

COMPARATIVE STUDY OF FUNCTIONAL OUTCOME OF EXTERNAL AND INTERNAL FIXATION IN TREATMENT OF COMMINUTED DISTAL RADIUS FRACTURES

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ABSTRACT

Fracture distal end of radius is one of the commonest fracture that accounts for about one-sixth of all fractures treated in emergency. Comminuted distal radius fractures are due to high velocity injuries. Conservative management of these unstable comminuted distal radius fractures by plaster cast shows high incidence of unsatisfactory results. Hence, External Fixation and Internal Fixation are widely used, where conservative methods fail to maintain the anatomical and functional stability. In our study, we have compared the functional outcome of External and Internal fixation in treatment of comminuted distal radius fracture, using DASH score. Our's is a prospective, non-randomised study of 68 patients in which 34 patients have undergone surgical intervention in the form of External Fixation application and 34 patients have undergone Internal fixation for comminuted distal radius fractures, done from January 2014 to September 2015. Anterior Henry's approach is used for Internal Fixation. We have used Frykman classification to classify distal radius fractures. Statistics analysis done by Chi-Square Test. With the results of our study, we have come to a Conclusion that there is no significant difference in functional outcome of patients with comminuted distal radius fracture treated by External fixation and Internal fixation.

KEYWORDS

Comminuted Distal Radius Fracture, External Fixation, Internal Fixation, DASH Score, Frykman Classification.

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INTRODUCTION

Fractures of distal end of radius are commonest fractures presenting to Orthopaedic outpatient Department and Emergency. It accounts for about One Sixth of all fractures treated in emergency rooms.¹ Fractures of distal end of radius are caused due to fall on an outstretched hand. Unstable comminuted fractures of these type occur due to high velocity injuries. It occurs commonly in both younger and elderly population due to Road traffic accidents and fall respectively and in females it is common in postmenopausal period.

Uncomplicated fractures of this type can be treated with closed reduction and immobilization in a cast, however, unstable comminuted fractures of distal radius occur as a treatment challenge. Conservative management of comminuted unstable fracture by plaster cast method shows high incidence of unsatisfactory results. It causes deformity and unsatisfactory results in patients.²

In recent years, due to advancement of Surgical techniques, External fixation and internal fixation are widely used where conservative methods fail to maintain anatomical and functional stability.

External skeletal fixation uses minimally invasive procedures with reduction by ligamentotaxis. Both static and dynamic external fixators are used, depending upon difficulty in maintaining the radial length and alignment. Internal fixation are increasingly used as it directly controls and maintains Anatomical and functional stability of wrist joint.

Locking compression plates and volar buttress plates are widely used in this method.

AIMS AND OBJECTIVES

To compare the effects of external and internal fixation in surgical Management of Unstable comminuted fracture of distal Radius.

MATERIALS AND METHODS

This study is a prospective study, non-randomized, study period includes January 2014 to September 2015. 68 Patients were included in the study. 34 patients underwent internal fixation and 34 patients underwent external fixation.

All patients were treated by below elbow plaster slab after other life threatening injuries were ruled out. Definitive treatment was based on decision of the surgeon on a non-randomized basis.

Treatment was either by external fixation with Schanz pins or internal fixation with Buttress plate and locking compression plate. For all internal fixation cases we used Anterior Henry's approach.³

Assessment

Done by non-blinder method. Subjective assessment-pain, numbness, weakness of hand, stiffness.

Objective-Range of motion (Flexion, extension, Radial deviation, ulnar deviation, supination and pronation.)

Range of movements measured by hand held goniometer.

Functional outcome of patient was assessed using DASH (Disability of the Arm, shoulder and hand) Method.

Inclusion Criteria:

- Comminuted fracture of distal end of radius.
- Age >18 years.
- Both Male and female.
- Closed/open fractures.

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Exclusion Criteria

- Age <18 yrs.
- Refusal by patient.
- Fractures with DRUJ instability.
- Patient not fit for surgery.

Follow Up

Patients were assessed clinically and radiologically, regularly with a Follow up interval of 6 weeks, 3 months and 1 year.

RESULTS

Sixty Eight cases with distal radius fracture were considered for the study.

Statistical Methods Employed

Chi Square test was employed in the study.

