ISSN 2250-3153

Modality of Treatment for the Distal End Radius Fracture

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Abstract- Fracture of the distal end of radius is one of the most common fractures. It occurs in middle aged and elderly women commonly. It also occurs in young men with high velocity, injury. With increase in longevity and activity in middle aged to elderly population, there is increase in number of this fractures various surgical interventions are available presently, like percutaneous pinning, intra focal pinning, external fixator and plate fixation.

Methods and Materials:

30 Patients who have sustained fractures of the distal radius admitted in the department of orthopaedics at M.V.J. Medical College & Research Hospital from July 2011 to July 2013 Inclusion criteria 1) Adults between age group of 20 years to 60 years with fracture lower end of radius 2) All patients having isolated Distal end radius fracture Exclusion criteria 1) Distal radius fracture associated with other injuries around the wrist joint .2) Open Fracture.3) Pathological Fracture .4) Distal radius Fracture associated with neurovascular complications

Results:

The assessment of functional outcome was made according to modified clinical system of Green and O'Brien 1978 and Brad way et al 1989 Overall results were graded as acceptable (excellent and good), fair or poor. In our study, 6 patients had full range of movements, no pain, returned to previous job and had 100% strength to that of normal side and the results were considered as excellent. Another 3 patients had full range of movements as compared to that of opposite side with mild pain not affecting the function of wrist. They also scored more than 90% and the results were considered as excellent. There was 9 case of Excellent, 14 cases of Good, 5 cases of Fair and 2 cases showed poor Result.14 patients had limitation of movements of wrist and forearm by 20% and decreased hand strength by 15-20% as compared to that of normal side, but they did not have pain. The function of hand was not affected and they continued their previous profession. They scored 80% and the result was considered as good.

Five patients had limitation of movements of wrist and forearms by 25% as compared to that of normal side, with mild pain, unable to lift heavy weights and their hand grip strength was also decreased by 20 to 25 % as compared to that of normal side. They scored between 65 - 79% and the results were considered as fair. Two patients had moderate pain, which subsiding with analgesics. They were unable to do heavy manual work, but could carry out daily activities. They had Restriction of wrist movements by 50% as compared to that of normal side. They scored less than 65% and the result was considered as poor.

Conclusion:

From the present study on 30 patients with distal end radius fractures after analyzing the observation and looking at the results we conclude the following. Fracture of distal end of radius is having a bimodal age distribution in our study we find young individual between 21-30yrs mostly male sustain road traffic accident as a common mode of injury. Right side was affected more than the left side. Restoration of anatomy of distal end of radius, early mobilization and less complication were achieved using Platting .Platting is a better method of treatment for fracture of the distal end of radius

I. INTRODUCTION

Fracture of the distal end of radius is one of the most common fractures. It occurs in middle aged and elderly women commonly. It also occurs in young men with high velocity injury .With increase in longevity and activity in middle aged to elderly population, there is increase in number of this fractures.

Patients with fracture distal end of radius have many complications more frequently are generally appreciated and Failure in management may cause Permanent disability. Distal radius fractures crush the mechanical foundation of the man's most elegant tool, the hand and the grip.

Pain and disability have resulted due to subsequent malunion of unstable fracture of distal radius which were managed by conservative method like plaster cast alone.

Recently surgical management has been widely recommended and performed to prevent disability. Several studies has shown convincingly that functional outcome is good when the anatomy is restored by obtaining good reduction of fracture fragments, maintaining the angulations of the articular surface of radius and radial Length.

Various surgical interventions are available presently, like percutaneous pinning, intra focal pinning, external fixator and plate fixation. External fixator may be performed in a bridging technique and a non bridging technique. Bridging external fixator allows distraction across the radio carpal joint.

The present study "A Comparative study of management of the fracture of the distal end radius by external fixator Vs plating**"** was undertaken in department of Orthopaedics at M.V.J.M.C & R.H to study fracture healing & functional outcome in distal radius fracture following external fixation & platting.

II. ANATOMY OF THE WRIST

SURFACE ANATOMY

The surface anatomy of the wrist offers many clues to the features of the underlying structures and their inter relationships.

Posterior aspect

The skin of the posterior aspect of the wrist is thicker and more mobile than the anterior skin and is covered by short hairs, which are more numerous on the ulnar side than the radial side. The dorso radial flares of the radial metaphysis and the ulnar head forms prominent features that are visible and palpated over proximal part of dorsal aspect of wrist. Just distal to the course of the out-cropping tendons Extensor pollicis brevis (EPB), abductor pollicis longus, Extensor carpi radialis longus (ECRL) and Extensor carpi radialis brevis (ECRB) muscles can be palpated. Between the second and third extensor compartment is a bony prominence called Listers' tubercle, which behaves as a pulley for the tendon of extensor pollicis longus (EPL) and also serves as a critical landmark because it marks one's orientation to the scapholunate joint and the interfacet prominence of the distal radius.

