A PROSPECTIVE STUDY OF

FUNCTIONAL OUTCOME OF COMMUNITED INTRA ARTICULAR DISTAL RADIUS FRACTURES MANAGED BY FRAGMENT SPECIFIC FRACTURE FIXATION

Dissertation submitted to

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for the award of the degree of

M.S (ORTHOPAEDIC SURGERY)

BRANCH II

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CERTIFICATE

This is to certify that this dissertation entitled '**FUNCTIONAL OUTCOME OF COMMUNITED INTRA ARTICULAR DISTAL RADIUS FRACTURES MANAGED BY FRAGMENT SPECIFIC FRACTURE FIXATION'** is a record of bonafide research work done by **Dr. M.NIRMAL**, post graduate student under my guidance and supervision in fulfilment of regulations of The Tamilnadu Dr. M.G.R. Medical University for the award of M.S. Degree Branch - II (Orthopaedic Surgery) during the academic period from 2014 to 2017, in the Department of Orthopaedics, Govt. Kilpauk Medical College, Kilpauk, Chennai-600010

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DECLARATION

I **Dr. M.NIRMAL,** solemnly declare that the dissertation, "**FUNCTIONAL OUTCOME OF COMMUNITED INTRA ARTICULAR DISTAL RADIUS FRACTURES MANAGED BY FRAGMENT SPECIFIC FRACTURE FIXATION"** is a bonafide work done by me in the Department of Orthopaedics, Govt. Kilpauk Medical College, Chennai under the guidance of **Prof. S.Senthil Kumar,** M.S.Ortho., D.Ortho., Professor of Orthopaedic Surgery, Govt. Kilpauk Medical College, Chennai-600010.

This dissertation is submitted to **"THE TAMILNADU DR. M.G.R MEDICAL UNIVERSITY",** towards partial fulfilment of regulations for the award of M.S.DEGREE BRANCH II (Orthopaedic Surgery).

Place: Chennai

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CONTENTS

INTRODUCTION

Fractures of the distal end of radius are one of the most common fractures encountered in orthopaedic practice encompassing 16% of all fractures[(1)]. It is the most common fracture involving the upper limb. About 50% of fractures of the distal radius involve the articular surface. The peak age groups involved are children from 5 to 14 years, males less than 50 years and females more than 60 years.

The management of distal radius fractures has undergone a lot of changes over the past years. Initially, universal cast treatment gave way to bridging external fixator, which in turn was replaced by dorsal buttress plating. Then palmar locked plate came into prominence. Outcome following treatment, especially in articular fractures depend upon anatomical reduction, restoration of articular congruency, stability of fixation and early mobilisation.

Improper reduction of intra articular fragments may lead to chronic wrist pain due to radiocarpal arthritis. This may lead to wrist stiffness and reduced range of motion in the wrist joint. Malpropagation of forces in the wrist joint may lead to reduced grip strength. Malunion of the fracture may occur.

Conventinal methods of treatment in communited intra articular fractures like volar plating, external fixation may result in some fragments not being properly reduced or some fragments not getting addressed by fixation. This can lead to incongruity in the articular surface.

Medoff classified intra articular distal radius fractures based on the fragments involved[(2)]. This classification is based on the observation that fracture lines along the distal radius propagate along recurrent pathways. According to this classification the distal radius is divided into 5 fragments (volar rim, dorsal wall, ulnar corner, radial column, central fragment).

This study focuses on fixation of communited intra articular distal radius fractures based on the fragments involved according to Medoff classification. If the volar rim is involved volar locking plates are used. If the dorsal wall is involved dorsal locking plates are used. If the radial column is involved radial plates are used. For involvement of multiple fragments, combinations of plates are used. Various approaches are used for plating on different fragments. Low profile plates are used in this study to avoid soft tissue complications.

AIM OF THE STUDY

To study the functional outcome of communited intra articular distal radius fractures treated by fragment specific fracture fixation

REVIEW OF LITERATURE

The various treatment modalities for distal radius fractures are closed reduction with casting, closed/open reduction with external fixation, closed/open reduction with Kirshner wire fixation, open reduction with plating (volar/dorsal) and intramedullary fixation. The main aim of fixation is to achieve intra articular congruity, radial length, radial tilt, radial inclination with stable fixation.

Altissimi et al (1986)[17] stated that conservative management of distal radius fractures may not be as acceptable as generally assumed. The comparative study of the post reduction and follow up radiographs shows the loss of reduction to be significant especially the volar tilt.

Trumble TE et al (1994)[15] stated that there is a strong correlation between the degree to which the articular step off is corrected and the outcome whereas the radial inclination or tilt do not have such a strong correlation.

Aurora J et al (2005)[18] concluded that external fixators when used for intra articular distal radius fractures, are not sufficient enough to result in good outcome and may result in serious complications due to articular step off.

Jakob M et al (2000)[9] stated that distal radius fractures could be fixed with 2.0mm plates and good functional outcome could be obtained by using 2 plates in the radial and intermediate columns.

Freeland AE et al (2005)[24] stated that osteopenic distal radius bones require stable fixation with plates and screws.

Paine R et al (2000)[16] stated that on comparing 2.0mm plates and 3.5mm plates for distal radius, 2.0mm plates showed superior stiffness and resistance to strain with better results.

Bartosh RA et al (1990)[24] stated that radial tilt in intra articular distal radius fractures could not be accurately re established only with ligamentotaxis.

Bae DS et al (2005)[7] stated that through the use of limited surgical incisions and low-profile, anatomically contoured implants, fragment-specific internal fixation provides a rational approach to the treatment of these complex injuries.

In fragment specific fracture fixation we use low profile 2.4mm plates hence there is less complications such as tendon irritation both in volar and dorsal sides. Also we directly approach all fragments so there is a better chance of anatomical reduction and stable fixation can be provided to all fragments.

REVIEW OF ANATOMY

OSSEOUS ANATOMY

The distal end of the radius has 4 surfaces (anterior, posterior medial and lateral). The scaphoid fossa and lunate fossa are concave fossae present on the articular surface of the distal radius. The articular surface of the distal radius is at an inclination of about 22 degrees to a line drawn perpendicular to the long axis of radius. The articular surface also has a volar tilt of 11 degrees in the sagittal plane[(4)].

The anterior surface extends from the radial styloid lateral to the medial end of radius which articulates with the ulna. Distally it extends upto the volar rim. It is covered by pronator quadrates muscle. It is concave and smooth[(1)].

The radial styloid constitutes the lateral surface of distal radius. The tip of the radial styloid has capsular attachments. More proximally it gives attachment to brachioradialis. The radial styloid overshoots the articular surface of the distal radius and accommodates the scaphoid.

The dorsal surface of the distal radius is convex and irregular as it has various grooves for the passage of extensor tendons. Lister’s tubercule is present in the dorsal surface 5mm from the articular surface.

The medial surface of the distal radius has the sigmoid notch where the ulnar head articulates. It lies just adjacent to the lunate fossa in the articular surface of distal radius.

LIGAMENTOUS ANATOMY

VOLAR EXTRINSIC LIGAMENTS

The following ligaments constitute the extrinsic ligaments in the volar side of distal radius[(1)]:

Radioscaphocapitate ligament

Long radiolunate ligament

Short radiolunate ligament

Radioscapholunate ligament

Ulnolunate ligament

Ulnocapitate ligament

VOLAR INTRINSIC LIGAMENTS

The following ligaments constitute the intrinsic ligaments in volar aspect of distal radius :

Lunotriquetral ligament

Trapeziotrapezoid ligament

Scaphotrapezial ligament

Scaphotrapezoidal ligament

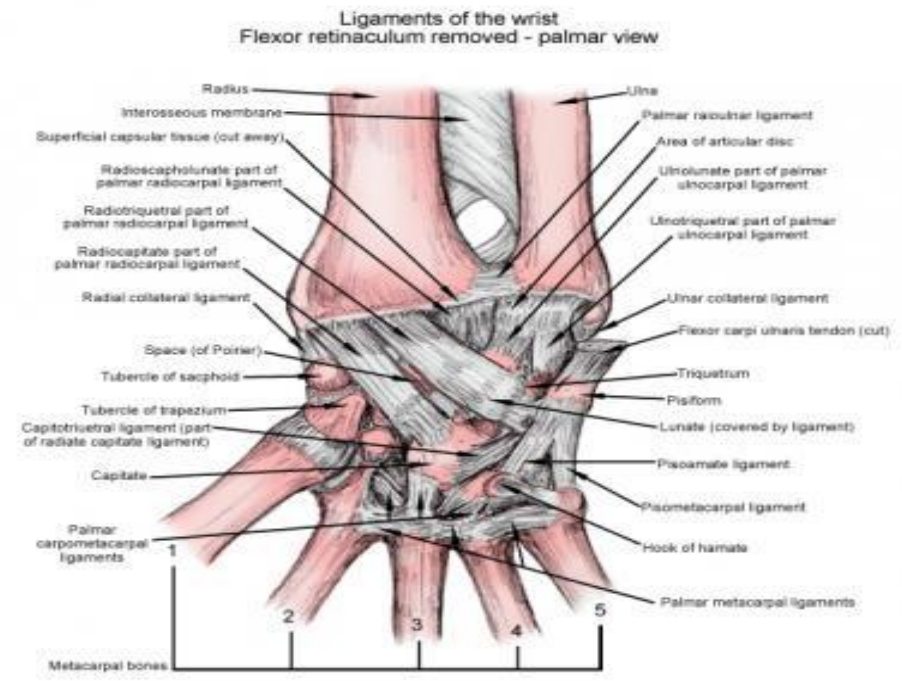
Scaphocapitate ligament

Capitotrapezoid ligament

Capitohamate ligament

Triquetrocapitate ligament

Triquetrohamate ligament



DORSAL EXTRINSIC LIGAMENTS

The following ligaments constitute the extrinsic ligaments in dorsal side

Intercarpal ligaments

Radiocarpal ligament

DORSAL INTRINSIC LIGAMENTS

The following ligaments constitute the intrinsic ligaments in dorsal side :

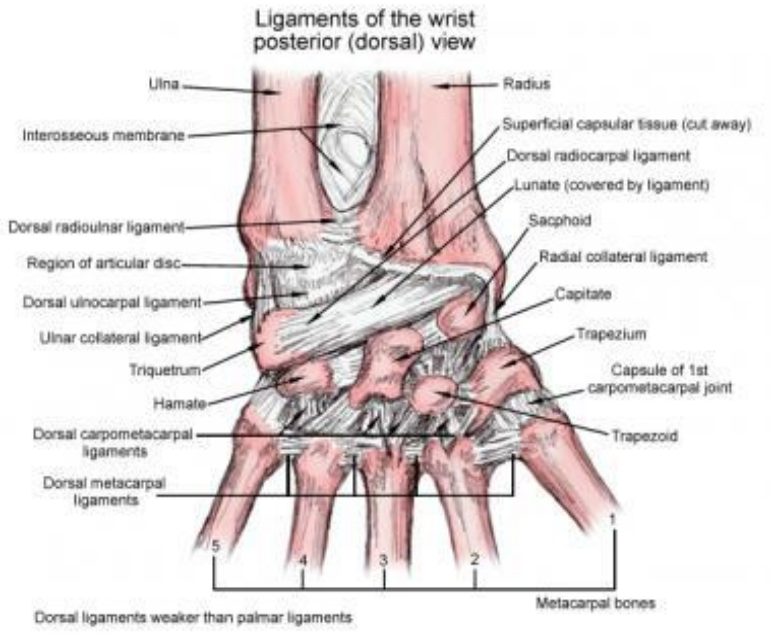
Intercarpal ligament

Trapeziotrapezoid ligament

Capitotrapezoid ligament

Capitohamate ligament

Triquetrohamate ligament



INTEROSSEOUS LIGAMENTS

Scapholunate ligament

Lunotriquetral ligament

Trapeziotrapezoid ligament

Capitotrapezoid ligament

Capitohamate ligament

Triangular fibrocartilage complex(TFCC)

