swept along the radial border of the radius under brachioradialis to practically release its insertion and that relieve the deforming force on radial styloid. Finally a 3.5 mm screw was placed in each of the proximal holes.
19. In many patients, the pronator quadratus is quite shredded by the fracture and complete coverage of the plate was not possible. Then pronator quadratus can be sutured to edge of brochioradialis with horizontal mattress suture to cover the distal plate which was prevent irritation of flexor tendons by the plate. The wound was then closed. A short arm back slab was given.

Post-operative management and rehabilitation: The wrist was remain immobilized in a supinated position with a sugar tong splint until pain and swelling had subsided. Antibiotic Injectable third generation Cephalosporin 1gm I/V for 2 days and then oral third generation Cephalosporin 200mg 12 hourly for 7 days. Analgesic**:** Parenteral NSAID was given 12 hourly for first post-operative day. Then oral form for 5 days. First post-operative day**:** Active and passive finger movement begun and continue the entire time the frame was in placed. Second post-operative day**:** Check dressing was done and discharged from hospital. At second week**:** Removal of stiches was done and supination and pronation of forearm were begun. After 6 weeks**:** External fixator frame usually was removed.

Follow-up schedule: 1st follow-up: 2nd week. 2nd follow-up: 6th week. 3rd follow-up: 12th week. 4th follow-up: 6th month. 5th follow-up: 12th month.

Data collection tool: A data collection form containing history and examination finding of the patient and follow up will be used to collect data (Appendix – V).

Statistical analysis: Data were processed and analyzed using computer software program SPSS version-25. The data present on categorical scale were expressed as frequency and corresponding percentage and compared by chi-square test, while the quantitative data were presented as mean and standard deviation (SD) and compared by student's t-test. Postoperative final outcome were evaluated using confidence interval. For all analyses level of significance was set at 0.05 and p-value <0.05 was considered significant.

Data presentation: Suitable chart, figures, tables and diagrams was presented the observation and results of the study and statistical analysis. In case of continuous variable mean, range, percentage and standard deviation (SD) was used. In case of categorized variable cross table and composite graph was used.

Ethical implication: Internal or external fixation for unstable distal radial fracture are invasive procedure. Patients and their legal guardians was consulted pre-operatively about the procedure, possible outcome and any complications. Institutional clearance was obtained from the Principal of Chattogram Medical College and Director of Chattogram Medical College Hospital. Written informed consent was taken from all patients. Detailed study related information was read out and explained in the local language from a printed hand out. All aspects including confidentiality and rights not to participate in the study was specially considered. All respondents was briefed about the study. Informed written consent was taken from respondents. Confidentiality was maintained. Withdrawal right of respondents was preserved. There was no scope of painful procedure or financial loss by the investigator. So there was no chance of ethical violation. Compensation claim was mitigated if any such claim raised.

As per rule of ethical committee of CMCH: Participation was voluntary. Consent was obtained after a brief of the study in Bangla or local language to all respondents. It was make clear to them that they are free to take part or withdraw from any part of the study at any stage. All answers was kept confidential and was not disclosed without prior permission of respondent. Interview was taken in a suitable time and place that was convenient to the responder. Refusal to take part or withdrawal from the study was not hamper his/her treatment.

III. RESULTS

This quasi experimental study was carried out at Department of Orthopedics and Traumatology, Chattogram medical College Hospital, Chattogram, from July 2017 to June 2019.

Total 60 patients admitted in the department of orthopedic surgery, aged from 18 years to 65 years with both gender diagnosed as AO/OTA 2.3-B2 to C3 fracture, treated either by external fixation (35 patients) or by internal fixation (25 patients) were studied. The salient results based on minimum 12 months follow up. Inferential statistics are measured by following:

- *Statistical analysis was done by Chi-square test and student t-test.*
- *P value > 0.05 indicates non-significant.*
- *P value = 0.000 indicates very highly significant*
- *ns= non-significant.*
- *vhs= very highly significant*.

Table 1. Distribution of the patients according to demographic variables (n=60).

Variables	Characteristics	External Fixation		Internal Fixation		Total		Statistics
		n	%	n	%	n	%	**P value** 0.160^{ns} **Range** 18-65 Average **Mean ± SD** 42.63 ± 10.544
Age (In yrs.)	**18-25 yrs.**	1	2.85	5	20.0	6	10.0	
	26-35 yrs.	7	20.00	5	20.0	12	20.0	
	36-45 yrs.	11	31.43	4	16.0	15	25.0	
	46-55 yrs.	11	31.43	8	32.0	19	31.7	
	56-65 yrs.	5	14.29	3	12.0	8	13.3	
Gender	**Male**	27	77.14	18	72	45	75	**P value** 0.650^{ns}
	Female	8	22.86	7	28	15	25	
Occupation		**n**			**%**			-----
	Service holder	27			45			
	Driver	2			3			
	Student	4			7			
	Housewife	13			22			
	Other	14			23			

Table-1 shows that, maximum age incidence was found in 46-55 years age group (31.7%). Average mean ± SD was 42.63 ± 10.544 and range was 18-65 years. The mean age was 44.26 ± 9.328 in external fixation group and 40.36 ± 11.867 in internal fixation group. P value was 0.160, statistically non-significant. Out of 60 patients, 45(75%) were male and 15(25%) were female. In both external Fixation group, 27(77.14%) patients were male and 8(22.86%) patients were female. In internal fixation group, 18(72%) patients were male and 7(28%) patients were female. According to P value, result was non-significant. Out of 60 patients 27(45%) were service holder, 4(7%) were student, housewife was 13(22%), driver was 2(3%) and 14(23%) were in other profession.

Table 2. Distribution of the patients according to Mechanism of injury, side of injury, type of fracture with type of operation, type of operation procedure and duration of operation (n=60).