Anterior Aspect

This area is covered by thin, practically hairless skin, which is rather adherent to the underlying fascia and has limited mobility, especially distally. The fascia about the wrist and the distal radius begins in the forearm as ante brachial fascia and becomes thick distally as it coalesces with deeper fascia to form the flexor retinaculum and transverse carpal ligament. These tendinous longitudinal protrusions are the limits of grooves on the lateral and the medial sides where the radial and the ulnar artery can be palpated. The central protrusion corresponds to the flexor tendons parallel to the median nerve, lateral to the Flexor Carpi Radialis (FCR) tendon and the medial to the Flexor Carpi Ulnaris (FCU). Three transverse skin creases proximal, middle, and distal correspond respectively to the ulnar head, the radio carpal joint and the mid carpal joint.

Radial aspect

The hallmark of the radial surface of the wrist is the "anatomical snuff box". It is the region between the EPL and EPB tendons and it is made most pronounced by extending and abducting the thumb. Radial styloid process can be palpated at the proximal part and the waist and distal pole of the scaphoid at the distal part of this region. The radial artery, if patent, can be traced through the anatomical snuff box as it courses dorsally. The branches of superficial radial nerve can be palpated through this region coursing in a distal direction.

Ulnar Aspect

Analogous to the anatomical snuff box an "ulnar snuff box" can be imagined in the interval between the tendons of ECU and FCU muscles on the ulnar surface of the wrist. The ulnar styloid process is palpable within the ulnar snuff box when forearm is in neutral position.

The Bones of forearm

The distal end of radius

The widest part, it is four sided in section. Its lateral surface is slightly rough projecting distally as a styloid process palpable when tendons around it are slack. Distal is the smooth carpal articular surface, divided by a ridge into medial and lateral areas. The medial is quadrangular and the lateral is triangular and curving on the styloid process. The anterior surface is a thick prominent ridge palpable even though over lying tendons, 2cms proximal to the thenar eminence. The medial surface is the ulnar notch, smooth, anteroposteriorly concave for the articulation with the ulna's head. The posterior surface displays a palpable dorsal tubercle limited medially by an oblique grove and in line with the cleft between the index and the middle fingers. A wide shallow grove lateral to it is divided by a faint vertical ridge.

III. CLASSIFICATION OF DISTAL RADIUS FRACTURES

The presentation of a classification of fractures of the distal radius must begin with an initial recognition of the different common types of fractures. Colle's' fracture is the most common.

(1) Colle's fracture: It is a distal metaphyseal fracture of distal radius, which occurs within 2 cm of the articular surface and may extend into the distal radio-carpal or radio-ulnar joints. Dorsal angulation (silver fork deformity), dorsal displacement, radial angulation and radial shortening are present. There is often an accompanying fracture of the ulnar styloid, which may signify avulsion of the TFC insertion.

(2) Smith's fracture or reverse colle's' fracture: It is a palmer angulated fracture of the distal radius with a "Garden spade" deformity. The hand and wrist are displaced forward or palmarly with respect to the forearm. The fracture may be extra-articular or intra-articular, or part of a fracture-dislocation of the wrist. Smith fractures are classified as modified Thomas classification into three types as follows.

(3) Barton's fracture is actually a fracture-dislocation or subluxations in which the rim of the distal radius, dorsally or palmarly, is displaced with the hand and carpus

(4) Pouteau fracture: In 1783 Pouteau of France first described the fractures of distal radius.

I. Radiological appearance or fracture displacement direction

1. AO classification
2. Sarmiento classification
3. Linstrom classification

II. The mechanism of injury

1. Castainign classification
2. Fernandez classification
3. Linscheid classification

III. Articular joint surface involvement

1. Myo classification
2. McMurtry and Jupiter classification
3. Melone classification

IV. Degree of comminution

1. Gartland and Werley classification
2. Jenkins classification
3. The Older classification

V. Bone calcification and resistance

1. Sennwald and Segmuller classification

VI. More recent classifications tend to provide therapeutic options and prognosis to prevent redisplacement and malunions.

1. Cooney's classification
2. Mathoulin, Letrosue and Saffar classification

The Frykman's Classification

It is now used to recognize the intra-articular distal radius fracture that we identify as the Frykman fracture to separate it from the colles' and smith fractures.

AO classification

There are three AO categories:

1) 'Extra-articular' fractures which do not involve the radiocarpal joint surface at all.

2) 'Partial articular' fractures which involve this joint, but a portion of the articular surface remains in continuity with the diaphysis.