The TFCC is triangular in shape with its apex pointing radially extending from the ulna proximally to the proximal carpal row distally

Volar components:

volar radioulnar ligament

ulnotriquetral ligament

ulnolunate ligament

Ulna components:

triangular ligament

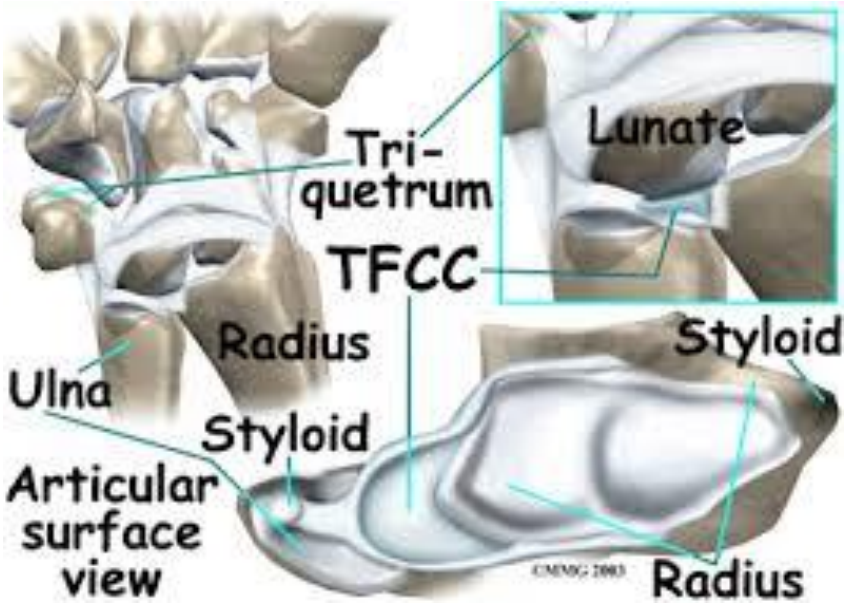
ulna collateral ligament

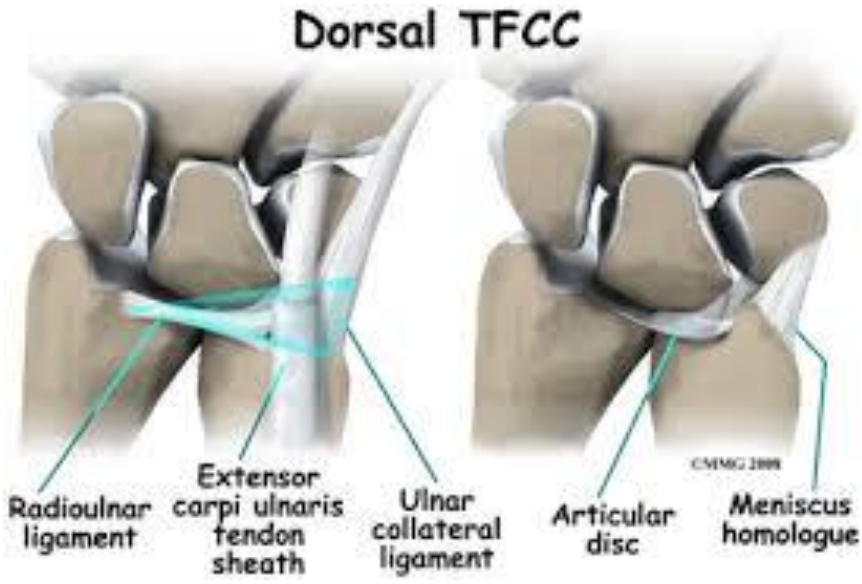
meniscal homologue

Dorsal components:

dorsal radioulnar ligament

extensor carpi ulnaris tendon sheath





MECHANISM OF INJURY

Most common cause of distal radius fractures are fall with outstretched hand. But the level of fracture depends upon the magnitude of force and the direction of impact and the position of wrist when it comes in contact with the ground[9].

When there is a fall on the outstretched hand with wrist in dorsiflexion and the forearm in pronation initially when the hand comes in contact with the ground, the volar cortex fails due to tension and fractures following which there is compression in the dorsal cortex which also fails resulting in communition in the dorsal cortex. This results in distal radius fractures with dorsal displacement. Transfer of load along the triangular fibrocartilage complex can result in fracture of the ulnar styloid[17].

When there is a fall on the outstretched hand with the on palmarflexion it results in a distal radius fracture with volar displacement. This can also occur with falls where the forearm is supinated. A strong compressive force can be transmitted from the groung to the lunate which in turn causes a die punch fracture in the lunate fossa which gets spilt into a dorsal and volar fragment[15].

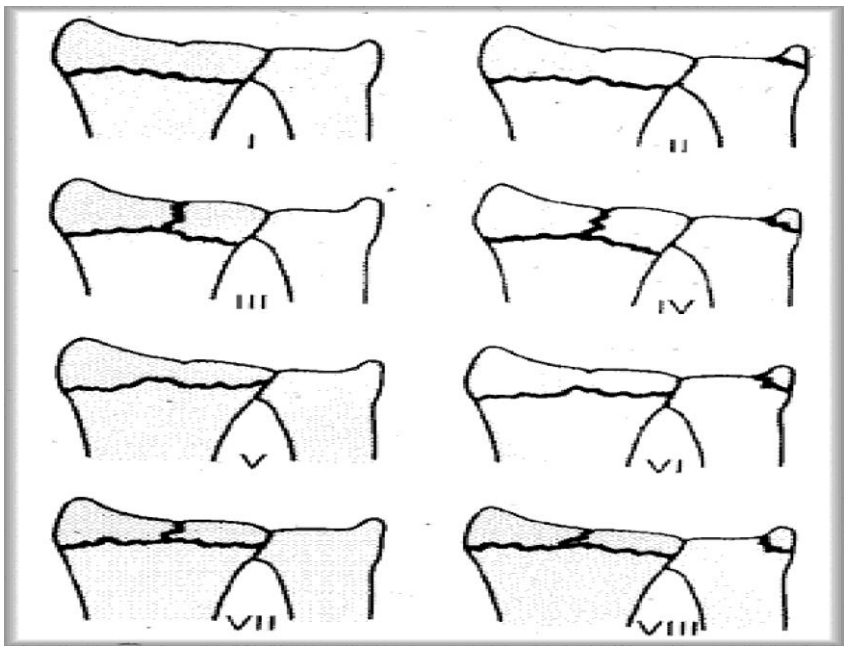
Radial styloid avulsion fractures can occur due to forces exerted along palmar extrinsic ligaments. Various ligamentous disruptions are also associated with distal radius fractures.

CLASSIFICATION OF DISTAL RADIUS FRACTURES

A number of classification schemes have been provided for distal radius fractures. But only a few of them have been consistently used by orthopaedics surgeons. They are as follows

FRYKMAN CLASSIFICATION

Frykman classified distal radius fractures based on the involvement of radioulnar and radiocarpal joints[10].



Type I: extra articular fracture

Type II: extra articular with ulnar styloid fracture

Type III: radiocarpal joint involved

Type IV: radiocarpal joint involved with ulnar styloid fracture

Type V: distal radioulnar joint involved

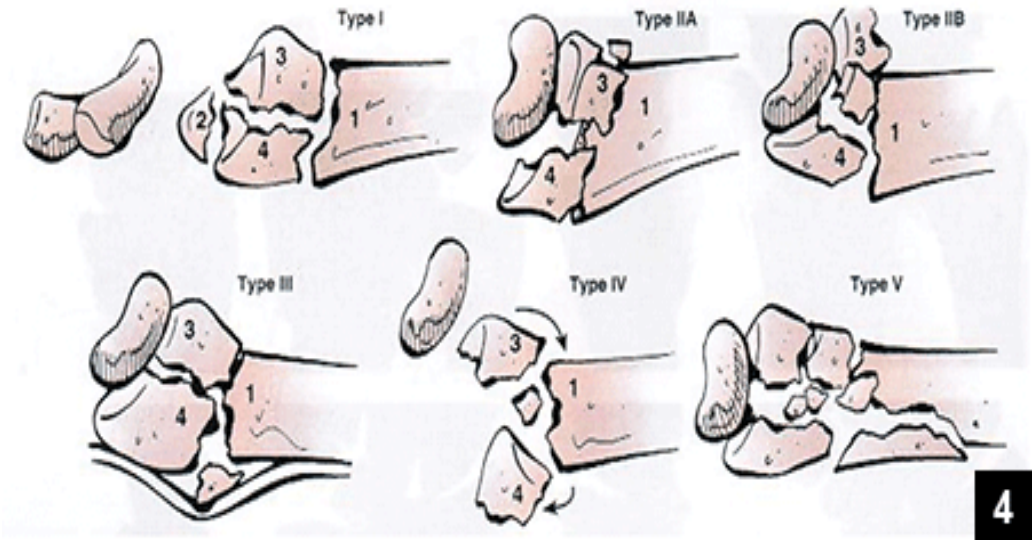
Type VI: distal radioulnar joint involved with ulnar styloid fracture

Type VII: both radiocarpal and distal radioulnar joint involved

Type VIII: both radiocarpal and distal radioulnar joint involved with ulnar styloid fracture

MELONE CLASSIFICATION

Melone classified distal radius fractures based on the effect of lunate impaction causing four main fracture fragments (radial shaft, radial styloid, palmar medial and dorsal medial)[10]



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Type 1 : undisplaced or variable diaplacement. Stable after closed reduction

Type 2 : die punch fracture, unstable

A: reducible

B: irreducible

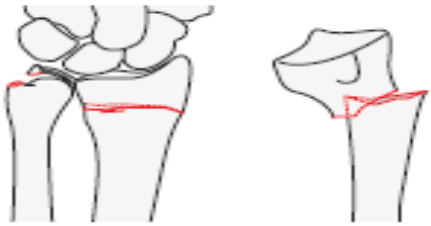
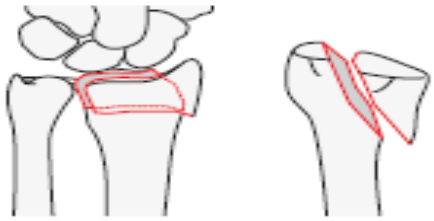
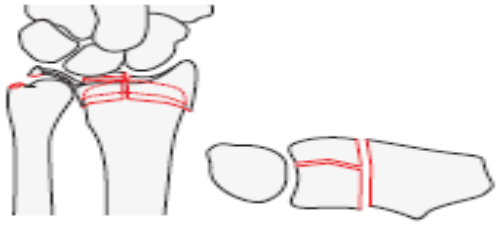
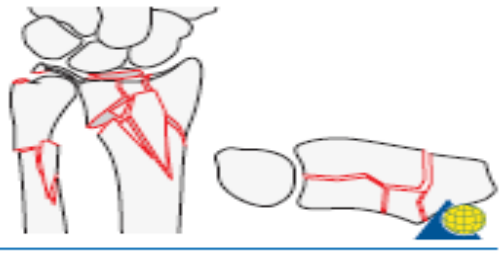
Type 3 : unstable die punch fracture with radial spike on volar side

Type 4 : split fracture, unstable

Type 5 : explosion fracture with severe communition

FERNANDEZ CLASSIFICATION

Fernandez classified distal radius fractures based on the forces acting during injury and the mechanism of injury.

Type I Bending fracture of the metaphysis	
Type II Shearing fracture of the joint surface	
Type III Compression fracture of the joint surface	
Type IV Avulsion fractures, radiocarpal fracture, dislocation	
Type V Combined fractures (I, II, III, IV); high-velocity injury	

AO Classification

Ao classification for distal radius was proposed by Mueller and his associates. It has three main types with many sub groups in them.