Pattern of injury	External Fixation		Internal Fixation		Total		P value
	n	%	n	%	n	%	
Mechanism of injury							0.485^{ns}
RTA	24	68.6	16	64.0	40	66.9	
Fall from height	11	31.4	8	32.0	19	31.7	
Assault	0	0.0	1	4.0	1	1.7	
Side of injury							0.542^{ns}
Right side	25	71.4	16	64.0	41	68.3	
Left side	10	28.6	9	36.0	19	31.7	
Type of fracture							0.162^{ns}
B2	4	11.4	3	12.0	7	11.7	
B3	6	17.1	5	20.0	11	18.3	
C1	17	48.6	9	36.0	26	43.3	
C2	8	22.9	4	16.0	12	20.0	
C3	0	0.0	4	16.0	4	6.7	

Duration of operation							0.000[vhs]
30-70 minutes	35	100.0	5	20.0	40	66.7	
80-120 minutes	0	0.0	20	80.0	20	33.3	
Mean ± SD	39.14 ± 7.017		92.80 ± 21.703		61.50± 30.522		
Range	30-120 minutes						

Table 2 represents that, among 60 patients, according to mechanism of injury, 66.9% injury'was due to RTA. According to side of injury, 68.3% patients had injury on right side. According to type of fracture, in external fixation group, 4(11.4%) patients had B2, 6(17.1%) patients had B3, 17(48.6%) patients had C1 and 8(22.9%) patients had C2 type fracture. In internal fixation group, 3(12%) patients had B2, 5(20%) patients had B3, 09(36%) patients had C1, 4(16%) patients had C2 and 4(16%) had C3 type fracture. out of 60 patients, 35(58.3%) patients were undergone to external fixation and 25(41.7%) patients were undergone to internal fixation. No significant statistical difference between external fixation and internal fixation groups according to mechanism (p=0.485), side (p=0.542) and type (p=0.162) of injury. Out of 60 patients, 40(66.7%) patient needed 30-70 minutes and 20(33.3%) patient needed 80-110 minutes for operation. In external fixation group, all 35(100%) patients needed 30-70 minutes. In internal fixation group, only 5(20%) patients needed 30-70 minutes and 25(80%) patients needed 80-120 minutes. Average mean ± SD time was 61 ± 30.522 minutes and rang was 30-120 minutes. Mean ± SD time in external fixation group was 39.14 ± 7.017 minutes and in internal fixation group was 92.80 ± 21.703 minutes. According to P value, result is statistically very highly significant.

Figure 1. Shows that out of 60 patients, 35(58.3%) patients were undergone to external fixation and 25(41.7%) patients were undergone to internal fixation.

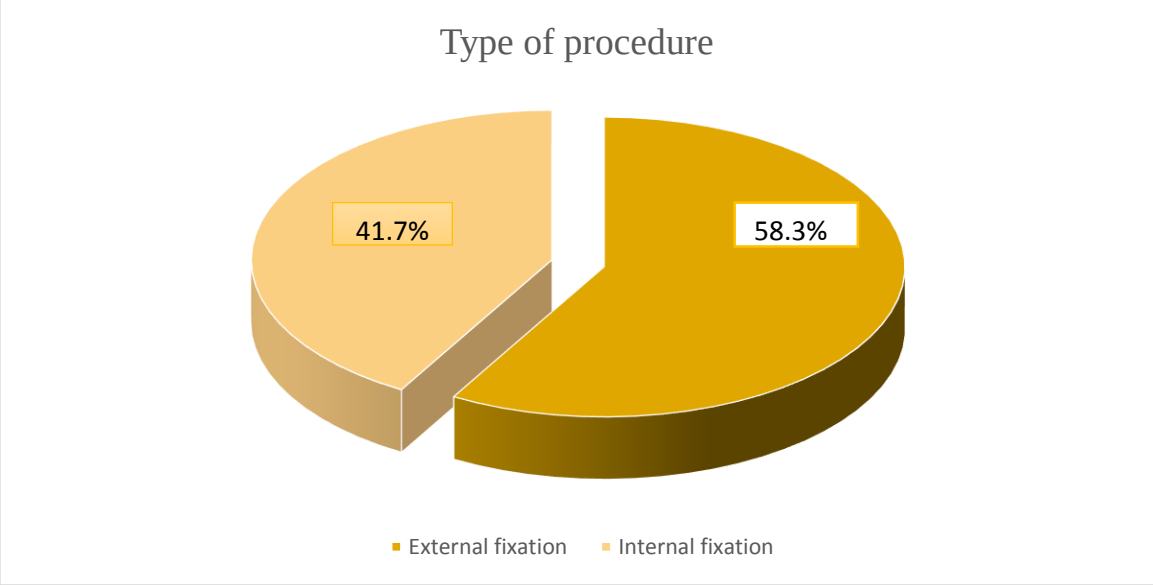

Figure 1. Distribution of the patients by type of procedure (n=60).

Table 3. Post-operative complications and time taken for radiological union.

Complication	**External Fixation**		**Internal Fixation**		**Total**		**P value**
	n	**%**	**n**	**%**	**n**	**%**	
Soft tissue infection							
No	23	65.7	17	68.0	40	66.7	0.853[ns]
Yes	12	34.3	8	32.0	20	33.3	
Delayed union							
No	26	74.3	17	68.0	43	71.7	0.549[ns]
Yes	9	25.6	8	32.0	17	28.3	
Non-union							
No	35	100.0	25	100.0	60	100	------
Yes	0	0.0	0	0.0	0	0	

Wrist stiffness							
No	9	25.7	11	44.0	20	33.3	0.139^{ns}
Yes	26	74.3	14	56.0	40	66.7	
Time taken for radiological union							
12-16 weeks	21	70	17	70.8	38	70.37	0.947^{ns}
22-26 weeks	9	30	7	29.1	16	29.63	

Table 3 shows, in external fixation group, patients had suffered with postoperative complication like soft tissue infection 12(34.3%), delayed union 9(25.7%) and wrist stiffness 26(74.3%). In internal fixation group, patients had suffered with postoperative complication like soft tissue infection 8(32%), and wrist stiffness 14(56%). No patient had non-union. Out of 54 patients having complete radiological union, in external fixation group, 21(70%) patient's radiological union time was within 12-16 weeks and 9(30%) patient's radiological union time was within 22-26 weeks. In internal fixation group, 17(70.8%) patient's radiological union time was within 12-16 weeks and 7(29.1%) patient's radiological union time was within 22-26 weeks. Average mean ± SD radiological union time were 16.59 ± 5.279 weeks. Mean ± SD radiological union time in external fixation group was 16.53 ± 5.386 weeks and in internal fixation group was 16.67 ± 5.264 weeks. According to P value, result is statistically non-significant.

Table 4. Open a tight or new jar (at 2nd week, n=60; at 6th week, n=58; at 12th week, n=54; at 6th month, n=53 and at 12th month, n=52).