Chi Square Test

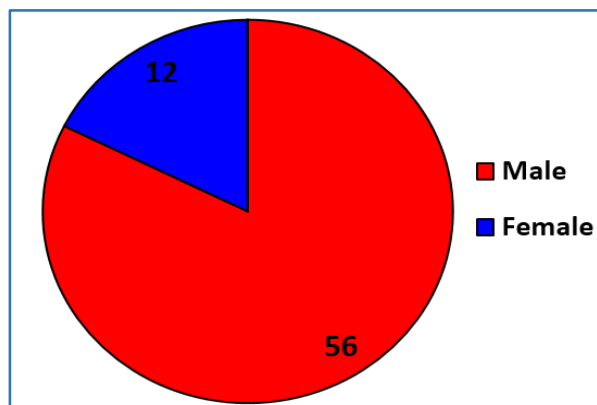
Chi Square test tabulates a variable into categories and computes a chi-square statistic. The test compares observed and expected frequencies in each category to test either all categories contain same proportion of values or each category contains user specified proportion of values.

The following observation were made from data collected during study and data was tabulated as follows.

Sex Distribution

Sex	No. of cases	%
Male	56	82.35%
Female	12	17.65%
Total	68	100%

Out of 68 cases, 56 were males and 12 were females.



Results	Male			Female		
	IF	EF	Total	IF	EF	Total
Excellent	2	1	3	0	0	0
Good	21	24	45	7	0	7
Fair	2	5	7	2	3	5
Poor	0	1	1	0	0	0
Total	56			12		

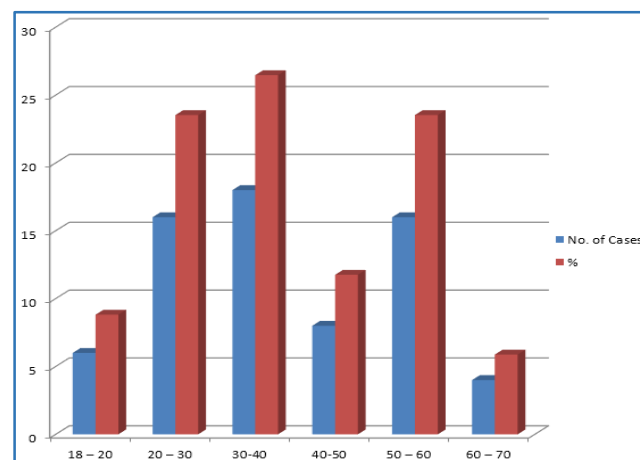
Results were assessed using Chi Square method. The Chi Square value was found to be 6.25 and p value 0.1021 which shows that sex of patient did not influence outcome of treatment.

	IF	EF	Total
Male	25	31	56
Female	9	3	12
Total	34	34	68

Age Distribution

Age	No. of Cases	%
18 – 20	06	8.82%
20 – 30	16	23.53%
30 – 40	18	26.47%
40 – 50	08	11.76%
50 – 60	16	23.53%
60 – 70	4	5.88%
Total	68	100%

The Youngest of the series was 18 years old and the oldest was 68 years old.



Results	18 – 20			20 – 30			30 – 40		
	IF	EF	Total	IF	EF	Total	IF	EF	Total
Excellent	0	0	0	1	1	2	1	0	1
Good	4	1	5	6	5	11	8	7	15
Fair	0	0	0	0	3	3	1	1	2
Poor	0	1	1	0	0	0	0	0	0
Total	6			16			18		

Results	40-50			50-60			60-70		
	IF	EF	Total	IF	EF	Total	IF	EF	Total
Excellent	0	0	0	0	0	0	0	0	0
Good	3	2	5	5	7	12	2	2	4
Fair	1	2	3	2	2	4	0	0	0
Poor	0	0	0	0	0	0	0	0	0
Total	8			16			4		

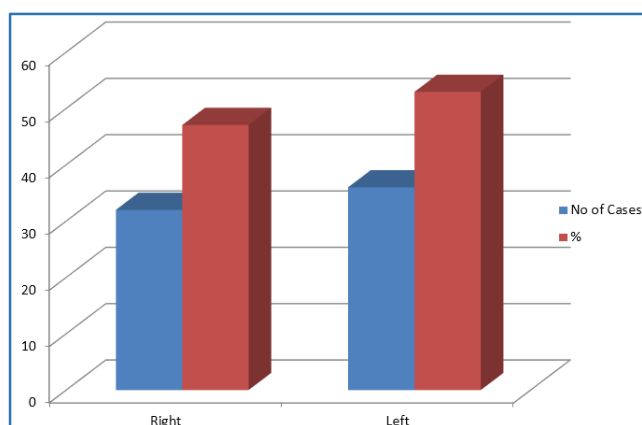
This Chi Square value was found to be 19.52 and p value 0.19117 which shows that age of patient did not influence outcome of the treatment.