Type A: extra articular fractures

Type B:partial articular fractures

Type C:intra articular fractures

MEDOFF CLASSIFICATION

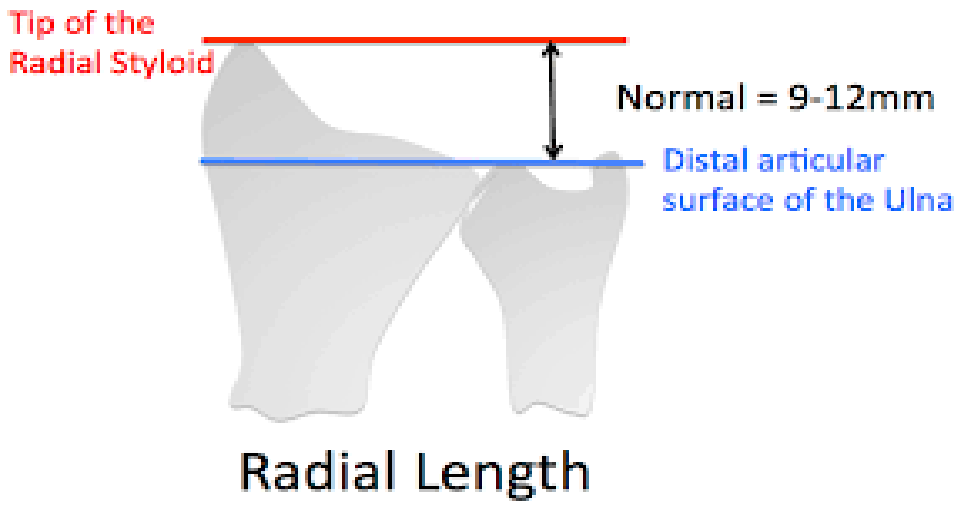
Medoff recently classified intra articular distal radius fractures into 5 fragments based on the observation that fracture lines in the distal radius generally propagate along recurrent pathways[7].

RADIOLOGICAL EVALUATION

We routinely take standard posteroanterior and lateral views of the wrist joint in the emergency department to evaluate wrist injuries. There are certain radiological parameters which need to be assessed in a distal radius fracture.

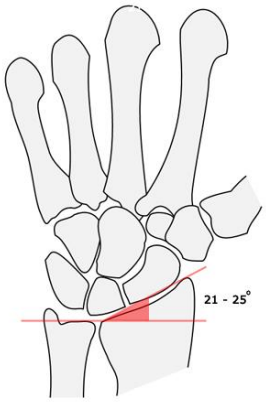
1. Radial height

Radial length is the distance between an imaginary line drawn perpendicular to the long axis of radius at the level of ulnar head and another imaginary line drawn perpendicular to the long axis of radius at the level of tip of radial styloid measured in AP radiograph[10].



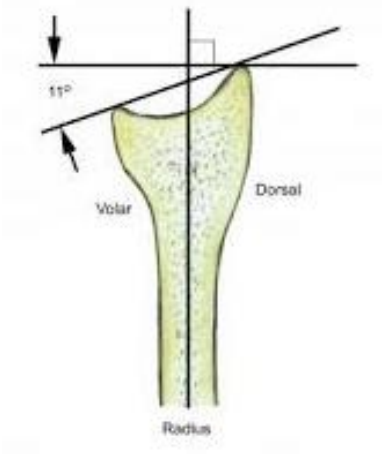
2. Radial inclination

Radial inclination is the angle between an imaginary line drawn from the tip of the radial styloid to the medial border of articular surface of distal radius and another line drawn perpendicular to the long axis of the radius.



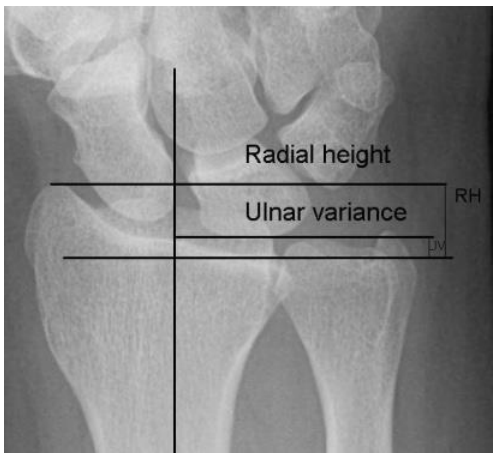
3. Radial tilt

Radial tilt is the angle between an imaginary line drawn from the volar to dorsal tip of distal radius and another line drawn perpendicular to the long axis of radius in a lateral radiograph.



4. **Ulnar variance**

Ulnar variance is the distance between an imaginary line drawn perpendicular to the long axis of radius at the level of medial corner of articular surface of distal radius to an imaginary line drawn perpendicular to the long axis of radius at the level of distal most point in the ulnar head in an AP radiograph.



5. **Articular step off**

Any intra articular extension in a fracture os distal radius should be looked for.Articular step off of more than 2mm should always be corrected.

RADIOGRAPHIC CRITERIA FOR ACCEPTABLE REDUCTION OF DISTAL RADIUS FRACTURE[8].

Ulnar variance – No more than 2mm of shortening relative to ulnar head

Radial height – Within 2-3 mm of normal wrist

Radial tilt – Neutral

Radial inclination - No less than 10 degrees

Intra articular step off – Less than 2mm

MATERIALS AND METHODS

This prospective study on ‘Functional outcome of intra articular distal radius fractures managed by fragment specific fracture fixation’ was conducted in the Department of Orthopaedic Surgery, Govt. Kilpauk Medical College and Hospital, Chennai from September 2014 to July 2016 after ethical committee clearance was obtained.

INCLUSION CRITERIA

A sample size of 20 patients were taken who satisfied the following inclusion criteria

1. Age 18-50 years
2. Patients > 50 years with high functional demand
3. Intra articular distal radius fractures with more than 2mm articular step off
4. > 0 degree dorsal tilt
5. 2mm or more of radial shortening
6. Loss of 5 degree or more of radial inclination

EXCLUSION CRITERIA

1. Skeletal immaturity
2. Extra articular fractures
3. Undisplaced intra articular fractures
4. Open fractures

5. Pathological fractures

6. Old fractures

7. Associated neurovascular injuries

All patients who satisfied the inclusion criteria were admitted and thoroughly investigated. The following routine investigations were taken preoperatively

- Complete hemogram
- Renal function tests
- Bleeding time and clotting time
- Chest Xray and Electrocardiogram

RADIOLOGICAL EVALUATION

Standard Posteroanterior and Lateral views of the involved wrist joint

CT of the involved wrist joint

CT and the Xrays are used to assess the morphology of the fracture based on which the implants to be used and the surgical approach to the fracture are decided.

This study is based on Medoff classification of intra articular distal radius fractures where distal radius was divided into 5 fragments based on the observation that fracture lines in the distal radius tend to propagate in recurrent pathways.The goal of the treatment is to achieve perfect

reduction without any intra articular step off so that the patients can have excellent functional outcome and arthritis can be avoided.Hence we approach each fracture according to its morphology and specific approaches and specific implants are used to stabilize each fragment.

IMPLANT CHOICE

Volar fragment fracture-2.4mm volar LCP

Radial column fracture-2.4mm straight LCP/K wire fixation

Dorsal fragment fracture-2.4mm dorsal T-LCP/K wire fixation

If multiple fragments are involved double plating of involved columns done

IMPLANTS USED

From left to right

Volar T oblique plate

Volar straight T plate

Dorsal T oblique plate

L plate

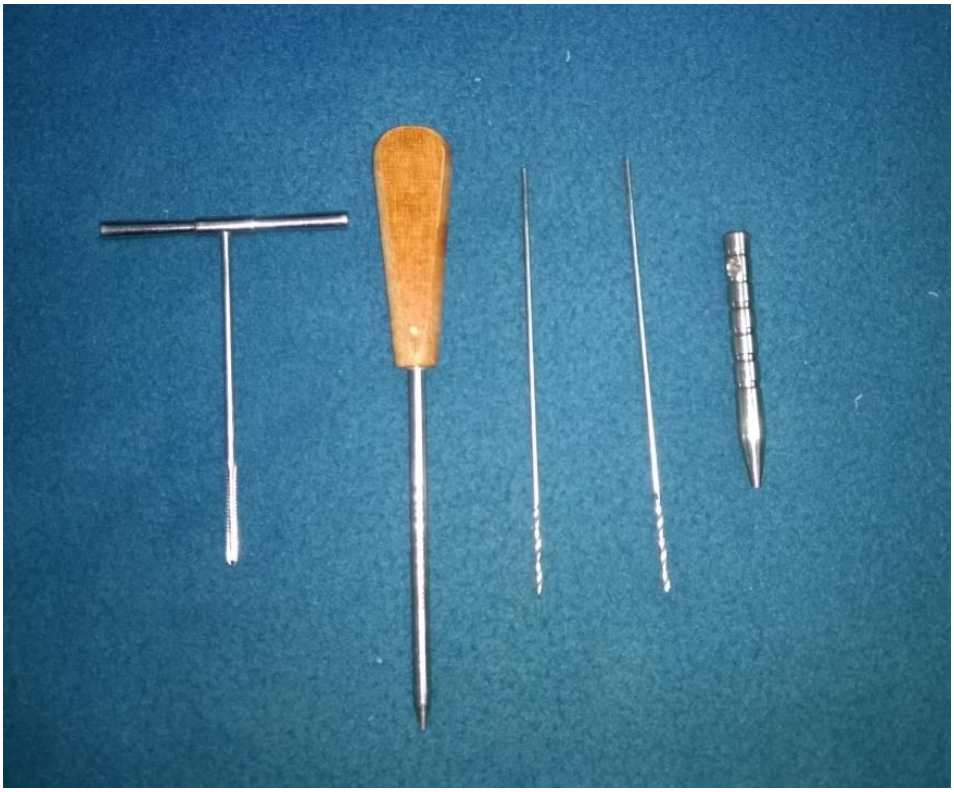
Radial styloid straight plate

Short L plate

L oblique plate

Dorsal T plate

INSTRUMENTS USED



From left to right

2 mm tap

2.4 mm screw driver

2 mm drill bit(2 in no)

Locking sleeve

SURGICAL TECHNIQUE

After regional anaesthesia, patient in supine position with the arm in a radiolucent forearm table and under strict aseptic precaution, parts were painted and draped upto midarm.

The C-arm is draped with sheets and is positioned perpendicular to the fracture table for further use during surgery to check for articular reduction and plate positioning.

SURGICAL APPROACH

Volar fragment

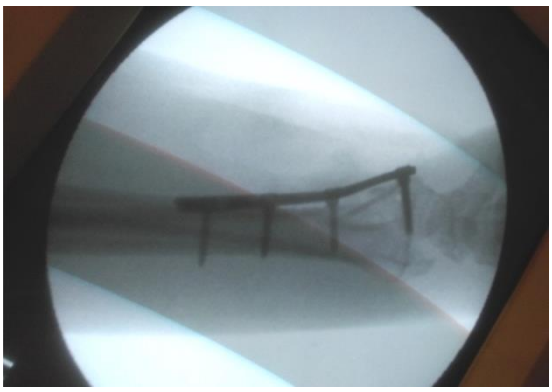
Modified Henry's approach is used to reach volar fragment.

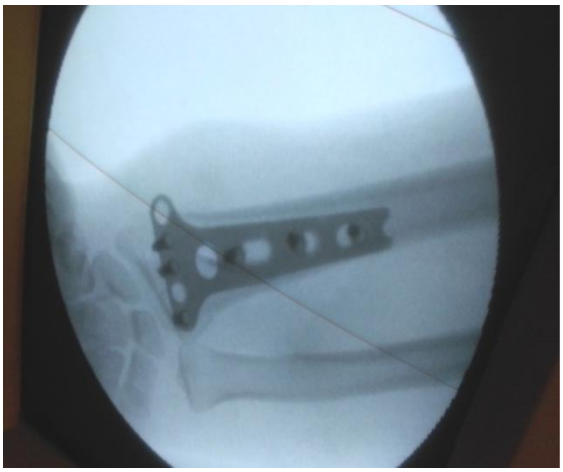
1. Skin incision is made along the radial border of flexor carpi radialis tendon.