Open a tight or new jar	**External Fixation**		**Internal Fixation**		**Total**		**P value**
	n	**%**	**n**	**%**	**n**	**%**	
At 2nd week							
Unable(5)	35	100	25	100	60	100	-----
At 6th week							
Moderate difficulty(3)	1	3.0	6	24.0	7	12.1	
Severe difficulty(4)	23	69.7	14	56.0	37	63.8	0.052^{ns}
Unable(5)	9	27.3	5	20.0	14	24.1	
At 12th week							
Mild difficulty(2)	1	3.3	6	25.0	7	13.0	
Moderate difficulty(3)	18	60.0	9	37.5	27	50.0	0.045^{s}
Severe difficulty(4)	11	36.7	9	37.5	20	37.0	
At 6th month							
No difficulty(1)	5	16.7	7	30.4	12	22.6	
Mild difficulty(2)	15	50.0	10	43.5	25	47.2	0.692^{ns}
Moderate difficulty(3)	8	26.7	5	21.7	13	24.5	
Severe difficulty(4)	2	6.7	1	4.4	3	5.7	
At 12th month							
No difficulty(1)	21	72.4	19	82.7	40	76.9	0.537^{ns}
Mild difficulty(2)	7	24.1	4	17.4	11	21.2	
Moderate difficulty(3)	1	3.5	0	0.0	1	1.9	

Table 4 reveals that, there was no significant difference in case of open a tight or new jar at every follow-up except, 12th week, where difficulty to open a tight or new jar was more in external fixation group according to p value.

Table 5. Do heavy household chores (at 2nd week, n=60; at 6th week, n=58; at 12th week, n=54; at 6th month, n=53 and at 12th month, n=52).

Do heavy household chores	**External Fixation**		**Internal fixation**		**Total**		**P value**
	n	**%**	**n**	**%**	**n**	**%**	
At 2nd week							
Unable(5)	35	100	25	100	60	100	-----
At 6th week							
Moderate difficulty(3)	0	0.0	1	4.0	1	1.7	

Severe difficulty(4)	4	12.1	10	40.0	14	24.1	0.020[s]
Unable(5)	29	87.9	14	56.0	43	74.1	
At 12th week							
Mild difficulty(2)	0	0.0	4	16.7	4	7.4	0.062[ns]
Moderate difficulty(3)	6	20.0	5	20.8	11	20.4	
Severe difficulty(4)	24	80.0	15	62.5	39	72.2	
At 6th month							
No difficulty(1)	0	0.0	4	17.4	4	7.5	
Mild difficulty(2)	10	33.3	9	39.1	19	35.8	0.044[s]
Moderate difficulty(3)	19	63.3	8	34.8	27	50.9	
Severe difficulty(4)	1	3.3	2	8.7	3	5.7	
At 12th month							
No difficulty(1)	5	17.2	8	34.8	13	25.0	
Mild difficulty(2)	18	62.1	13	56.5	31	59.6	0.241[ns]
Moderate difficulty(3)	6	20.7	2	8.7	8	15.4	

Table 5 reveals that, in internal fixation group do heavy household chores score was significantly better according to P value at 6th week and 6th month follow-up. At other follow up no significant difference was found.

Table 6. Wash your back (at 2nd week, n=60; at 6th week, n=58; at 12th week, n=54; at 6th month, n=53 and at 12th month, n=52).

Wash your back	External Fixation		Internal Fixation		Total		P value
	n	%	n	%	n	%	
At 2nd week							
Severe difficulty(4)	0	0.0	1	4.0	1	1.7	0.233[ns]
Unable(5)	35	100	24	96.0	59	98.3	
At 6th week							
Moderate difficulty(3)	0	0.0	5	20.0	5	8.6	
Severe difficulty(4)	24	72.7	16	64.0	40	69.0	0.023[s]
Unable(5)	9	27.3	4	16.0	13	22.4	
At 12th week							
No difficulty(1)	0	0.0	1	4.2	1	1.9	
Mild difficulty(2)	2	6.7	7	29.2	9	16.7	0.052[ns]
Moderate difficulty(3)	22	73.3	10	41.7	32	59.3	
Severe difficulty(4)	6	20.0	6	25.0	12	22.2	
At 6th month							
No difficulty(1)	5	16.7	7	30.4	12	22.6	0.442[ns]
Mild difficulty(2)	17	56.7	12	52.2	29	54.7	
Moderate difficulty(3)	8	26.7	4	17.4	12	22.6	
At 12th month							
No difficulty(1)	20	69.0	20	87.0	40	76.9	
Mild difficulty(2)	6	20.7	2	8.7	8	15.4	0.311[ns]
Moderate difficulty(3)	3	10.3	1	4.3	4	7.7	

Table 6 shows that, according to P value, statically non-significant difference found except at 6th week's follow-up, Where difficulty to wash own back was more in external fixation group.

Table 7. Use a knife to cut food (at 2nd week, n=60; at 6th week, n=58; at 12th week, n=54; at 6th month, n=53 and at 12th month, n=52).

Use a knife to cut food	External Fixation		Internal Fixation		Total		P value
	n	%	n	%	n	%	
At 2nd week							
Unable(5)	35	100	25	100	60	100	----
At 6th week							
Moderate difficulty(3)	0	0.0	4	16.0	4	6.9	
Severe difficulty(4)	12	36.4	11	44.0	23	39.7	0.031[s]
Unable(5)	21	63.6	10	40.0	31	53.4	
At 12th week							
Mild difficulty(2)	1	3.3	4	16.7	5	9.3	
Moderate difficulty(3)	14	46.7	13	54.2	27	50.0	0.219[ns]
Severe difficulty(4)	14	46.7	6	25.0	20	37.0	
Unable(5)	1	3.3	1	4.2	2	3.7	
At 6th month							
No difficulty(1)	2	6.7	5	21.7	7	13.2	
Mild difficulty(2)	15	50.0	12	52.2	27	50.9	0.303[ns]
Moderate difficulty(3)	12	40.0	5	21.7	17	32.1	
Severe difficulty(4)	1	3.3	1	4.4	2	3.8	
At 12th month							
No difficulty(1)	16	55.2	14	60.9	30	57.7	0.482[ns]
Mild difficulty(2)	7	24.1	7	30.4	14	26.9	
Moderate difficulty(3)	6	20.7	2	8.7	8	15.4	

Table 7 shows that, P value does not show significant difference between the fixations groups except at 6th week Follow up, where unable to use a knife to cut food were more in external fixation group.

Table 8. Recreational activities (at 2nd week, n=60; at 6th week, n=58; at 12th week, n=54; at 6th month, n=53 and at 12th month, n=52).

Recreational activities	External Fixation		Internal Fixation		Total		P value
	n	%	n	%	n	%	
At 2nd week							
Unable(5)	35	100	25	100	60	100	----
At 6th week							
Moderate difficulty(3)	0	0.0	1	4.0	1	1.7	
Severe difficulty(4)	9	27.3	13	52.0	22	37.9	0.062[ns]
Unable(5)	24	72.7	11	44.0	35	60.3	
At 12th week							
Mild difficulty(2)	0	0.0	4	16.7	4	7.4	
Moderate difficulty(3)	15	50.0	9	37.5	24	44.4	0.063[ns]
Severe difficulty(4)	15	50.0	11	45.8	26	48.1	
At 6th month							
No difficulty(1)	2	6.7	4	17.4	6	11.3	
Mild difficulty(2)	11	36.7	10	43.3	21	39.6	0.475[ns]
Moderate difficulty(3)	16	53.3	8	34.8	24	45.3	
Severe difficulty(4)	1	3.3	1	4.4	2	3.8	
At 12th month							
No difficulty(1)	17	58.6	11	47.8	28	53.8	
Mild difficulty(2)	8	27.6	9	39.1	17	32.7	0.668[ns]
Moderate difficulty(3)	4	13.8	3	13.1	7	13.5	

Table 8 shows that, according to P value, statically non-significant difference found in case of recreational activities.