Age	IF	EF	Total
18 – 20	4	2	6
20 – 30	7	9	16
30 - 40	10	8	18
40 - 50	4	4	8
50 – 60	7	9	16
60 – 70	2	2	4
Total	34	34	68

Side Involved

Side	No. of Cases	%
Right	32	47.06%
Left	36	52.94%
Total	68	100%

Majority of the fractures were of the left side.



Result	Right			Left		
	IF	EF	Total	IF	EF	Total
Excellent	0	1	1	2	0	2
Good	11	14	25	17	10	27
Fair	3	3	6	1	5	6
Poor	0	0	0	0	1	1
Total	32			36		

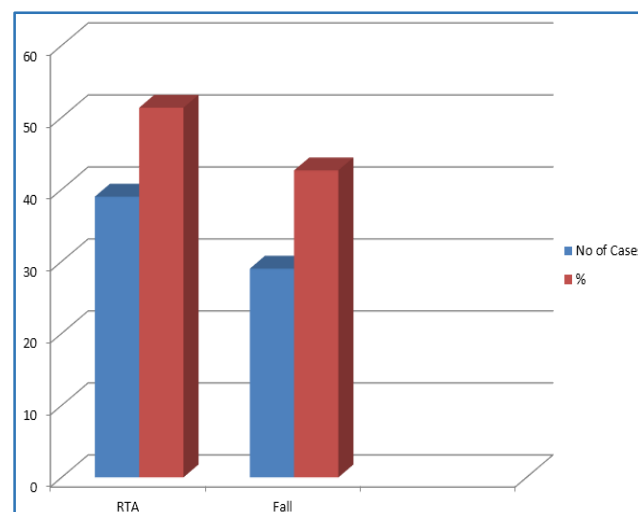
The Chi Square value was found to be 1.179 and p value 0.7580 which shows that side involved did not influence the outcome of treatment.

	IF	EF	Total
Right	14	18	32
Left	20	16	36
Total	34	34	68

Mode of Injury

Mode	No. of Cases	%
RTA	39	51.35%
Fall	29	42.65%
Total	68	100%

In the study prominent cause of injury was high energy trauma due to Road Traffic accident followed by fall on outstretched hand.



Results	RTA			Fall		
	IF	EF	Total	IF	EF	Total
Excellent	1	1	2	1	0	1
Good	21	10	31	7	14	21
Fair	3	3	6	1	5	6
Poor	0	0	0	0	1	1
Total	39			29		

The Chi Square value was found to be 1.83 and p value 0.6094 which shows that mode of injury did not influence the outcome of treatment.

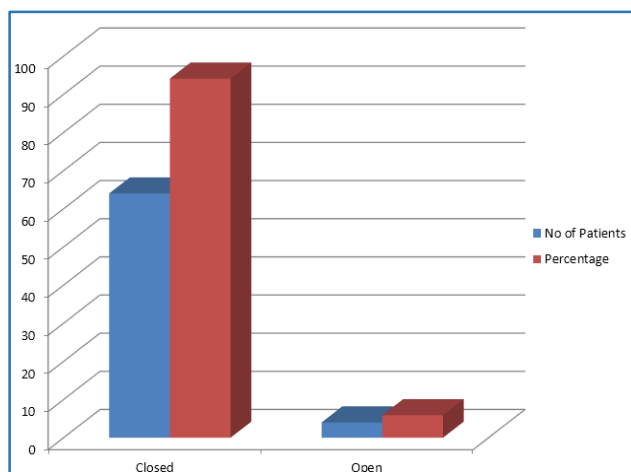
	IF	EF	Total
RTA	25	14	39
Fall	9	20	29
Total	34	34	68

Type of Fracture

Type of Fracture	No. of Patients	Percentage
Closed	64	94.12%
Open	4	5.88%
Total	68	100%

Out of 68 fractures, only 4 were Gustilo Type I open fractures. All four were treated by External Fixator application.