2. Incision is deepened between flexor carpi radialis and the radial artery.

3. The pronator quadratus muscle is elevated using an L shaped incision

4. The fracture is reduced under C-arm guidance and fixed with a plate.





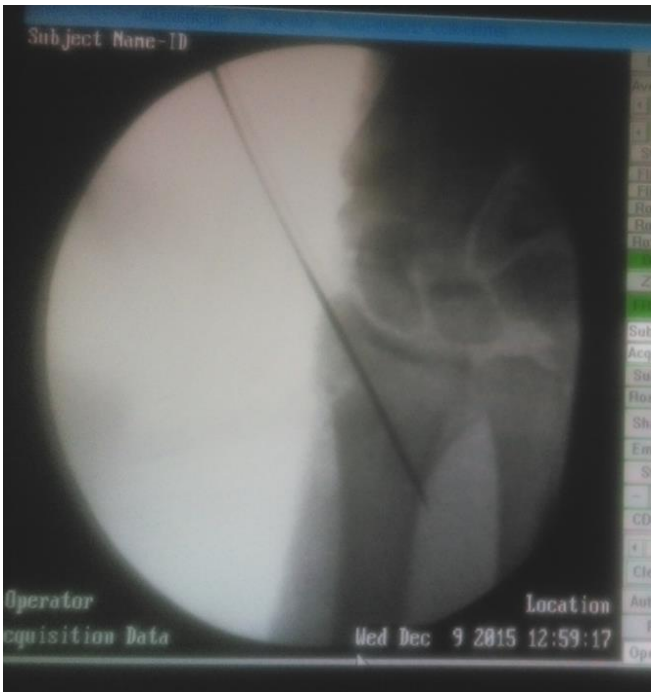
5. Once plate positioning and fixation was confirmed with adequate C-arm views wound is washed and closed over a suction drain

Radial fragment

1. A straight skin incision is made over the anatomical snuff box with the distal and proximal extent as required. The superficial cutaneous branch of the radial nerve is identified and protected.

2. The first and second dorsal compartments are elevated and radial styloid is exposed

3. The fracture is provisionally fixed under C-arm guidance with k wires.



4. Once provisional fixation is obtained fracture is fixed with a straight lateral plate after plate positioning is confirmed under C-arm guidance.

Dorsal fragment

The intermediate and radial columns may be approached through a single dorsal skin incision. The skin incision is put in line with the third metacarpal with the proximal and distal extents as necessary

1. The 3rd extensor compartment is opened in line with the extensor pollicis longus tendon. The distal part of extensor retinaculum is maintained so that the EPL tendon can still glide over the thumb.

2. The fourth extensor compartment is elevated subperiosteally for adequate exposure of the fracture site.

POST OPERATIVE CARE

Strict limb elevation was maintained for all patients post operatively.In the immediate post operative period, adequate pain relief was given in consultation with anaesthetists. Intravenous antibiotics were given till the 2nd post operative day following which oral antibiotics were started.

Post operative Xray was taken on the 1st post operative day. Check dressings were done on the 2nd and 5th post operative day. Drain removal was done on the 2nd post operative day. Suture removal was done on the 12th post op day.

Patients were reviewed at 3 weeks,6 weeks,3months, 6 months and 1 year and subsequent xrays were taken to assess union. Finger and elbow mobilisation was started immediately after surgery. Wrist mobilisation was started 1 week post operatively as pain tolerated. Strengthening exercises were started 6 weeks post operatively.

IV antibiotics	First two days after surgery
Check dressings	2nd and 5th post op days
Suture removal	12th post op day
Finger and elbow mobilisation	Immediate post op
Wrist mobilisation	1 week post op
Strengthening exercises	6 weeks post op

OUTCOME ASSESSMENT

Functional outcome was assessed using Gartland and Werley scoring system.

GARTLAND AND WERLEY SCORING SYSTEM

Residual deformity

Prominent ulnar styloid-1

Residual dorsal tilt-2

Radial deviation of hand-3

Subjective evaluation

No pain, disability or limitation of motion-0

Occasional pain, slight limitation of motion, no disability-2

Occasional pain, some limitation of motion, activities slightly restricted, no disability - 4

Pain, limitation of motion, disability, activities markedly restricted – 6

Objective evaluation

Loss of dorsiflexion – 5

Loss of ulnar deviation – 3

Loss of supination – 2

Loss of palmar flexion – 1

Loss of radial deviation – 1

Loss of circumduction – 1

Pain in distal radioulnar joint - 1

Complications

Minimal arthritis – 1

Minimal arthritis with pain – 3

Moderate arthritis – 2

Moderate arthritis with pain – 4

Severe arthritis – 3

Severe arthritis with pain – 5

Nerve complications – 1 to 3

Poor finger function – 1 to 3

Score

0 to 2 – excellent

3 to 8 – good

9 to 20 – fair

> 20 – poor

The minimum for normal function:

dorsiflexion -45°

palmar flexion -30°

radial deviation -15°

ulnar deviation -15°

pronation -50°

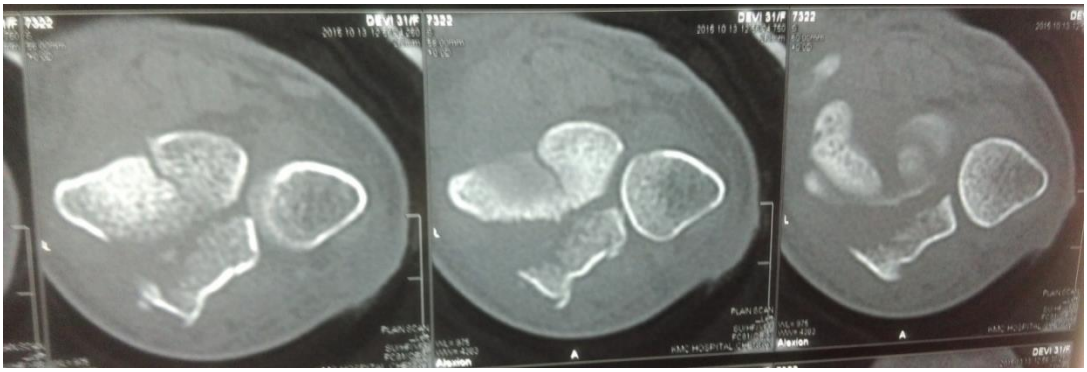
supination- 50°

CASE REPORTS

CASE - 1

Pre op Xray

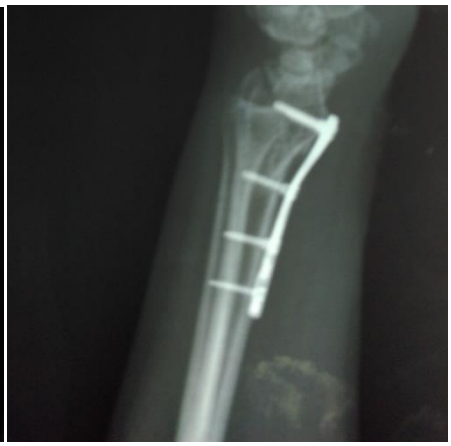
Pre op CT



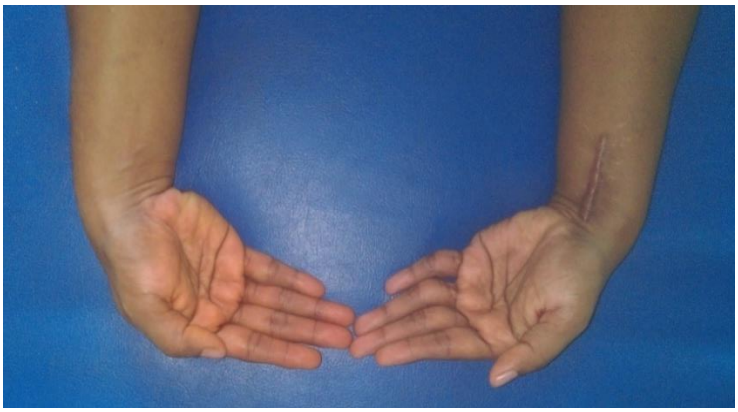
Immediate post op Xray

3 months follow up

6 months follow up

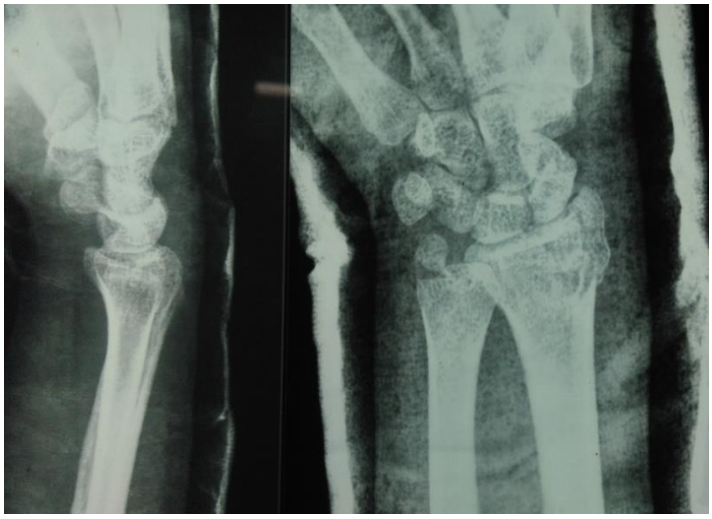


Clinical pictures

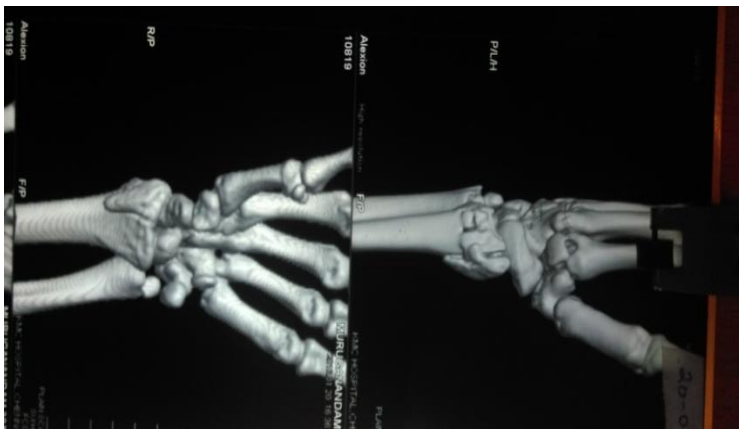


Case 2

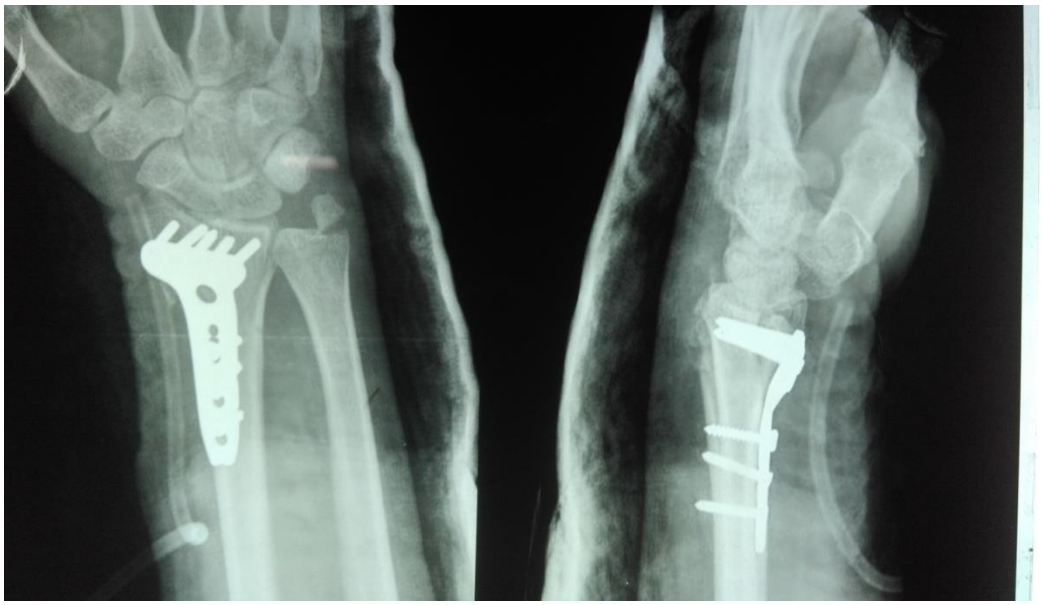
Pre op Xray



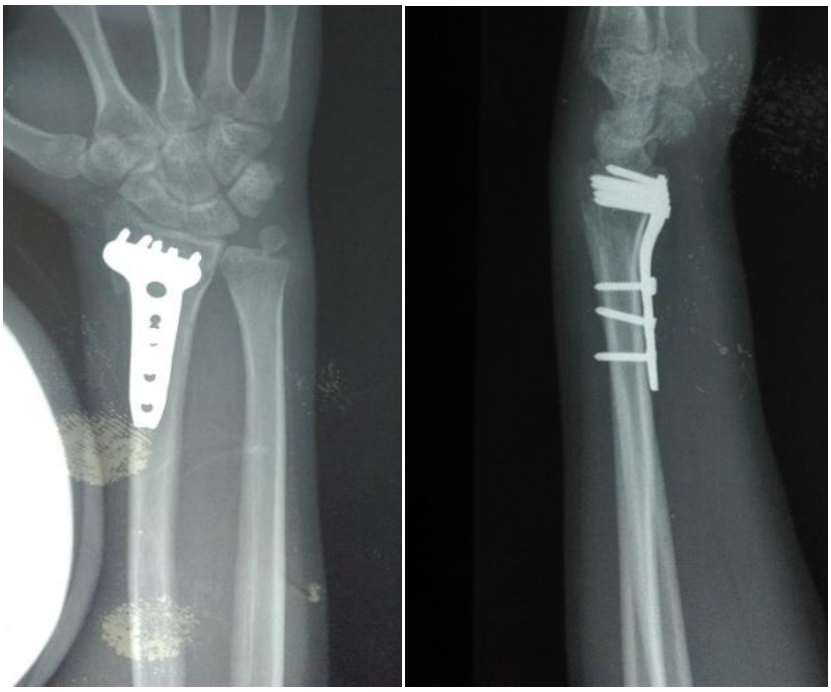
Pre op CT



Immediate post op Xray



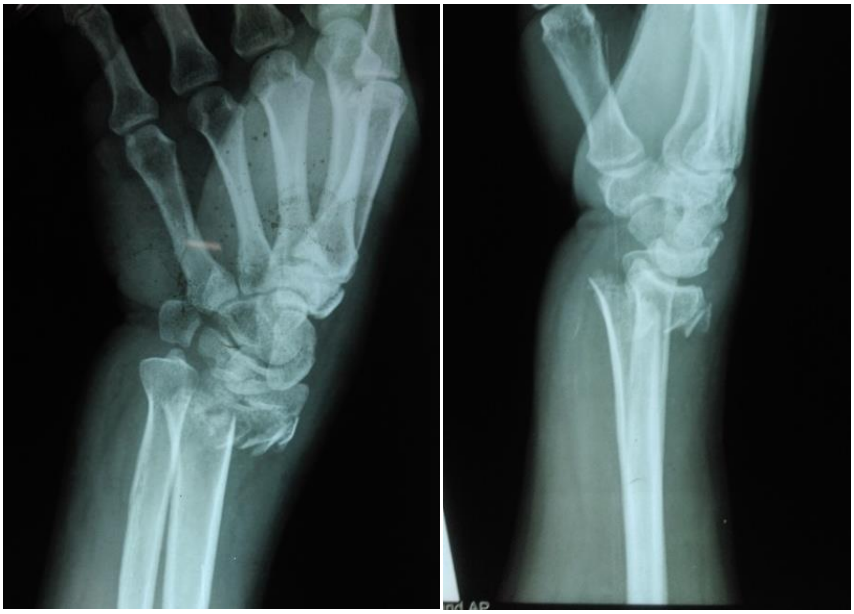
6 months follow up



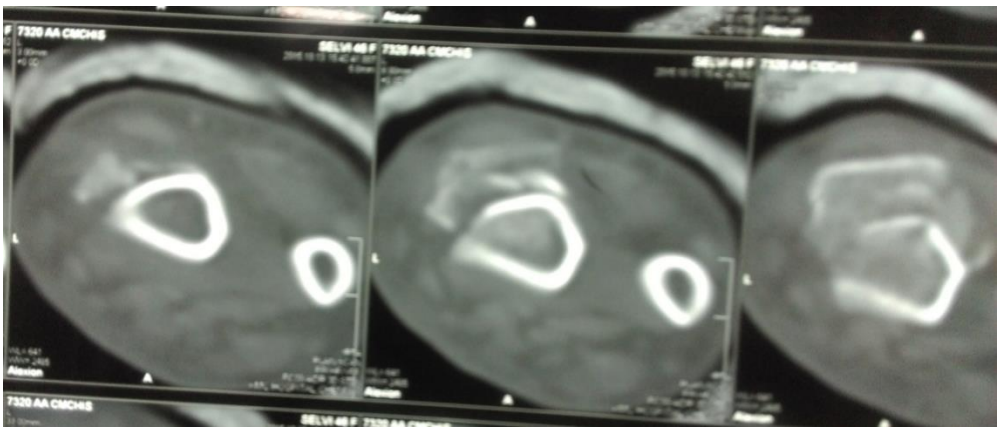
Clinical pictures