3) 'Complete articular' fractures which are distinguished by complete separation of the involved articular surface and the diaphysis

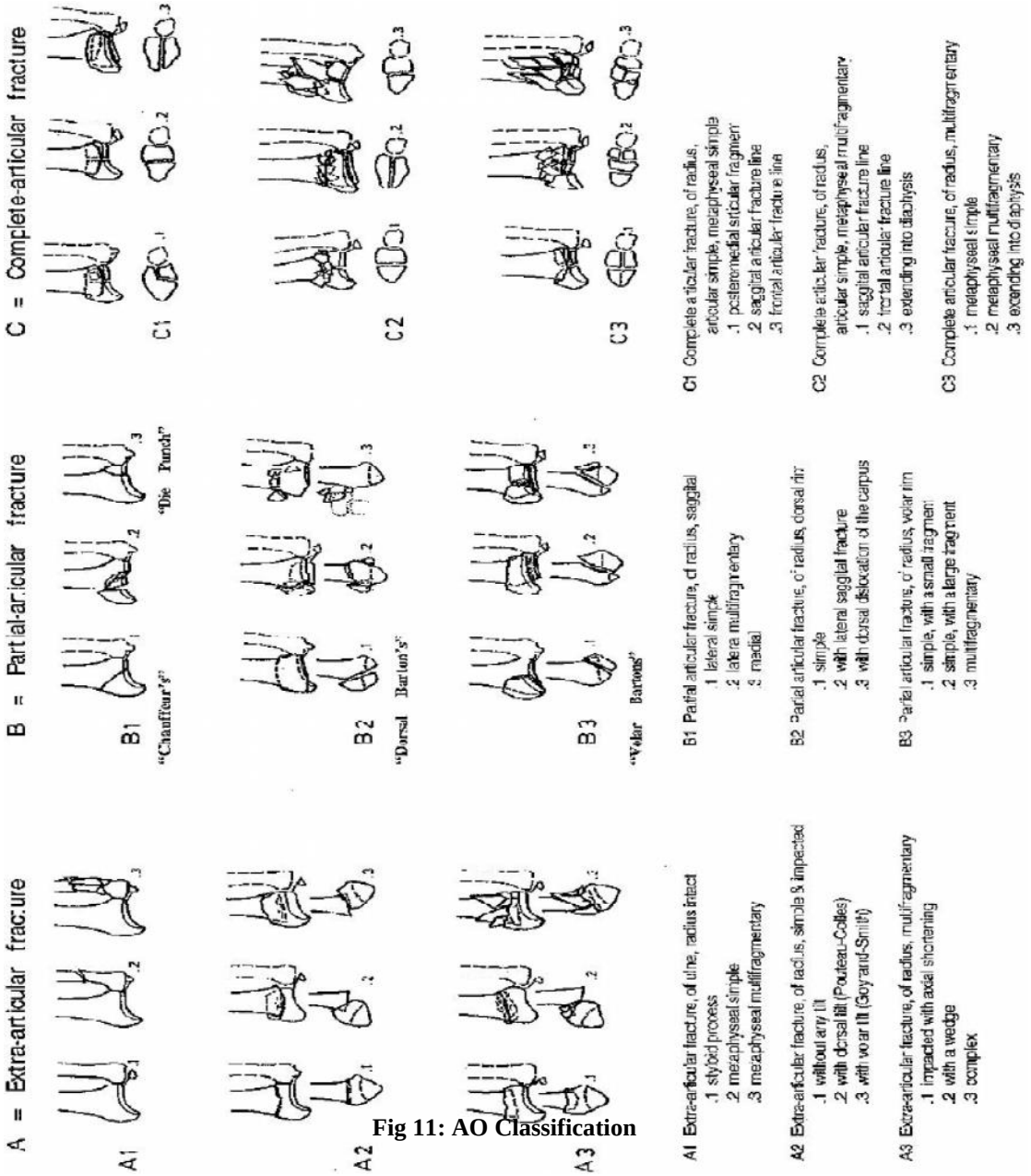


Fig 11: AO Classification

IV. TREATMENT OF THE DISTAL RADIUS FRACTURES

Percutaneous Direct Pinning

An early technique, in fact, one of the first used for fixation of distal radius fractures, was percutaneous pinning, usually entering at the level of the radial styloid Process. Some variations in the point of penetration and the direction of the pins were presented, but the aim was always to fix the mobile fragment to the opposite cortex proximal to the fracture. This type of pinning cannot prevent re displacement of certain fragments, and this is particularly true of intra-articular and osteoporotic fractures. Direct pinning of the fragments, especially the posterior medial fragment (which can involve DRUJ), through the distal ulna, adds stability to the structure.

External Fixation

This technique was proposed for comminuted fractures, and it has improved the reduction of comminuted intra-articular fractures. Ligamentotaxis can exert influence on fragments in which capsule ligamentous attachments are still intact. The traction is exerted mainly by the strong volar ligament plane on the anterior rim of the distal radius. The dorsal tilt may not be completely reduced because dorsal ligaments are thinner and in a transverse plane.

Plate Fixation

This is indicated in fractures with volar displacement, such as Barton's and Smith's fractures and in selected cases of dorsal displacement where rigid fixation can provide for early wrist motion. Plate fixation can provide either a buttress effect or hold the distal epiphysis by cortico cancellous screws. The pre molded plates reproducing the distal curvature of the radius are best, as they give an anatomic reduction. The disadvantage of this technique is difficulty in screw placement if the fracture is severely comminuted and number of soft tissue complications have been noted.