Table 9. Limitation of social activities (at 2nd week, n=60; at 6th week, n=58; at 12th week, n=54; at 6th month, n=53 and at 12th month, n=52).

Limitation of social activities	External Fixation		Internal Fixation		Total		P value
	n	%	n	%	n	%	
At 2nd week							
Extremely(5)	35	100	25	100	60	100	----
At 6th week							
Moderately(3)	0	0.0	5	20.0	5	8.6	
Quite a bit(4)	15	45.5	15	60.0	30	51.7	0.003hs
Extremely(5)	18	54.5	5	20.0	23	39.7	
At 12th week							
Slightly(2)	0	0.0	7	29.2	7	13.0	
Moderately(3)	17	56.7	8	33.3	25	46.3	0.005s
Quite a bit(4)	13	43.3	9	37.5	22	40.7	
At 6th month							
Not at all(1)	3	10.0	5	21.7	8	15.1	
Slightly(2)	10	33.3	9	39.1	19	35.8	0.268ns
Moderately(3)	17	56.7	8	34.8	25	47.2	
Quite a bit(4)	0	0.0	1	4.3	1	1.9	
At 12th month							
Not at all(1)	17	58.6	11	47.8	28	53.8	
Slightly(2)	8	27.6	9	39.1	17	32.7	0.668ns
Moderately(3)	4	13.8	3	13.1	7	13.5	

Table 9 represents, statically non-significant difference found except at 6th and 12th week follow-up, where Limitation of social activities were more in external fixation group, according to P value.

Table 10. Limitation of daily activities (at 2nd week, n=60; at 6th week, n=58; at 12th week, n=54; at 6th month, n=53 and at 12th month, n=52).

Limitation of daily activities	External Fixation		Internal Fixation		Total		P value
	n	%	n	%	n	%	
At 2nd week							
Unable(5)	35	100	25	100	60	100	----
At 6th week							
Moderately limited(3)	0	0.0	3	12.0	3	5.2	
Very limited(4)	16	48.5	15	60.0	31	53.4	0.045s
Unable(5)	17	51.5	7	28.0	24	41.4	
At 12th week							
Slightly limited(2)	2	6.7	6	25.0	8	14.8	
Moderately limited(3)	16	53.3	11	45.8	27	50.0	0.164ns
Very limited(4)	12	40.0	7	29.2	19	35.2	
At 6th month							
Not limited at all(1)	3	10.0	5	21.7	8	15.1	
Slightly limited(2)	9	30.0	10	43.5	19	35.8	0.277ns
Moderately limited(3)	17	56.7	7	30.4	24	45.3	
Very limited(4)	1	3.3	1	4.4	2	3.8	
At 12th month							
Not limited at all(1)	18	62.1	11	47.8	29	55.8	0.586ns
Slightly limited(2)	8	27.6	9	39.2	17	32.7	
Moderately limited(3)	3	10.3	3	13.0	6	11.5	

Table 10 represents, P value shows, statically non-significant difference found except at 6th week follow-up, where limited daily activities were more in external fixation group.

Table 11. Pain (at 2nd week, n=60; at 6th week, n=58; at 12th week, n=54; at 6th month, n=53 and at 12th month, n=52).

Pain	External Fixation		Internal Fixation		Total		P value
	n	%	n	%	n	%	
At 2nd week							
Moderate(3)	1	2.8	0	0.0	1	1.7	
Severe (4)	24	68.6	1	4.0	25	41.7	0.000vhs
Extreme(5)	10	28.6	24	96.0	34	56.7	
At 6th week							
Mild(2)	0	0.0	2	8.0	2	3.4	
Moderate(3)	5	15.1	8	32.0	13	22.4	0.098ns
Severe (4)	19	55.6	12	48.0	31	53.4	
Extreme(5)	9	27.3	3	12.0	12	20.7	
At 12th week							
None(1)	1	3.3	0	0.0	1	1.9	
Mild(2)	5	16.7	10	41.7	15	27.8	0.146ns
Moderate(3)	17	56.7	8	33.3	25	46.3	
Severe (4)	7	23.3	6	25.0	13	24.1	
At 6th month							
None(1)	3	10.0	8	34.8	11	20.8	
Mild(2)	18	60.0	7	30.4	25	47.2	0.042s
Moderate(3)	9	30.0	8	34.8	17	32.1	
At 12th month							
None(1)	26	89.7	16	69.6	42	80.8	0.068ns
Mild(2)	3	10.3	7	30.4	10	19.2	

Table 11represents, statically very highly significant and significant difference found at 2nd week and 6th month follow-up respectively, where pain was more in internal fixation group at 2nd week but in 6th month pain was more in external fixation group. At other follow up no significance was found according to p value.

Table 12. Tingling (at 2nd week, n=60; at 6th week, n=58; at 12th week, n=54; at 6th month, n=53 and at 12th month, n=52).

Tingling	External Fixation		Internal Fixation		Total		P value
	n	%	n	%	n	%	
At 2nd week							
Mild(2)	6	17.1	1	4.0	7	11.7	
Moderate(3)	19	54.3	7	28.0	26	43.3	0.017s
Severe (4)	8	22.9	11	44.0	19	31.7	
Extreme(5)	2	5.7	6	24.0	8	13.3	
At 6th week							
Mild(2)	2	6.0	12	48.0	14	24.1	
Moderate(3)	22	66.7	9	36.0	31	53.4	0.001hs
Severe (4)	9	27.3	4	16.0	13	22.4	
At 12th week							
None(1)	5	16.7	10	41.7	15	27.8	
Mild(2)	19	63.3	12	50.0	31	57.4	0.098ns
Moderate(3)	6	20.0	2	8.3	8	14.8	
At 6th month							
None(1)	20	66.7	17	73.9	37	69.8	0.569ns
Mild(2)	10	33.3	6	26.1	16	30.2	

At 12th month							
None(1)	25	86.2	21	91.3	46	88.5	0.568ns
Mild(2)	4	13.8	2	8.7	6	11.5	

Table 12 reveals, statically significant difference found at 2nd and 6th week follow-up, where tingling was more in internal fixation group at 2nd week then more in external fixation group at 6th week. At other follow up no significant difference was found according to p value.