Results	Closed	Open
Excellent	3	0
Good	51	1
Fair	9	3
Poor	1	0
Total	64	4



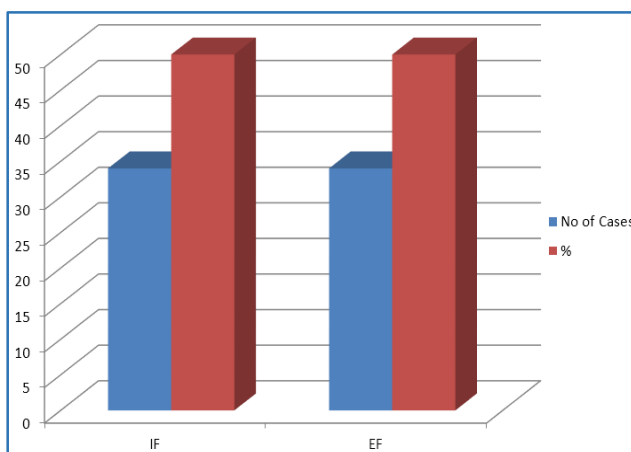
Frykman's Classification⁴

Classification	No. of Patients	Type of Fixation
Type I	03	Internal Fixation
Type II	00	-
Type III	13	Internal Fixation
Type IV	08	Internal Fixation
Type V	02	External fixation
Type VI	07	Internal Fixation
Type VII	06	External fixation
Type VIII	03	Internal Fixation
Type VIII	05	External fixation
Type VII	11	External Fixation
Type VIII	10	External Fixation

Largest number of cases were of Frykman's Type III, (13) though there were cases in other types also. Fracture type was classified according to Frykman's classification and cases were selected randomly. Three cases of Frykman's Type I fracture were treated by Internal fixation because of inability to achieve reduction by closed methods. Period of minimum follow up of patients was 1 year and patients were assessed clinically.

Method of Fixation

Method of Fixation	No. of Cases	%
IF	34	50%
EF	34	50%
Total	68	100%



Results	IF	EF
Excellent	2	1
Good	28	24
Fair	4	8
Poor	0	1
Total	34	34

The Chi Square value was found to be 2.97 and p value 0.3955 which shows that method of fixation does not determine the outcome of treatment.

Movements After 12 Weeks Compared with Normal Side

Wrist:	Normal ROM	Result (Average)
Dorsiflexion	75°	70°
Palmar Flexion	75°	65°
Ulnar Deviation	30°	25°
Radial Deviation	20°	15°
Forearm		
Supination	80°	70°
Pronation	75°	65°

Average Time of Fracture Union

The Average time of fracture union was 5.76 months with a standard deviation of 0.50 in case of ORIF with Buttress plate and 3.76 months with standard deviation of 0.74 in case of fracture treatment with external fixator.

COMPLICATION

External Fixation

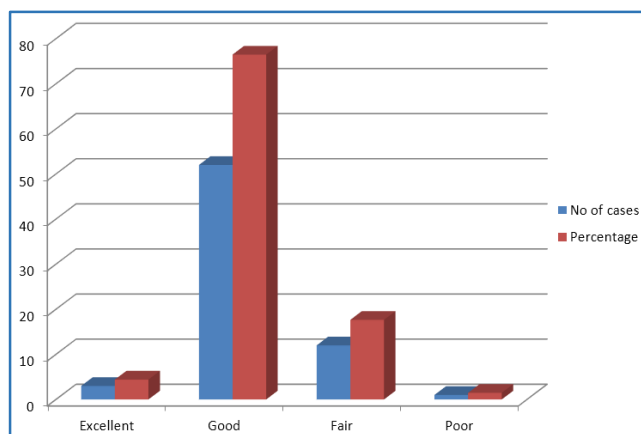
Complications	No. of Patients
Wrist Stiffness	5
Pin site infection	5
Pin Loosening	2
Tendon rupture	0
Compression Neuropathy	0
Sudeck's Osteodystrophy	0
Finger Stiffness	1

The commonest complications were pin tract infection and pain in wrist joint.