COMPLICATIONS OFTHE DISTAL RADIUS FRACTURES

1. Distal radioulnar subluxations, dislocation.
2. Depressed major articular components
3. Difficult reduction; unstable reduction maintained only by extreme position.
4. Median or ulnar nerve stretch, contusion or compression.
5. Acute carpal tunnel syndrome.
6. Tendon damage.
7. Peripheral nerve injury in external fixation errors.
8. Post-reduction swelling, compartment syndrome.
9. Carpal tunnel syndrome.
10. Associated carpal injury.
11. Radial nerve Dysaesthesias.
12. Pain dysfunction syndrome

V. MATERIALS AND METHODS

Source of Data

30 Patients who have sustained fractures of the distal radius admitted in the department of orthopaedics at M.V.J. Medical College & Research Hospital from July 2011 to July 2013.

Method of Collection of Data

Inclusion criteria

1) Adults between age group of 20 years to 60 years with fracture lower end of radius
2) All patients having isolated Distal end radius fracture

Exclusion criteria

1) Distal radius fracture associated with other injuries around the wrist joint
2) Open Fracture
3) Pathological Fracture
4) Distal radius Fracture associated with neurovascular complications

Sample size : 30 cases (15External fixator and 15 Plating)
Sample Procedure : a prospective study

Methods

Patients with distal end radius fractures admitted in MVJ hospital after meeting the inclusion and exclusion criteria were taken up. All patients were evaluated preoperatively by clinical and roentgen graphic examination. Systemic, hematological investigations, chest X-ray and assessment of cardiac status using ECG were done as a routine and pre anesthesia evaluation done. Preoperatively patients were immobilized with POP or splints. Patients were informed about the operative procedure and consent taken.

Selection of patients:

1. Patients were randomly selected for external fixator or platting

External Fixator

The Joshi type of External fixator was used in our study. This fixator consists of, distractor bar attachment with the schanz pins (screws). In our series, the joshi type of External fixator was applied in all the cases. We have used two 3mm schanz screws for radius and two 2.5 mm schanz screws for the second metacarpal, and 4 mm connecting rods.

Instruments Used for the Procedure

1. External fixator set
2. Spanner No 7&8
3. Drill-bits
4. Electric drill & hand drill
5. T handle
6. Scalpel blade
7. Image intensifier

Surgical Technique (EXTERNAL FIXATOR)

Under regional block Anesthesia (Brachial block) or GA depending upon anesthesiologist preference, patient was placed supine on the operating table. The forearm and hand were scrubbed with Betadine and saline. The tourniquet was applied over the arm. The forearm and hand were painted with Betadine and draped. The operating forearm was placed on a radiolucent arm-board. Closed reduction was done under C-arm.

In this technique , 5mm incision for 4 shanz pins, 2 in the middle third of the radius on the dorso lateral aspect about 10-

12cm from distal end and 2-3cm apart. We have done soft tissue dissection using a hemostat, care taken to avoid injury to radial nerve. Another 2 incision over the base of the second metacarpal on dorso lateral aspect about 1-2cm apart were done, 3mm shanz pin were inserted in the radius, and 2.5mm shanz pins was introduced in second metacarpal, then with fixator pins securely in place, clamps and external fixator rod were mounted to shanz pin. The clamps were loosened and longitudinal traction was given with manual molding of the fracture fragments back into a more normal alignment and gentle flexion and ulnar deviation was maintained. The reduction was confirmed through image intensifier and then external fixation device was locked into place. The tension across the wrist generated by the external fixator device which provides enough ligamentotaxis was confirmed by image intensifier wherein, radiocarpal articulation was seen to be 1 mm wider than the mid-carpal joint in A-P projection.

SURGICAL TECHNIQUE (PLATTING)
INSTRUMENTS USED:

Ellis Buttress plate or locking compression plate of varying length

2.5mm drill bit and 3.5mm drill sleeve system.

3.5mm LCP drill bit and sleeve system.

Hand drill and power drill.

Tap for 3.5mm cortical screws and 3.5mm depth gauge.

Hexagonal screw driver for 3.5mm cortical screws and locking screw driver.

Other instrument like retractors, periosteal elevator, reduction clamps, bone lever.

Pneumatic tourniquet.

Postoperative Care and Rehabilitation

The check X-rays were taken in both A-P and Lateral views. The reduction of the fracture was confirmed and amount of distraction was also studied by radio carpal joint space in A-P view, which should be 1 mm wider than the midcarpal joint space.