Table 13. Sleeping difficulty (at 2nd week, n=60; at 6th week, n=58; at 12th week, n=54; at 6th month, n=53 and at 12th month, n=52).

Sleeping difficulty	External Fixation		Internal Fixation		Total		P value
	n	%	n	%	n	%	
At 2nd week							
Mild difficulty(2)	2	5.7	0	0.0	2	3.3	
Moderate difficulty(3)	17	48.6	3	12.0	20	33.3	0.000vhs
Severe difficulty(4)	13	37.1	8	32.0	21	35	
Cannot sleep(5)	3	8.6	14	56.0	17	28.3	
At 6th week							
Mild difficulty(2)	0	0.0	7	28.0	7	12.1	
Moderate difficulty(3)	22	66.7	6	24.0	28	48.3	0.001hs
Severe difficulty(4)	8	24.2	8	32.0	16	27.6	
Cannot sleep(5)	3	9.1	4	16.0	7	12.1	
At 12th week							
No difficulty(1)	2	6.7	8	33.3	10	18.5	
Mild difficulty(2)	20	66.7	11	45.8	31	57.4	0.056ns
Moderate difficulty(3)	7	23.3	3	12.5	10	18.5	
Severe difficulty(4)	1	3.3	2	8.3	3	5.6	
At 6th month							
No difficulty(1)	21	70.0	17	73.9	38	71.7	
Mild difficulty(2)	7	23.3	5	21.7	12	22.6	0.920ns
Moderate difficulty(3)	2	6.7	1	4.3	3	5.7	
At 12th month							
No difficulty(1)	20	69	19	82.6	39	75	0.259ns
Mild difficulty(2)	9	31	4	17.4	13	25	

Table 13 shows, according to P value, statically very highly significant and highly significant difference found at 2nd week and 6th week follow-ups, where sleeping difficulty was more in internal fixation group at 2nd week and in external fixation group at 6th week. In other follow-ups no significant difference found.

Figure 2 shows that, out of 52 patients at 12th month follow-up, 34(65.4%) patient's functional outcome was good and 13(25%) patient's functional outcome was excellent. In external fixation group, 22(75.9%) patient's functional outcome was good and 5(17.2%) patient's functional outcome was excellent. In internal fixation group, 12(52.2%) patient's functional outcome was good and 8(34.8%) patient's functional outcome was excellent. According to P value, result is statistically non-significant.

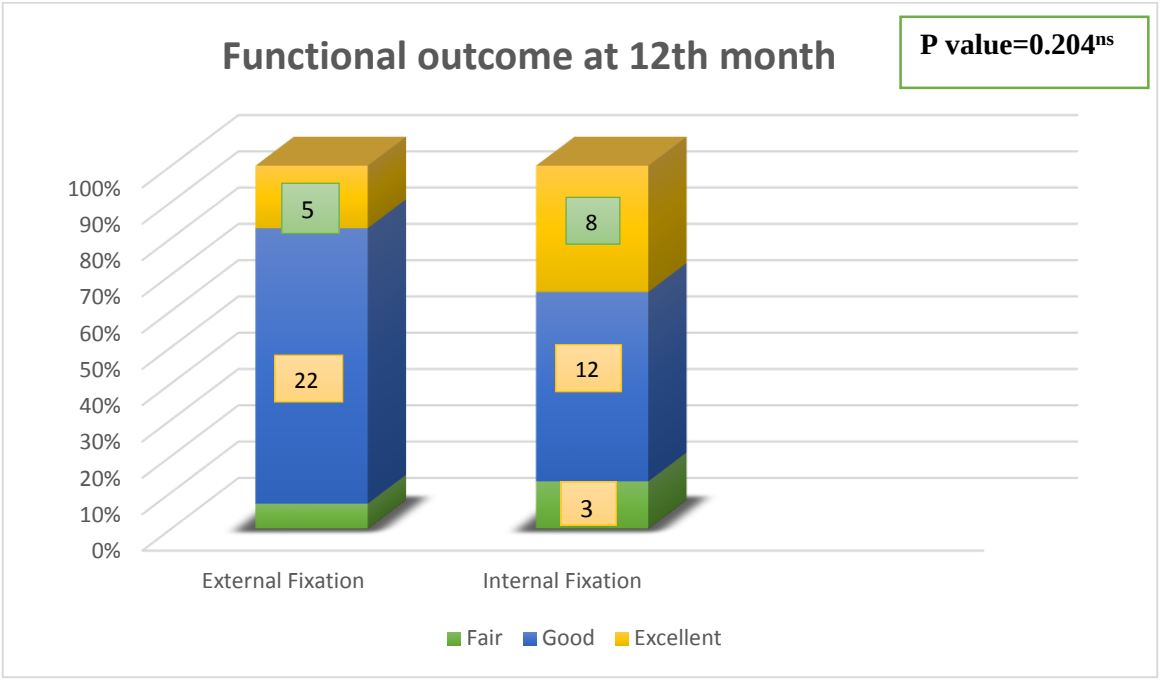

Figure 2. Distribution of the patients according to functional out come at 12th month and type of operation (n=52).

IV. DISCUSSION

In this study several follow up were done at 2nd week, 6th week, 12th week, 6th month and 12th month, where at 2nd, 3rd, 4th and last follow-up 2, 4, 1 and 1, that means total 8 patients were dropped out from this study. Functional assessment were done according to Quick DASH Score by several daily activities like open a tight or new jar, do heavy household chores, carry shopping bag or briefcase, wash your back, use a knife to cut food, recreational activities, limitation of normal social activities, limitation of regular daily activities, pain, tingling and sleeping difficulty score[22]. The complications were defined as conditions leading soft tissue infection, delayed union, non-union and wrist stiffness. Delayed union was defined as the persistence of bone pain and tenderness three months after the fracture without complete union radio graphically. Non-union was defined as the absence of osseous union more than six months after the injury. Prognosis was described as time taken for radiological union. The overall clinical outcomes were categorized according to Quick DASH Score as excellent, good, fair and poor at 12th month follow-up[22].

In this study, maximum age incidence was found in 46-55 years age group (31.7%). Average mean ± SD was 42.63 ± 10.544 and range was 18-65 years. The mean age was 44.26 ± 9.328 in external fixation group and 40.36 ± 11.867 in internal fixation group. P value was 0.160, statistically non-significant. These figures were compared favorably with other workers. Shukla *et al*. (2014) showed mean age was 38.95 ± 13.15 in external fixator group and 39.33 ± 13.1 in internal fixation group. Average mean age was 39.12 ± 13.06. P value was 0.88. In other studies like showed mean age was (range) in years 55 (20–69) in volar plating group and 56 (21–69) in external fixation group[12]. Another study done by Kundu *et al.* (2017) revealed average age was 42 (range 18-64) years[23]. Nagnur *et al.* (2016) showed, distal radial fracture was more common in the 3rd to 5th decade with average of 43.35 years in internal fixation group and 36.8 years in external fixation group[24].