Internal Fixation

Complications	No. of Patients
Wrist Stiffness	3
Nerve Injuries	0
Vascular injuries	0
Tendon rupture	0
Compression Neuropathy	0
Sudeck's Osteodystrophy	0
Finger Stiffness	2

Results	No. of Cases	Percentage
Excellent	3	4.41%
Good	52	76.47%
Fair	12	17.65%
Poor	1	1.47%
Total	68	100%



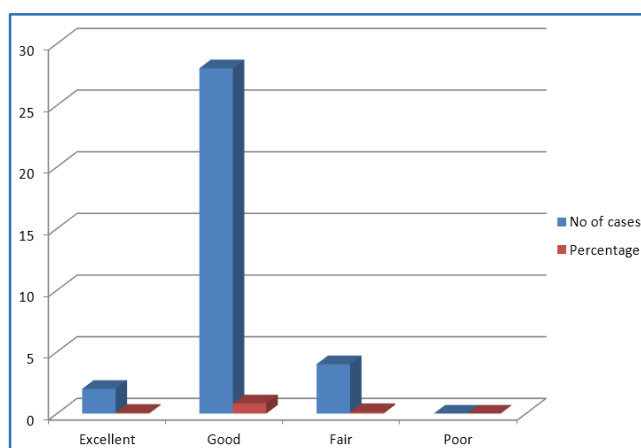
With help of DASH (Disability of Arm, shoulder and Hand) method, Functional results were as follows:

Excellent (3) - 4.41%
 Good (52) - 78.18%
 Fair (12) - 17.65%
 Poor (1) - 1.47%

RESULTS

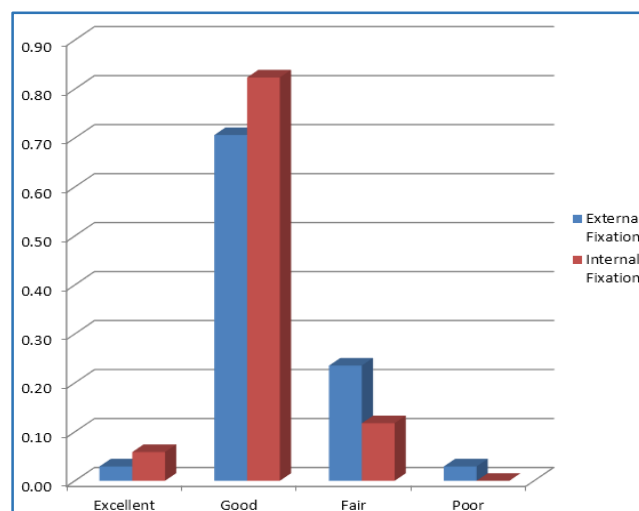
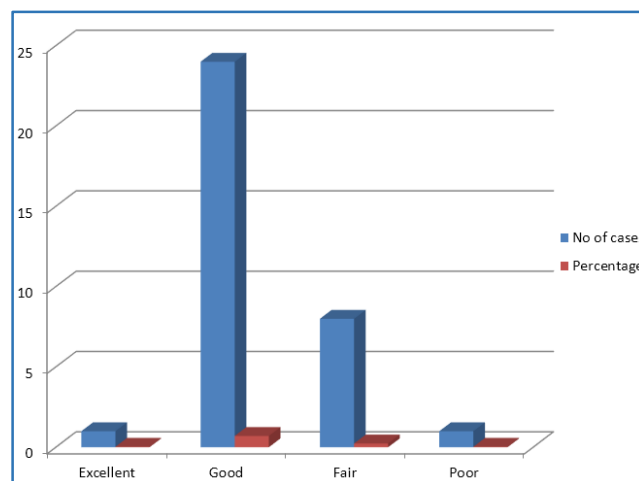
Internal Fixation

Results	No. of Cases	Percentage
Excellent	2	5.88%
Good	28	82.35%
Fair	4	11.76%
Poor	0	0%
Total	34	100%



External Fixation

Results	No. of cases	Percentage
Excellent	1	2.94%
Good	24	70.59%
Fair	8	23.53%
Poor	1	2.94%
Total	34	100%