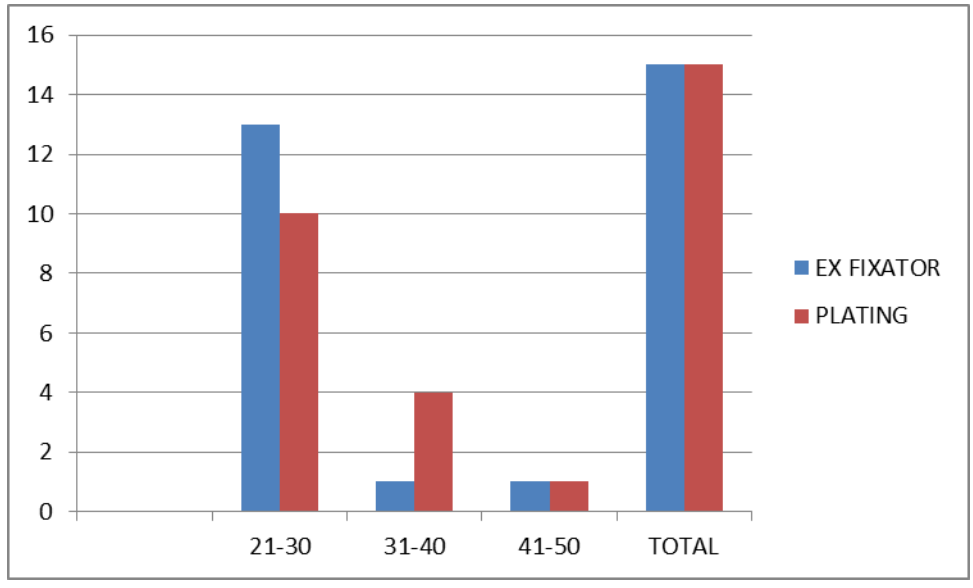
Active exercises of fingers, thumb, elbow, forearm and shoulder were commenced from the day 1 of operation. On the 3rd post operative day the dressing was removed. The pins were cleaned in external fixator and small dressing done applied in platting case. Patient was discharged after the 3rd day with an advice to clean the pins alternate days and was reviewed after 1 week followed by fortnightly. The patient was followed up after 2 weeks, 4 wks, 6wks, 8 wks and 12 wks. On demonstration of the radiological union, the external fixator was removed after 5-7 weeks (average 6 weeks) and physiotherapy of the wrist was commenced. A removable splint for forearm was applied during night time and was removed during day time for physiotherapy for another 2 weeks and wrist and finger exercises were taught to continue at home.

The follow up period was ranging from minimum 3 months to a maximum of 24 month (Average 9 months). During the follow up, all the patients were observed for any possible complication. Each patient was evaluated for functional recovery at the end of three months and also at the latest follow up visit up by clinical and radiological examination.

VI. OBSERVATION AND ANALYSIS

Table 1: Age Distribution

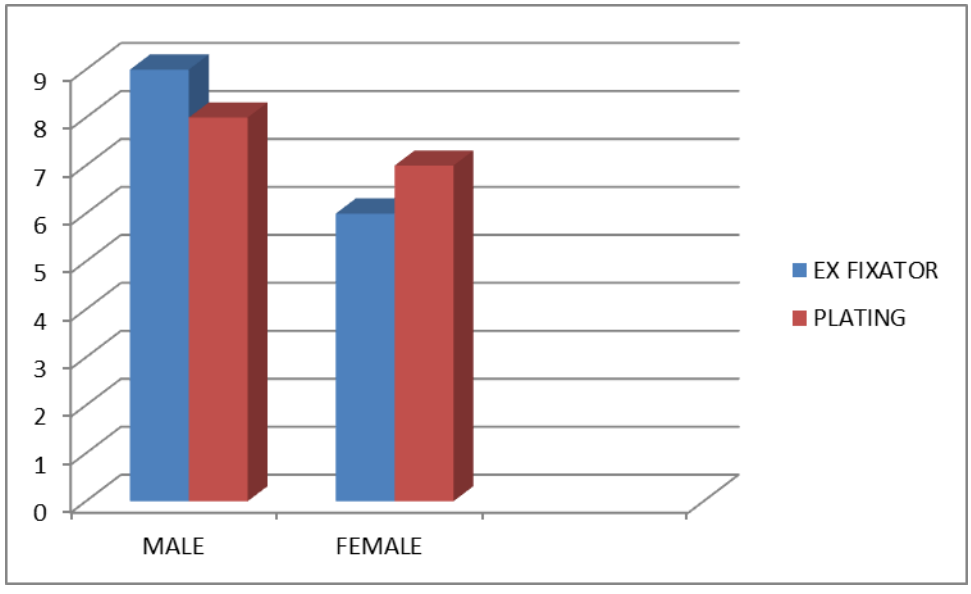
AGE GROUP	EXTERNAL FIXATOR	PLATING
21-30	13	10
31-40	1	4
41-50	1	1
TOTAL	15	15



The commonest age group was between 21-30 years of the age (P=0.1534) [NOT SIGNIFICANT]