This study had 45(75%) were male and 15(25%) were female. In external fixation group, 27(77.14%) patients were male and 8(22.86%) patients were female. In internal fixation group, 18(72%) patients were male and 7(28%) patients were female. According to P value, result was non-significant. Similar demographic scenario was revealed in studies[25]. They showed male were 28 in external fixation group and 30 in volar plating group. Female were 30 in external fixation group and 35 in volar plating group. P value was 0.546, which was not significant. In Pradhan *et al.* (2015) study gender (M/F ratio) was 9:13 in external fixation group and 11:15 was in volar locking plate group[26]. In Shukla *et al.* (2014), sex (male/female) was 29/33 in external fixator group and 20/28 in volar plate group. Total male/female ratio was 49/61, P value was 0.733. Present study showed, out of 60 patients 27(45%) were service holder, 4(7%) were student, housewife was 13(22%), driver was 2(3%) and 14(23%) were in other profession[27].

According to side of injury, in external fixation group, 25(71.4%) patients had on right side and 10(28.6%) patients had on left side. In internal fixation group, 16(64%) patients had on right side and 9(36%) patients had on left side involvement. P value was 0.542, statistically not significant. Also in a study conducted by Nagnur *et al.* (2016) showed

that Side involvement in that study in LCP group 14:6 (R: L) and in EXFIX 9:11 (R: L). Another study done by Ma *et al.* (2016), presented, Hand dominance was right-26(external fixation group) and 41(volar plating group) and left- 32(external fixation group) and 24(internal fixation group). P value was 0.446. Therefore no difference was observed between the present and past series[24].

Regarding the mechanism of injury, in external fixation group, 24(68.6%) patients had RTA and 11(31.4%) patients had fall from height. In internal fixation group, 16(64%) patients had RTA, 8(32%) patients had fall from height and 1(4%) patient had history of assault. P value was 0.485 that is statistically not significant. In another study done by Nagnur *et al.* (2016), where causes of fracture in LCP, RTA was 12 cases and fall on outstretched hands was 8 cases and in EXFIX, RTA was 16 and fall on outstretched hands was 4 cases[24].

In this series fracture were classified according to AO/OTA classification system. Here, in external fixation group, 4(11.4%) patients had B2, 6(17.1%) patients had B3, 17(48.6%) patients had C1 and 8(22.9%) patients had C2 type fracture. In internal fixation group, 3(12%) patients had B2, 5(20%) patients had B3, 09(36%) patients had C1, 4(16%) patients had C2 and 4(16%) had C3 type fracture. P value was 0.162, which is statistically not significant. In Fok *et al.* (2013) study AO type C classification of distal radius, C1 was 15. C2 was 44 and C3 was 42[28]. Kundu *et al* (2017) showed, in their study 60% of cases were of type C of AO classification and 20% cases were of B2 and 18% cases were of B3 type[23].

According to type of procedure, out of 60 patients, 35(58.3%) patients were undergone to external fixation and 25(41.7%) patients were undergone to internal fixation.

This present study showed, out of 60 patients, 40(66.7%) patient needed 30-70 minutes and 20(33.3%) patient needed 80-110 minutes for operation. In external fixation group, all 35(100%) patients needed 30-70 minutes. In internal fixation group, only 5(20%) patients needed 30-70 minutes and 25(80%) patients needed 80-120 minutes. Average mean ± SD time was 61 ± 30.522 minutes and rang was 30-120 minutes. Mean ± SD time in external fixation group was 39.14 ± 7.017 minutes and in internal fixation group was 92.80 ± 21.703 minutes. According to P value, result is statistically very highly significant. Another study Shukla *et al.* (2014) corresponds with present result, mean surgery time was 35.1 ± 2.5 in the external fixation group and 56.5 ± 2.7 min in the volar plate fixation group[27].

In external fixation group, patients had suffered with postoperative complication like soft tissue infection 12(34.3%), delayed union 9(25.7%) and wrist stiffness 26(74.3%). In internal fixation group, patients had suffered with postoperative complication like soft tissue infection 8(32%) and wrist stiffness 14(56%). No patient had non-union. According to P value, result is statistically non-significant. In Ma *et al.*(2016) study, in External fixation Plating group, post-operative nerve deficit was 1, wound infection was 1, pin-track infection was 8, painful-retained hardware was 0, tendon rupture was 1, tendonitis was 1, nonunion was 1 and further surgery was 1. In plating group, post-operative nerve deficit was 3, wound infection was 6, pin-track infection was 0, painful-retained hardware was 1, tendon rupture was 2, tendonitis was 8, nonunion was 2 and further surgery was 7. P values were 0.367, 0.043, 0.000, 0.343, 0.627, 0.024, and 0.042 respectively[25]. Another study of Phandis *et al.* (2012) revealed, tendon rupture was 3, late carpal tunnel syndrome was 2, acute carpal tunnel syndrome was 2, superficial infection was 2, deep Infection was 1 and hypertrophic scar was 2 among 180 patients[29]. Wilcke, Abbaszadegan and Adolphson (2011) showed, in the external fixation group, 1 patient was re-operated with a supplementary volar plate within a week due to an unacceptable fracture position postoperatively[12]. At the 12-month evaluation, a corrective osteotomy was planned in 1 patient, due to a painful malunion. 4 patients suffered from pin tract infections and in 1 of these, pin loosening occurred with malunion as a consequence. 1 patient suffered from a mild complex regional pain syndrome and 1 patient reported a disturbing skin adhesion after a Hoffmann pin. In 4 patients, a light sensory deficit was noted, corresponding to a superficial radial nerve branch. Regarding open a tight or new jar score, there was no significant difference in case of open a tight or new jar at every follow-up except, 12th week, where difficulty to open a tight or new jar was more in external fixation group according to p value.