CLINICAL PICTURES

External Fixation

Case 1: 50 yr./M - Fair Result



Pre-Op



Post-Op



One Year Followup X-Rays

Range of Motion



Palmar Flexion

Dorsiflexion



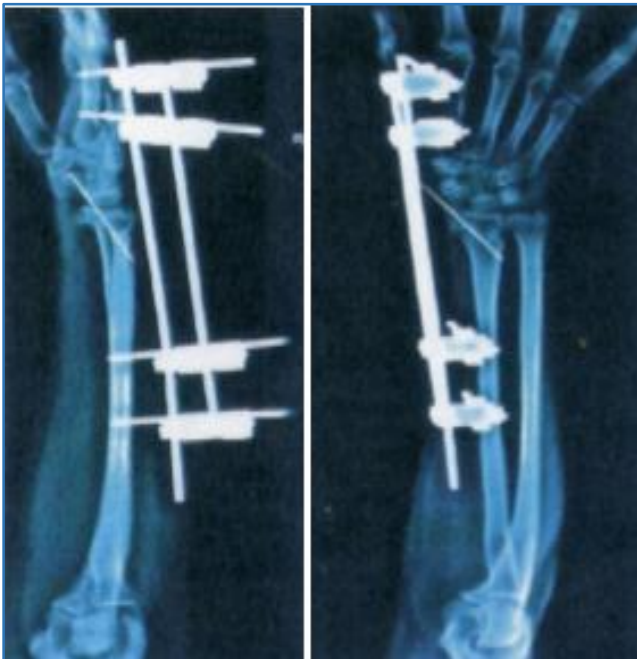
Pronation

Supination

Case 2: 53 Yr/f- Good Result



Pre-Op



Post-Op



Post Ex-Fix Removal (6 Weeks)

Range of Motion



Dorsi-Flexion

Palmar-Flexion



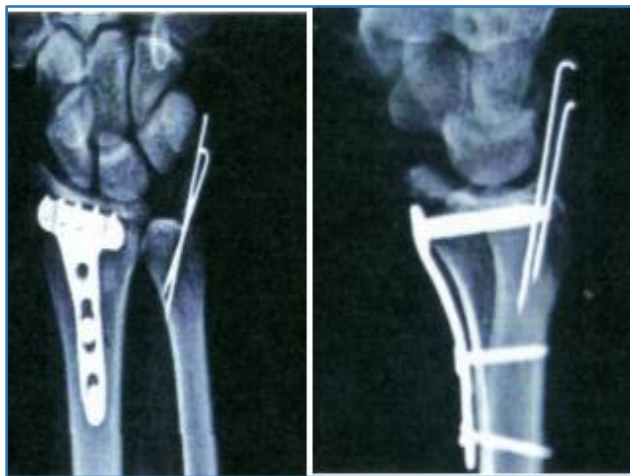
Pronation

Supination

Case 3: 28 yr/M- Good Result



Pre-Op



Post-Op

Range of Motion



Dorsi-Flexion

Palmar-Flexion



Supination

Pronation

Case 4: 51 Yr/M-Fair Result



Pre-Op



Post-Op

Range of Motion



Dorsi-Flexion

Palmar-Flexion



Supination

Pronation

DISCUSSION

This prospective study was undertaken for comparative analysis of surgical management using external fixation and internal fixation in treatment of unstable comminuted fracture of distal radius.

In recent years, both External fixation and internal fixation are used. The patient selection was based on factors like Age, fracture pattern, bone quality.

External fixation done with Schanz Pins allows fracture fragments to fall in place and brings about reduction and maintains the distraction force during fracture healing. It is used when fracture fragments are very small. Extremely comminuted and open fractures are best treated by this method. Ligamentotaxis is useful in restoring skeletal length and wrist position can be adjusted. Advantages of external fixator are its superior mechanical efficiency, its capacity of fracture adjustment during the healing period.

Open reduction and Internal fixation are widely used than External fixation in recent years. Buttress Plate and locking Compression Plates are used. Even comminuted fractures with dorsal metaphyseal instability can be fixed with a volar plate. It has the advantages like early and better mobilization and function of hand, repair of ruptured tendons, less residual pain, stiffness, and restriction and best chance of restoring joint congruity.