Case 3

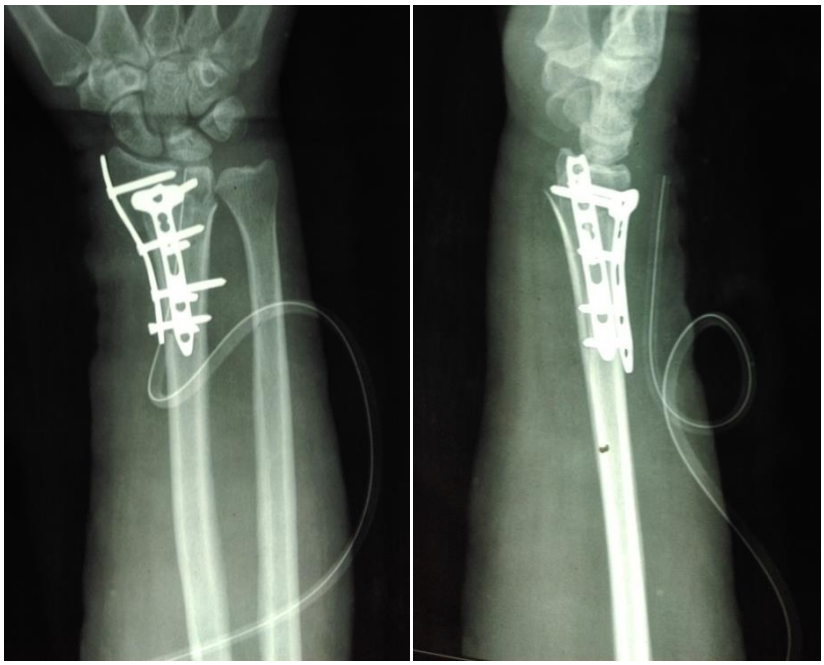
Pre op Xray



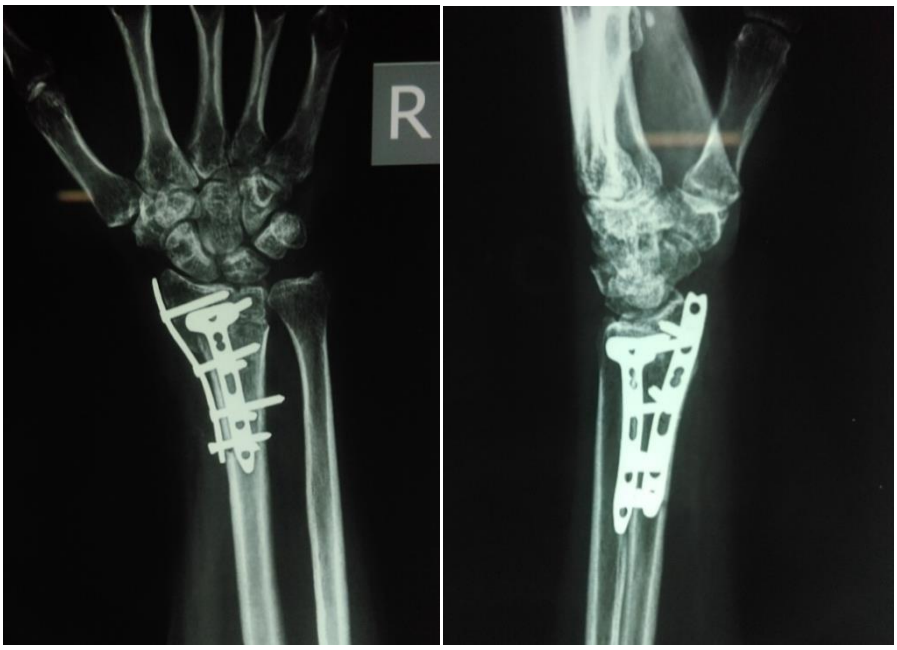
Pre op CT



Immediate post op Xray

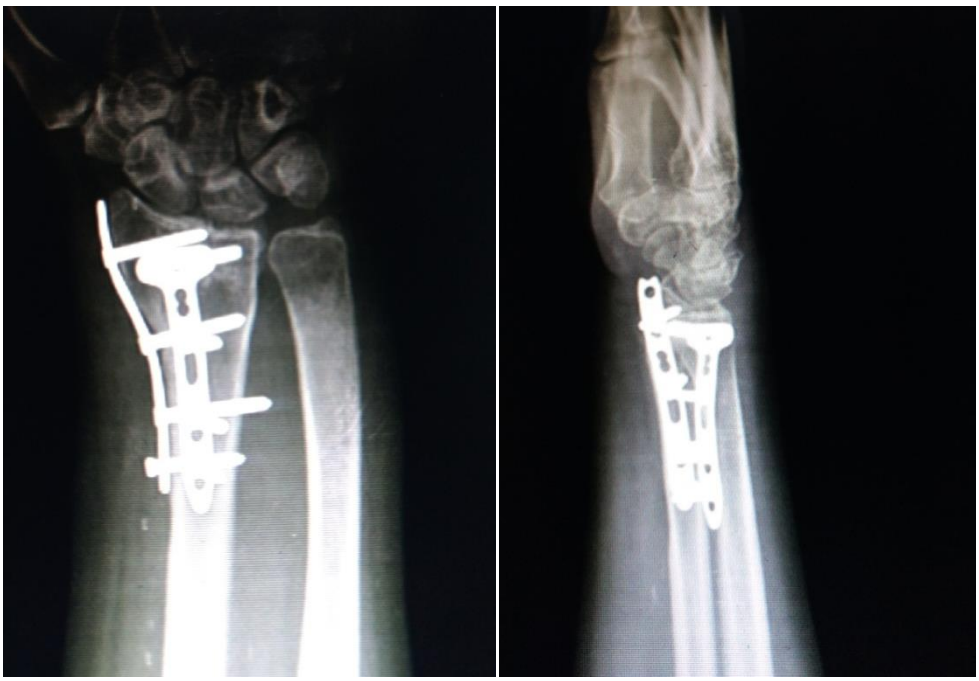


3 months follow up



6 months follow up

1 year follow up

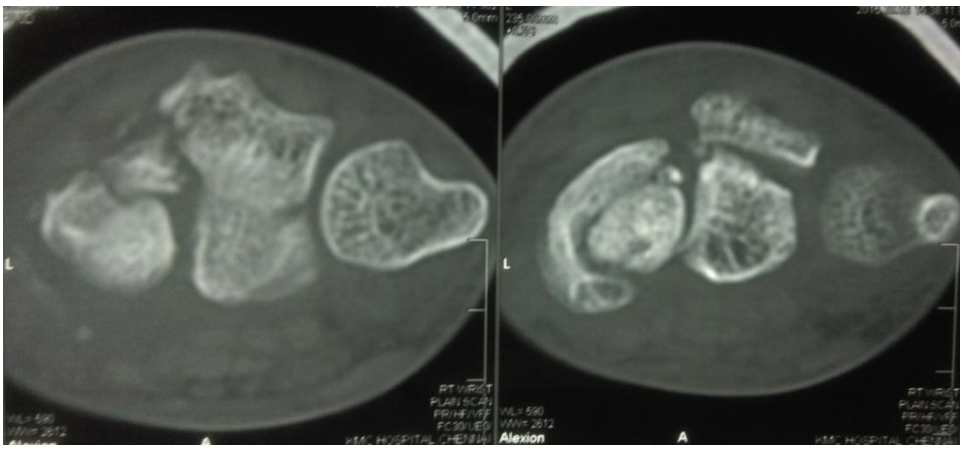


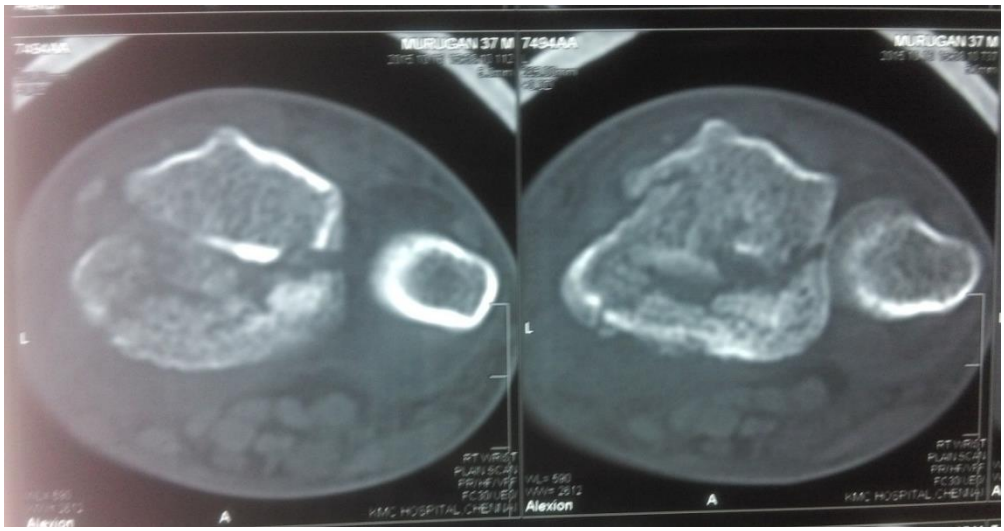
Clinical pictures

Case 4

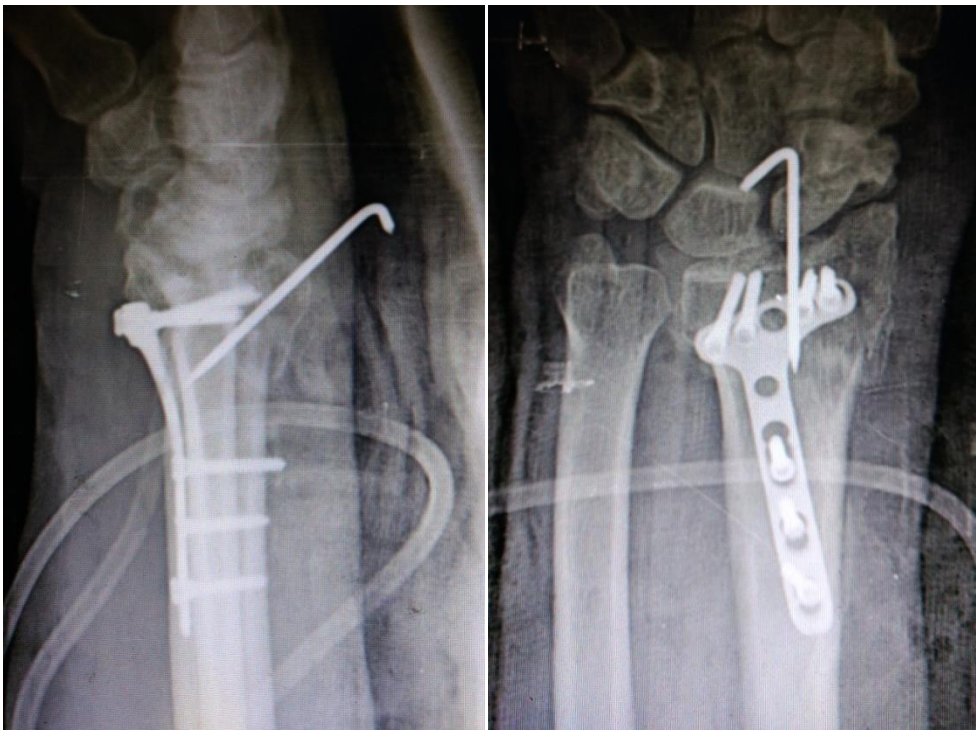
Pre op Xray

Pre op CT





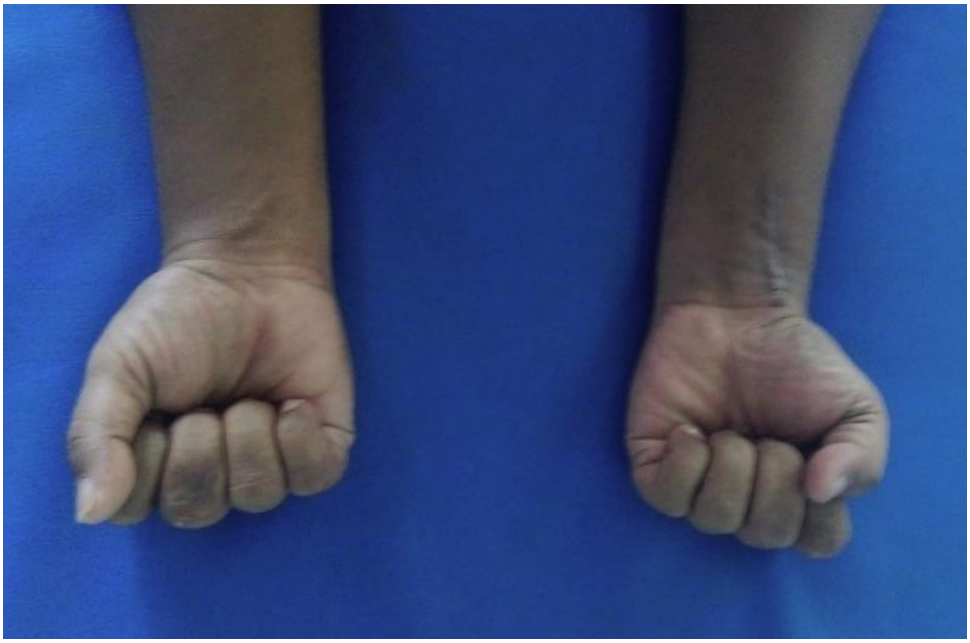
Immediate post op Xray



3 months follow up

6 months follow up

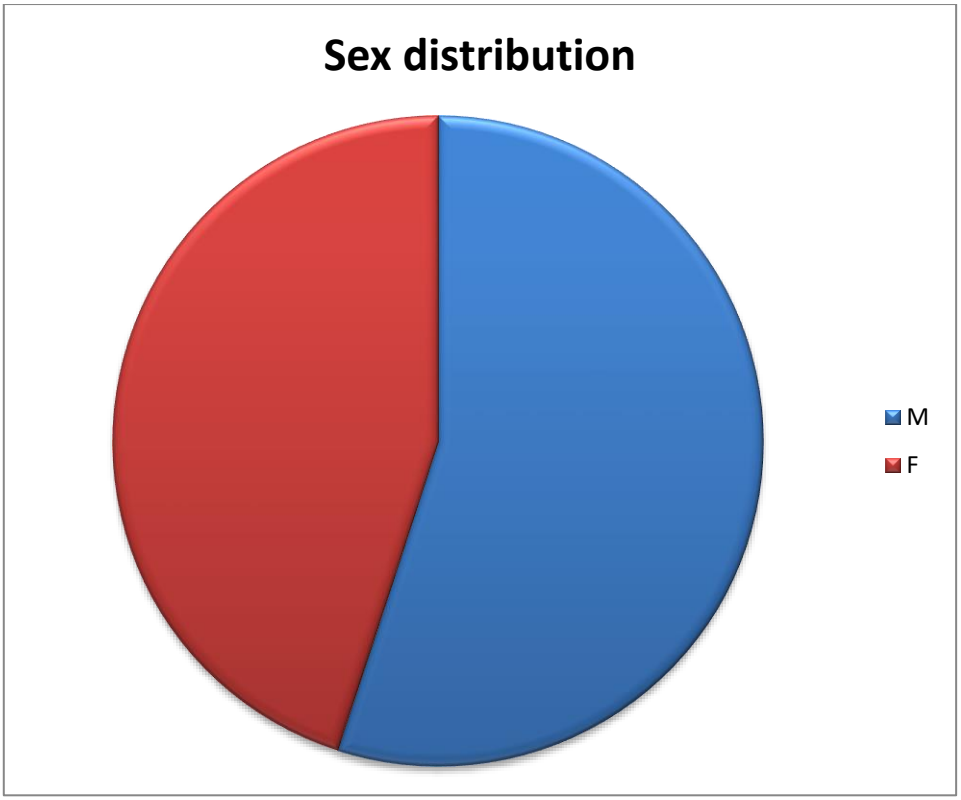
Clinical picture



OBSERVATIONS

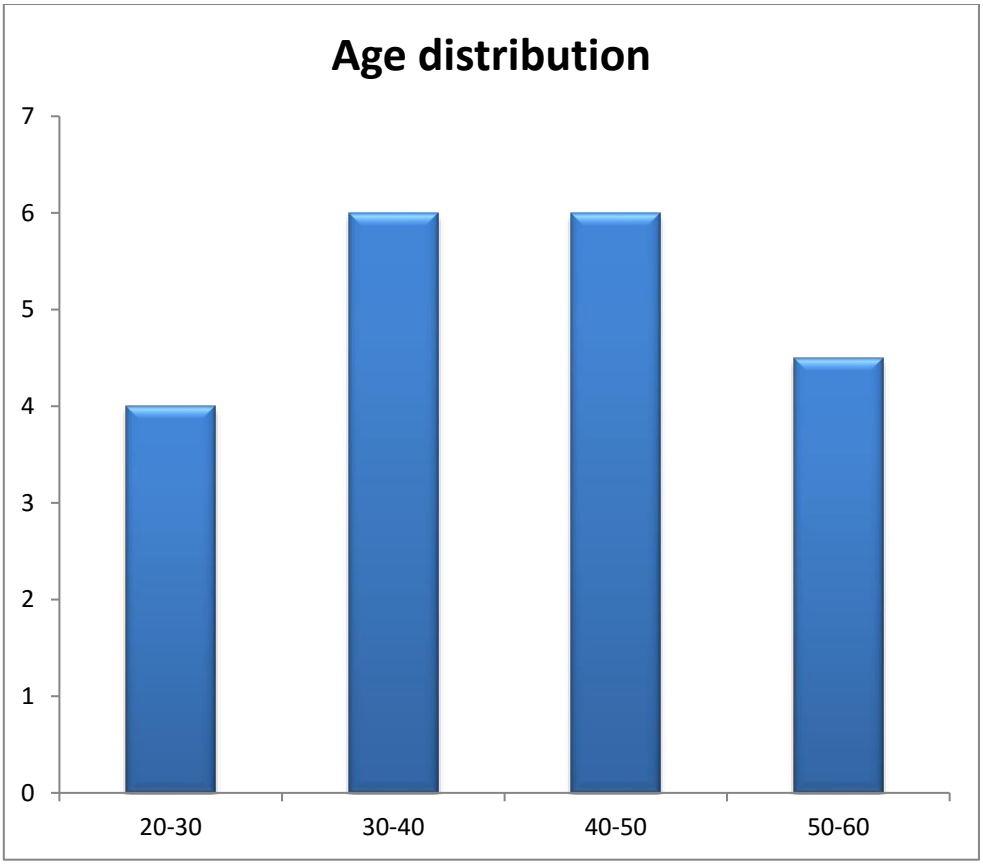
SEX DISTRIBUTION

The patients involved in our study were predominantly male.