Study showed that, statistically highly significant difference found at 6th and 12th week follow-up and significant difference found at 6th month follow-up between two groups. At other follow-up no significant difference was found. According to wash your back score, statically non-significant difference found except at 6th week's follow-up, where difficulty to wash own back was more in external fixation group (according to P value). This study represents, regarding use a knife to cut food score, P value does not show significant difference between the fixation groups except at 6th week follow up, where unable to use a knife to cut food were more in external fixation group. Regarding recreational activities score, according to P value, statically non-significant difference found. According to limitation of normal social activities score, P value shows, statically non-significant difference found except at 6th week follow-up, where limited daily activities were more in external fixation group. Concerning limitation of regular daily activities score, P value shows, statically non-significant difference found except at 6th week follow-up, where limited daily activities were more in external fixation group. According to pain score, statically very highly significant and significant

difference found at 2nd week and 6th month follow-up respectively, where pain was more in internal fixation group at 2nd week but in 6th month pain was more in external fixation group. At other follow up no significance was found according to p value. Regarding tingling score, statically significant difference found at 2nd and 6th week follow-up, where tingling was more in internal fixation group at 2nd week then more in external fixation group at 6th week. At other follow up no significant difference was found according to p value. Concerning sleeping difficulty score, according to P value, statically very highly significant and highly significant difference found at 2nd week and 6th week follow-ups, where sleeping difficulty was more in internal fixation group at 2nd week and in external fixation group at 6th week. In other follow-ups no significant difference found.

Regarding union at fracture site radiologically, out of 54 patients having complete radiological union, in external fixation group, 21(70%) patient's radiological union time was within 12-16 weeks and 9(30%) patient's radiological union time was within 22-26 weeks. In internal fixation group, 17(70.8%) patient's radiological union time was within 12-16 weeks and 7(29.1%) patient's radiological union time was within 22-26 weeks. Average mean ± SD radiological union time were 16.59 ± 5.279 weeks. Mean ± SD radiological union time in external fixation group was 16.53 ± 5.386 weeks and in internal fixation group was 16.67 ± 5.264 weeks. According to P value, result is statistically non-significant. In Phandis *et al.* (2012) study, Overall mean time to fracture union was 8.4 weeks (628 weeks) [29]. In another study done by Kundu *et al.* (2017), the mean time to union was eight weeks (range 6-12 weeks)[23]. Nagnur *et al.* (2016) showed, time of union in LCP group, 16(80%) were within 2-3 months, 3(15%) were within 3-4 months and 1(10%) was more than 4 months and in EXFIX group, 14(70%) were within 2-3 months, 4(20%) were within 3-4 months and 2(10%) were more than 4 months[24].

According to Quick DASH score (Gummesson, Ward and Atroshi, 2006) criteria 04 categories were subdivided-excellent, good, fair and poor. In this study at 12th month's final follow-up, out of 52 patients, 34(65.4%) patient's functional outcome was good and 13(25%) patient's functional outcome was excellent. In external fixation group, 22(75.9%) patient's functional outcome was good and 5(17.2%) patient's functional outcome was excellent. In internal fixation group, 12(52.2%) patient's functional outcome was good and 8(34.8%) patient's functional outcome was excellent[22]. According to P value, result is statistically non-significant. Similar results were observed in other studies. In Nagnur *et al.* (2016) study, in LCP group, 9(45%) were excellent, 9(45%) were good, 2(10%) were fair and 0(0%) was poor and in EXFIX group, 1(5%) was excellent, 9(45%) were good, 8(40%) were fair and 2(10%) were poor[24]. In Phandis *et al.* (2012), the median DASH score was 2.3 and overall, 133 patients (74%) had a good or excellent DASH score. In another study Pradhan *et al.* (2015), the functional outcomes of the patients with both internal and external fixation were follows, Volar locking plate: Excellent 17, Good 6, Fair 2 and Poor 1 and External fixation group: Excellent 12, Good 6, Fair 3 and Poor 1. So these results corresponds with present study[29].

V. CONCLUSION & RECOMMENDATIONS

The most appropriate surgical management for unstable distal radial fracture in the adult patients continues to be debated. Although external fixation remains a popular choice of treatment, the current studies supports the trend toward locked volar plating, as it allows for a more rapid return of function. Internal fixation should therefore be considered in patients for whom an accelerated functional recovery would be advantageous. All though, at early follow-ups internal fixation shows better outcome, nevertheless after 12 months of surgery both external fixation and locked volar plating provide good to excellent clinical outcomes. As present study was done on a relatively small sample, a large-scale study to be conducted to make the findings of the study generalized to reference population. Good anatomical and radiological knowledge. Long term follow up is needed for furthermore better evaluation. A multicenter study could be undertaken to interpret such results better.

ACKNOWLEDGEMENTS

All praises to the almighty God the merciful, for giving me the courage, opportunity and providing me with enough energy to carry out and complete the entire thesis. With profound regards, I would like to express my heartfelt gratitude to my teacher and guide **Professor Dr. Chandan Kumar Das**, MS (Ortho), Department of Orthopaedic Surgery, Chattogram Medical College Hospital for his constant guidance, valuable suggestions and encouragement in the field of my work. Without his constant supervision, successful completion of this study would have been difficult. I shall remain ever grateful to him for his affectionate help and inspiration. I also express my deepest gratitude to my respected teacher and co-guide, **Dr. Jabed Jahangir Tuhin**, MS (Ortho) Assistant Professor, Department of Orthopaedic Surgery, Chattogram Medical College Hospital, who in a nutshell, is an umbrella over my head from topic selection to the completion of this laborious work. I am indebted to my patients and O.T. stuff for their co-operation during the whole period of this study. Finally, I express my heartfelt gratitude to my parents and my brother for their blessings and support during this study.

Statement of Informed Consent:

"Informed consent was obtained from all individual participants included in the study."

Contribution to Authors:

All authors involved in protocol preparation, data collection and literature search up to manuscript writing as well as revision of this manuscript.

REFERENCES

I. Bentohami, A., Bosma, J., Akkersdijk, G. J. M., van Dijkman, B., Goslings, J. C., Schep, N. W. L. (2014). Incidence and characteristics of distal radial fractures in an urban population in The Netherlands, *Eur J Trauma Emerg Surg*, 40(3): p. 357–61. doi:10.1007/s00068-014-0394-7.

II. Mellstrand-Navarro, C., Pettersson, H. J., Tornqvist, H. and Ponzer, S. (2014). The operative treatment of fractures of the distal radius is increasing: results from a nationwide Swedish study, *Bone Joint J*, 96-b(7): p. 963–9. doi:10.1302/ 0301-620x.96b7.33149.

III. Nagnur, R. K., Patil, A. B., Angadi, V. and Palled, G. S. (2016). Locking compression plate fixation vs external fixator for distal radius fractures, *International Journal of Orthopaedics Sciences*, 2(3): p. 92-96.

IV. Jupiter, J. B., Ring, D. and Weitzel, P. P. (2002). Surgical treatment of re-displaced fractures of the distal radius in patients older than 60 years, *J Hand Surg Am*, 27: p. 714-23.