The total number of patients recruited in the study was 68 and there were 82% males and 18% females. In our study, sex of the patients did not influence the outcome.

In our study, patients from age group 18 years to 68 years old were employed. Majority of patients were in the age groups of 30-40 years and 20-30 years. This reflected the bimodal distribution of distal radius fractures. More patients of distal radius fractures. In the younger age group reflecting a greater incidence of high velocity Injuries than low velocity injuries in elderly population.

Previously, Zhuang cui et al⁵ conducted a meta- analysis of unstable distal radius fractures treated with Internal fixation versus External fixation. It included pooled data from ten randomized controlled trails included 738 patients,

orthopaedic Journals. It discussed that a prospective study of patients aged ≥ 35 years with Colle's fracture at Six centers in the United Kingdom for a period of one year reported that the overall incident of this fracture to be 9/10,000 in men and 37/10,000 in women. Therefore, although there may be effect modification due to mean and proportion of women, we could not determine this from, available data.

In our series, left sided fractures were commoner than Right sided fractures. Also road traffic accidents were the main cause of Injury. However, Jerry Knirk et al⁶ found on their series, fall from height to be the main cause of fractures.

In our study, Frykman's classification was used for classification of the fracture type. Most fractures were of Frykman type 3. However, Fractures are also distributed evenly in other groups. There were no type 2 fractures.

Similarly, Kapoor et al⁷ conducted a study in orthopaedic department for a period of 5 years. They used Frykman classification for assessment of fractures.

In our study, 34 patients who underwent internal fixation and 34 patients who underwent External fixation were included. The functional outcomes of patients were assessed using DASH (Disabilities of Arm, Shoulder and Hand) method.

In the external fixation group, one had excellent result, 24 had good result, 8 had fair results and no one had poor result.

In the Internal fixation group, two patients had excellent results, 28 patients had good results, 4 patients had fair results and no one had poor results. Majority of patients both groups had good results. The results in both groups were comparable and the difference is not significant.

Previously, Wei et al⁸ conducted a systematic meta-analysis of clinical trials comparing external fixation with open reduction and internal fixation. A definitive conclusion of which is superior method could not be arrived in treatment of distal radius fractures. Data from 12 trials with 1011 patients were included. 491 patients were treated with external fixation and 520 were treated with Internal fixation. They concluded that ORIF yielded significant functional results (DASH Method) and external fixation yielded better grip strength and wrist flexion.

The mean range of dorsiflexion in external and internal fixation groups were 70 degrees and 72 degrees. The mean palmar flexion was 56 degrees and 65 degrees. Pronation in both groups are similar but supination was greater in Internal fixation group. The reason may be external fixation are finally assembled and completed in pronation or midprone, whereas position of forearm during Internal fixation was supination.

Similarly, Margaliot et al⁹ did a meta-analysis of distal radius fractures treated by external and Internal fixation 46 articles were included in the study after careful serenity of Internal and external fixation. 917 patients were included in external fixation group and 603 were included is Internal fixation group. Outcomes were assessed using pooled grip strength, Range of motion, Radiographic assessment and physician related outcomes. The authors conclude that current literature does not recommend the superiority of one method over the other. The most common complication in our series was pin tract infection and wrist stiffness in External fixation group.

In Internal fixation group wrist stiffness was the major complication. The complications can be avoided by proper post-operative care and rehabilitation. Our study showed no significant differences in outcome of distal radius fracture treatment using internal fixation and external fixation.

CONCLUSION

The study was conducted to assess the functional outcome of distal radius fractures in adults treated with external fixation and Internal fixation surgical techniques.

- Proper pre-operative evaluation, patient selection, surgical technique and proper post-operative care is essential for success of the operative procedures.
- In our study, surgical management of unstable comminuted fracture of distal radius, with both internal Fixation and external fixation produced good results and functional outcomes without significant differences
- In our study age, sex, side of fracture, Type of Fracture, Mode of Injury does not seem to influence the outcome of fracture.
- The most common complication was pin tract infection and wrist stiffness in fractures treated by External Fixation. The cases with pin tract infection had open fractures. In Internal Fixation group, again wrist stiffness is the commonest complication.
- In recent years, comminuted unstable fractures of distal Radius are treated with advanced techniques using external fixation and internal fixation, which yields better results in almost all cases than conservative management.

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