Table 2: Sex distribution

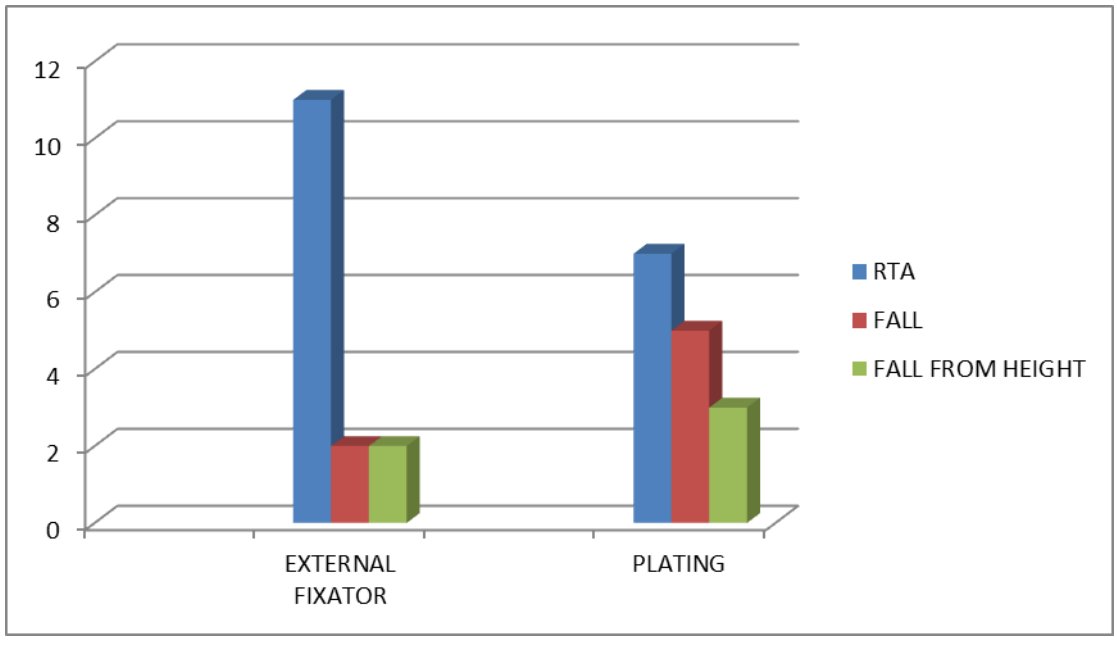
SEX	EX FIXATOR	PLATTING
MALE	9	8
FEMALE	6	7
TOTAL	15	15



Male patient are affected more as compare to the women's patients (P=0.7125) [NOT SIGNIFICANT]

Table 3: Mode of injury

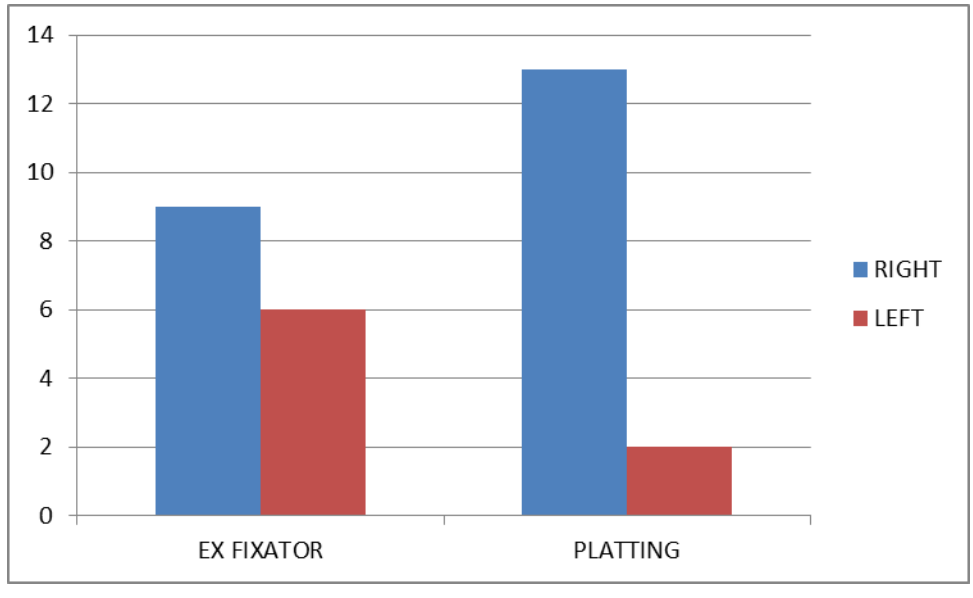
MODE OF INJURY	EXTERNAL FIXATOR	PLATING
RTA	11	7
FALL	2	5
FALL FROM HEIGHT	2	3
TOTAL	15	15



Road traffic accident was the most common mode of injury in both the type (P=0.3050) [NOT SIGNIFICANT]