V. Brogren, E., Petranek, M. and Atroshi, I. (2007). Incidence and characteristics of distalradius fractures in a southern Swedish region, *BMC Musculoskeletal Disorders*, 8: p. 48. http://www.biomedcentral.com/1471-2474/8/48

VI. Rockwood, C. A. and Green, D. P. (2015). Rockwood and Green's Fractures in Adults, 8th edition, Wolters Kluwer Health, Philadelphia, USA.

VII. Slutsky, D. J. (2007). External fixation of distal radius fractures, *J Hand Surg Am*, 32: p. 1624–1637.

VIII. Chung, K. C., Watt, A. J., Kotsis, S. V., Margaliot, Z., Haase, S. C. and Kim, H. M. (2006). Treatment of unstable distal radial fractures with the volar locking plating system, *J Bone Jt Surg Am*, 88: p. 2687–2694.

IX. Schnall, S. B., Kim, B. J., Abramo, A. and Kopylov, P. (2006). Fixation of distal radius fractures using a fragment-specific system, *Clin Orthop*, 445: p. 51–57.

X. Konstantinos, C. X., Dionysios, A. V. and Konstantinos, J. K. (2009). Classifying fractures of the distal radius: impossible or unnecessary? Review of the literature and proposal of a grouping system, *Med Sci Monit*, 15(3): RA67–RA74.

XI. Scot, M. L., Cory, O. N., Jonathon, D. B., Glen, A.T., Yong, K. and Fred, S. H. (2008). Biomechanical evaluation of volar loking plate for distal radius, *Hand*, 3(1): p. 57-60.

XII. Wilcke, M. K. T., Abbaszadegan, H. and Adolphson, P. Y. (2011). Wrist function recovers more rapidly after volar locked plating than after external fixation but the outcomes are similar after 1 year, *Acta Orthopaedica*, 82: p. 76-81.

XIII. Hakimi, M., Jungbluth, P., Windolf, J. and Wild, M. (2010). Functional results and complications following locking palmar plating on the distal radius: a retrospective study, *J Hand Surg Eur*, 35(4): p. 283–8.

XIV. Othman, A. Y. (2009). Fixation of dorsally displaced distal radius fractures with volar plate, *J Trauma*, 66: p. 1416-20.

XV. Marcheix, P. S., Dotzis, A., Benko, P. E., Siegler, J., Arnaud, J. P. and Charissoux, J. L. (2010). Extension fractures of the distal radius in patients older than 50: a prospective randomized study comparing fixation using mixed pins or a palmar fixed-angle plate, *J Hand Surg Eur*, 35: p. 645-51.

XVI. Wright, T. W., Horodyski, M. B. and Smith, D. W. (2005). Functional outcome of unstable distal radius fractures: ORIF with a volar fixed-angle tine plate versus external fixation, *J Hand Surg (Am)*, 30: p. 289-99.

XVII. Egol, K., Walsh, M., Tejwani, N., McLaurin, T., Wynn, C. and Paksima, N. (2008). Bridging external fixation and supplementary Kirschner-wire fixation versus volar locked plating for unstable fractures of the distal radius: a randomised, prospective trial, *J Bone Joint Surg (Br)*, 90 (9): p. 1214-21.

XVIII. Rizzo, M., Katt, B. A. and Carothers, J. T. (2008). Comparison of locked volar plating versus pinning and external fixation in the treatment of unstable intraarticular distal radius fractures, *Hand (N Y)*, 3 (2): p. 111-7.

XIX. Wei, D. H., Raizman, N. M. and Bottino, C. J., *et al.* (2009). Unstable distal radial fractures treated with external fixation, a radial column plate, or a volar plate. A prospective randomized trial, *J Bone Joint Surg Am*, 91: p. 1568–1577.

XX. Margaliot, Z., Haase, S. C., Kotsis, S. V., Kim, H. M. and Chung, K. C. (2005) A meta-analysis of outcomes of external fixation versus plate osteosynthesis for unstable distal radius fractures, *J Hand Surg Am*, 30: p. 1185–1199.

XXI. Walenkamp, M. M., Bentohami, A., Beerekamp, M. S., Peters, R. W., van der Heiden, R., Goslings, J. C. and Schep, N. W. (2013).

Functional outcome in patients with unstable distal radius fractures, volar locking plate versus external fixation: a meta-analysis, *Strategies Trauma Limb Reconstr*, 8(2): p. 67–75.

XXII. Gummesson, C., Ward, M. M. and Atroshi, I. (2006). The shortened disabilities of the arm, shoulder and hand questionnaire (Quick DASH): validity and reliability based on responses within the full-length DASH, *BMC Musculoskelet Disord*, 7: p. 44.

XXIII. Kundu, A. K., Wale, N., Phuljhele, S., Ghritlahre, D. and Gurudatta, H. S. (2017). Intra articular distal radius fractures and volar plate fixation: a prospective study, *Int J Res Orthop*, 3: p. 589-94.

XXIV. Nagnur, R. K., Patil, A. B., Angadi, V. and Palled, G. S. (2016). Locking compression plate fixation vs external fixator for distal radius fractures, *International Journal of Orthopaedics Sciences*, 2(3): p. 92-96.

XXV. Ma, C., Deng, Q., Pu, H., Cheng, X., Kan, Y., Yang, J., Yusufu, A. and Cao, L. (2016). External fixation is more suitable for intra-articular fractures of the distal radius in elderly patients, *Bone Research*, 4: p. 16017. doi:10.1038/boneres.2016.

XXVI. Pradhan, R. L., Sharma, S., Pandey, B. K., Manandhar, R. R., Prasai, T., Lakhey, S. and Rijal, K. P. (2015). Comparison of volar locking plate and external fixation with K wire augmentation in unstable distal radius fractures, *Nepal Med Coll J*, 17(1-2): p. 67-72.

XXVII. Shukla, R., Jain, R. K., Sharma, N. K. and Kumar, R. (2014). External fixation versus volar locking plate for displaced intraarticular distal radius fractures: a prospective randomized comparative study of the functional outcomes, *J Orthopaed Traumatol*, 15:265–270. DOI 10.1007/s10195-014-0317-8

XXVIII. Fok, M. W. M., Klausmeyer, M. A., Fernandez, D. L., Orbay, J. L. and Bergada, A. L. (2013). Volar Plate Fixation of Intra-Articular Distal Radius Fractures: A Retrospective Study, *Journal of Wrist Surgery*, 2(3): p. 247-254.

XXIX. Phadnis, J., Trompeter, A., Gallagher, K., Bradshaw, L., Elliott, D. S. and Newman, K. J. (2012). Mid-term functional outcome after the internal fixation of distal radius fractures, *Journal of Orthopaedic Surgery and Research*, 7:4.