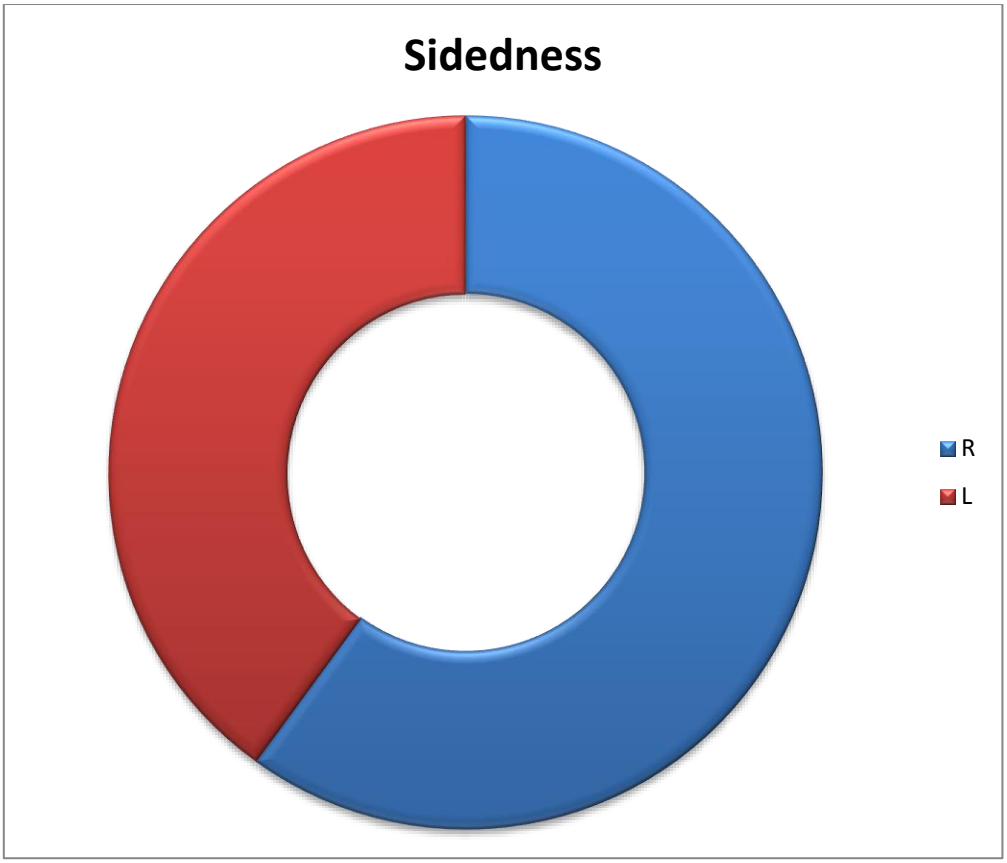
AGE DISTRIBUTION

Most patients involved were between 30 to 50 years of age.



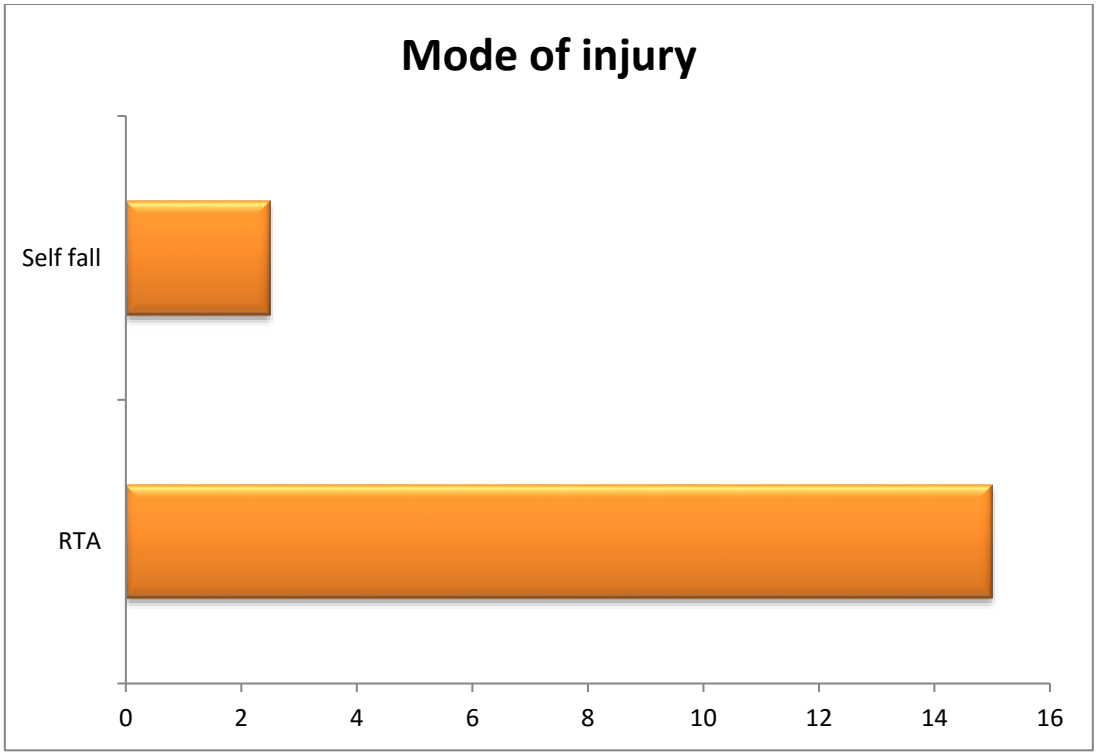
SIDEDNESS

Most patients had involvement of right limb.