Table 4: Side Affected

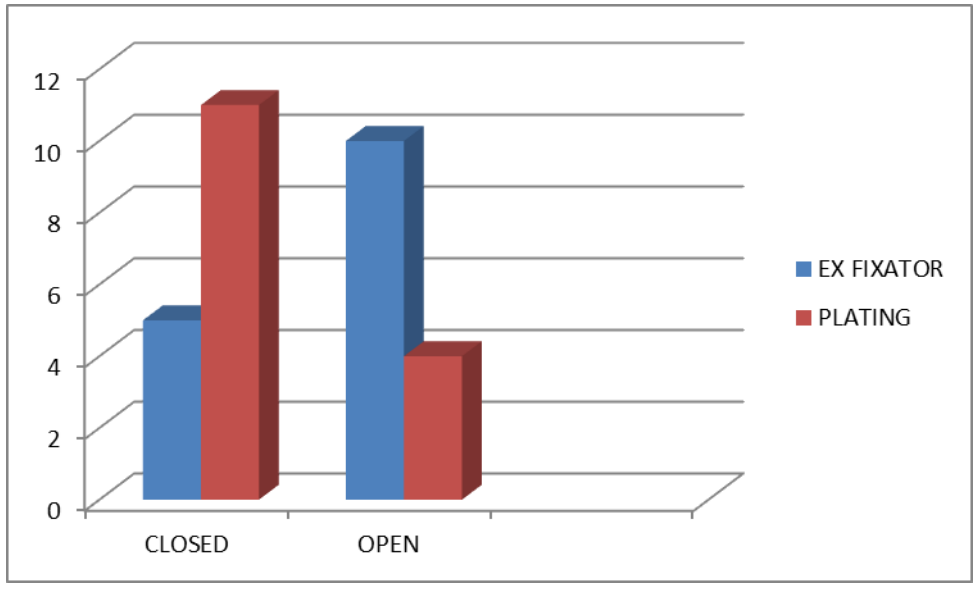
SIDE AFFECTED	EX FIXATOR	PLATTING
RIGHT	9	13
LEFT	6	2
TOTAL	15	15



Right side is more common site of the injury in both the series (P=0.0986) [NOT SIGNIFICANT]

Table 5: TYPE OF FRACTURE

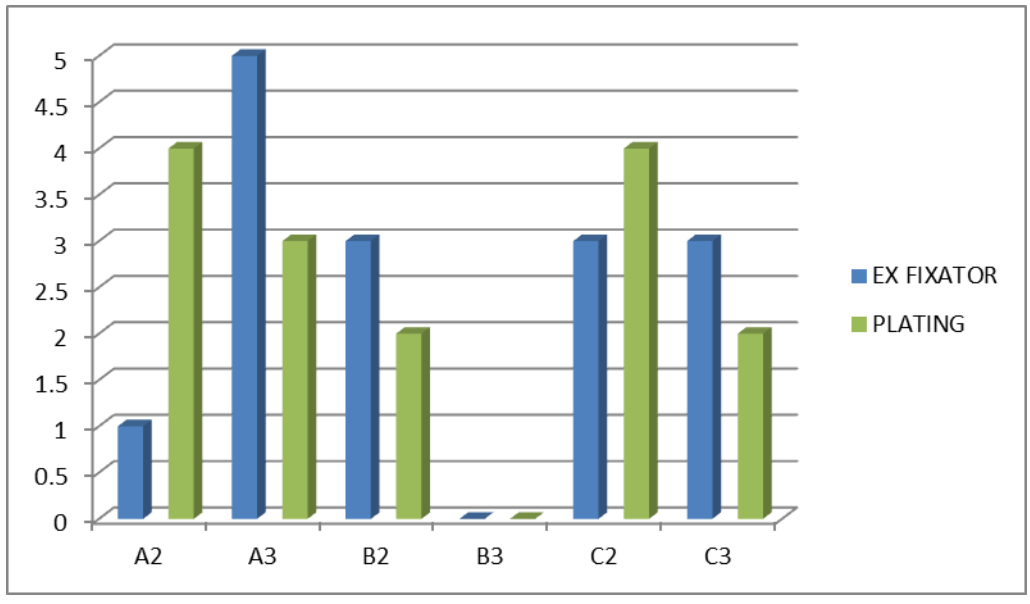
TYPE OF FRACTURE	EX FIXATOR	PLATING
CLOSED	5	11
OPEN	10	4
TOTAL	15	15



More number of the open type fractures was noted in case of the external fixator (P=0.0281) [SIGNIFICANT]

Table 6: AO CLASSIFICATION

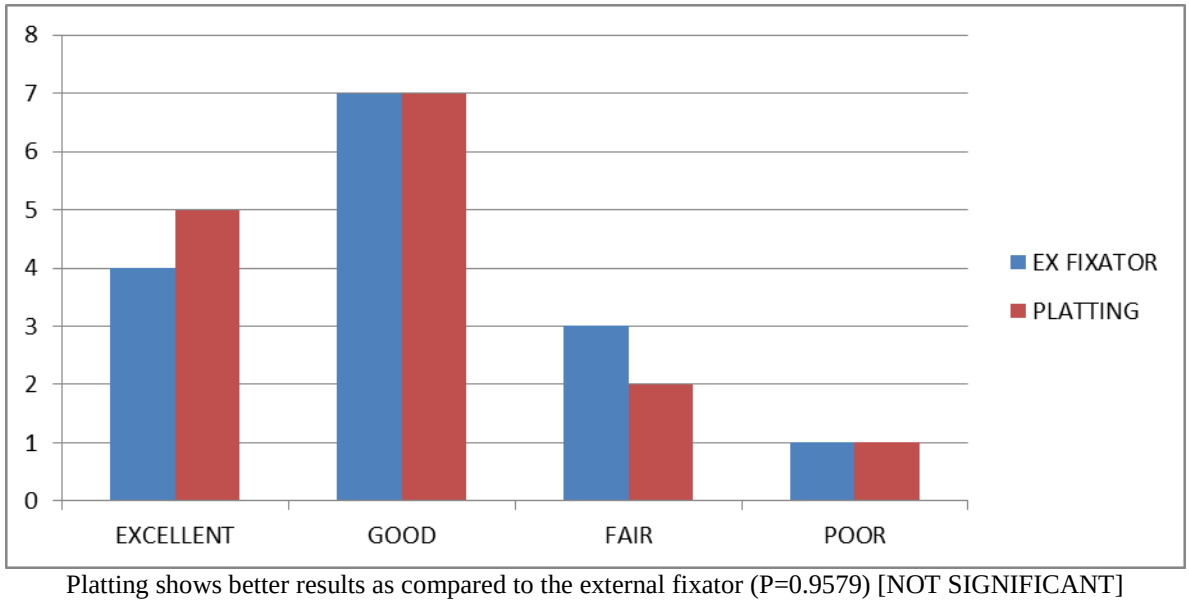
CLASSIFICATION	EX FIXATOR	PLATING
A2	1	4
A3	5	3
B2	3	2
B3	0	0
C2	3	4
C3	3	2
TOTAL	15	15



A3 was the commonest type of the fracture noted in the series (P=0.5845) [NOT SIGNIFICANT]

Table 7: RESULTS

RESULTS	EX FIXATOR	PLATTING
EXCELLENT	4	5
GOOD	7	7
FAIR	3	2
POOR	1	1
TOTAL	15	15



Platting shows better results as compared to the external fixator (P=0.9579) [NOT SIGNIFICANT]

Extension

Flexion

Radial Deviation

Ulnar Deviation

Pronation

Supination

Extension

Flexion

Supination

Pronation

Radial Deviation

Ulnar Deviation

CASE NO.1 (EX FIX)

Pre-op

Post-op

After 6 weeks

After 3 months

CASE NO.5 (EX FIX)

Pre-op

Post-op

After 3 months

After 6 months

CASE NO. 9 (EX FIX)

Pre-op

Post-op

After 6 weeks

After 3 months

After 12 months

VII. RESULTS

The assessment of functional outcome was made according to modified clinical system of Green and O'Brien 1978 and Brad way et al 1989.

This modified score includes independent scores for motion, strength, pain, and activity level, which can be objectively graded as per the table below. To achieve an excellent result full range motion of wrist and forearm, strength, function of hand and comfort must be present.

Table 8: The Modified Green- O'Brein clinical scoring system.

Category	Score	Findings
Pain	25	None
	20	Mild
	15	Moderate (medication required)
	00	Severe (requires narcotics)
Function	25	same job
	20	Different job
	15	Able, no job
	00	Unable
Motion	25	100%
	15	75-99%
	10	50-74% of normal side
	5	25-49%
	00	0-24%
Strength	25	100%
	15	75-99%
	10	50-74% of normal side
	5	25-49%
	00	0-24%

Scoring : Excellent : 90-100%
Good : 80-89%
Fair : 65-79%
Poor : <65%

Overall results were graded as acceptable (excellent and good), fair or poor. In our study, six patients had full range of movements, no pain, returned to previous job and had 100% strength to that of normal side and the results were considered as excellent. Another three patients had full range of movements as compared to that of opposite side with mild pain not affecting the function of wrist. They also scored more than 90% and the results were considered as excellent. There was 9 case of Excellent, 14 cases of Good, 5 cases of Fair and 2 cases showed poor Result.

Excellent : 9 [5- Plating & 4- Ext Fixator] cases (30.2%)
Good : 14 [7- Plating & 7- Ext Fixator] cases (46.66%)
Fair : 5 [2- Plating & 3- Ext Fixator] cases (16.66%)
Poor : 2 [1- Plating & 1- Ext Fixator] cases (6.66%)

VIII. CONCLUSION

From the present study on 30 patients with distal end radius fractures after analyzing the observation and looking at the results we conclude the following.

Fracture of distal end of radius is having a bimodal age distribution in our study we find young individual between 21-30yrs mostly male sustain road traffic accident as a common mode of injury. Right side was affected more than the left side.
Restoration of anatomy of distal end of radius, early mobilization and less complication were achieved using Platting

Platting is a better method of treatment for fracture of the distal end of radius.

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