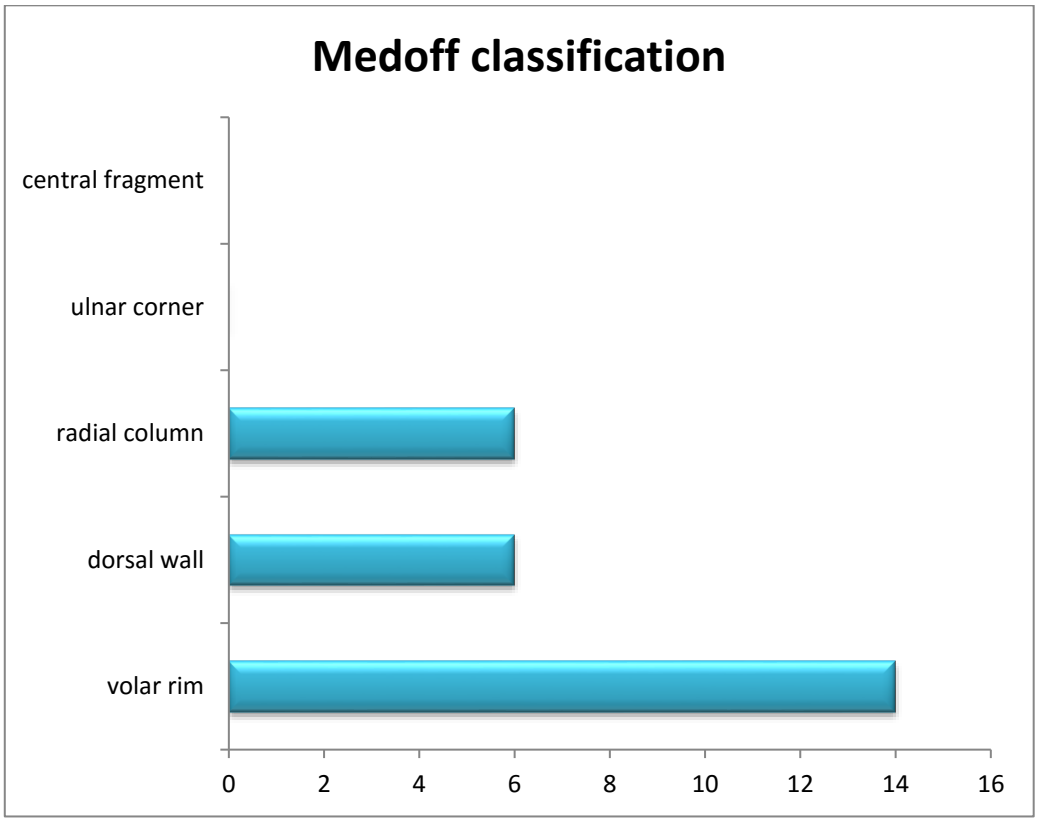
MODE OF INJURY

Road traffic accident was the most common mode of injury



CLASSIFICATION

The fragments involved as per the Medoff classification is as follows

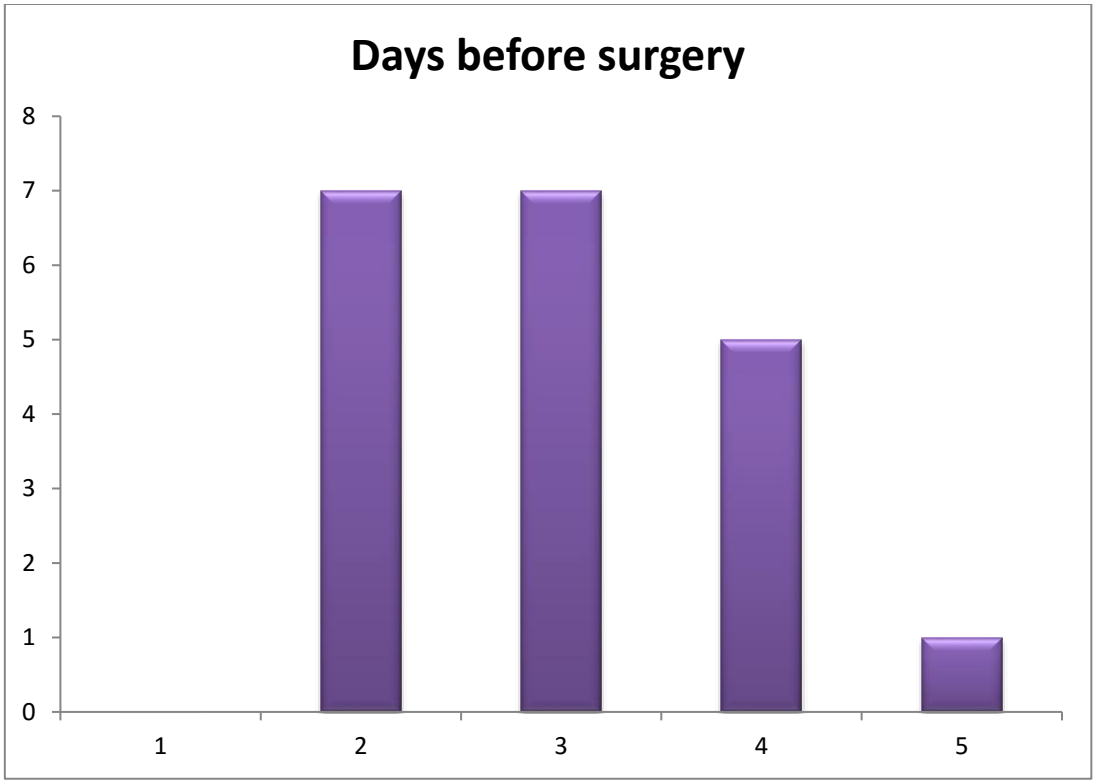


ASSOCIATED FRACTURES

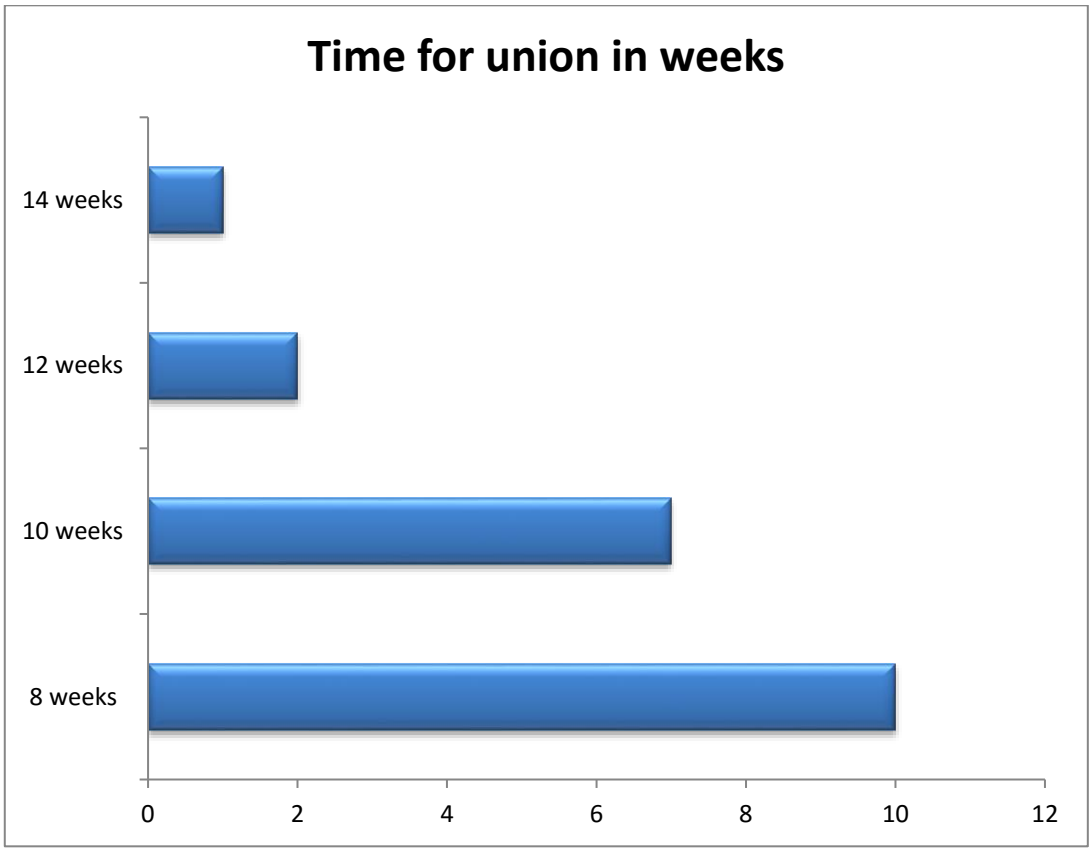
Only 2 patients had associated fractures.1 patient had # shaft of humerus on the ipsilateral side and another patient had # both bones forearm on the contralateral side.Both of these fractures were treated surgically in the same sitting

TIMING OF SURGERY

All patients were operated within 5 days

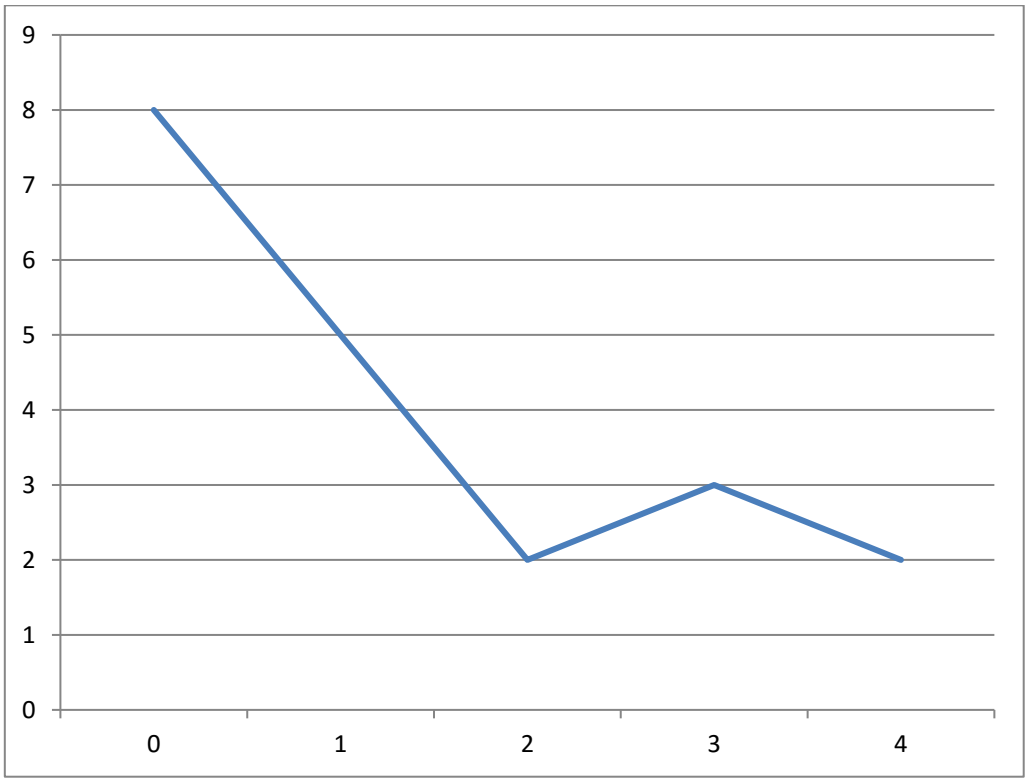


TIME FOR FRACTURE UNION



In our study, all fractures united on an average of 9.05 weeks with a Standard Deviation of 1.73 weeks.

GARTLAND AND WERLEY SCORING SYSTEM



The above graph shows that most the patients in our study had a Gartland and Werley score of 0 or 1.The Gartland and Werley score was done for each case individually 6 months after the surgery.

RESULTS

RANGE OF MOTION

Movements	Average(Mean+SD)
Palmar flexion	57.1 with SD 3.5
Dorsi flexion	63.3 with SD 3.2
Radial deviation	17.6 with SD 3.0
Ulnar deviation	24.1 with SD 4.4

At the end of six months four patients had stiffness of wrist with reduced radial deviation.

SUBJECTIVE EVALUATION

Symptoms	Score	No. of patients
No pain	0	13(65%)
Occasional pain	2	7(35%)
Occasional pain with slight limitation of motion	4	0(0%)
Pain with severe limitation of motion	6	0(0%)

RESIDUAL DEFORMITY

Deformity	Score	No. of patients
Prominent ulnar styloid	1	4(20%)
Residual dorsal tilt	2	0(0%)
Radial deviation of hand	3	0(0%)

OBJECTIVE EVALUATION

Movements	Score	No. of patients
Loss of dorsiflexion	5	0(0%)
Loss of ulnar deviation	3	0(0%)
Loss of supination	2	0(0%)
Loss of palmar flexion	1	0(0%)
Loss of radial deviation	1	4(20%)
Loss of circumduction	1	0(0%)
Pain in DRUJ	1	3(15%)

RESULT

Result	Score	No. of patients
Excellent	0-2	15(75%)
Good	3-8	5(20%)
Fair	9-20	0(0%)
Poor	>20	0(0%)

STATISTICS

- The collected data were analysed with IBM.SPSS statistics software 23.0 Version.
- To describe about the data descriptive statistics frequency analysis were used for categorical variables.
- To assess the relationship between the variables Pearson's Correlation was used.
- To find the significance in categorical data Chi-Square test was used.
- In both the above statistical tools, the probability value 0.05 is considered as significant level.

CORRELATIONS

Correlations			
		Age	**Time for union in weeks**
Age	Pearson Correlation	1	.634**
	Sig. (2-tailed)		.003
	N	20	20
Time for union in weeks	Pearson Correlation	.634**	1
	Sig. (2-tailed)	.003	
	N	20	20
**. Correlation is significant at the 0.01 level (2-tailed).			

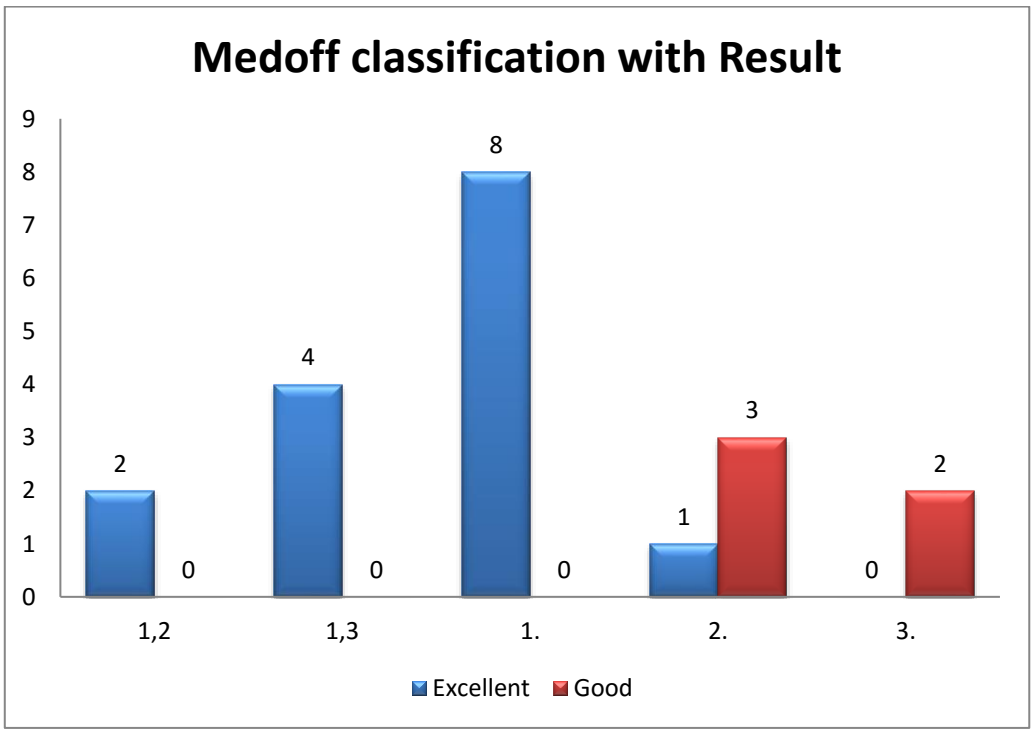
MEDOFF CLASSIFICATION * RESULT

		Result		Total
		Excellent	**Good**	
Medoff classification	1,2	2	0	2
	1,3	4	0	4
	1.	8	0	8
	2.	1	3	4
	3.	0	2	2
Total		15	5	20

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	16.000[a]	4	.003
Likelihood Ratio	17.995	4	.001
N of Valid Cases	20		

9 cells (90.0%) have expected count less than 5. The minimum expected count is .50.



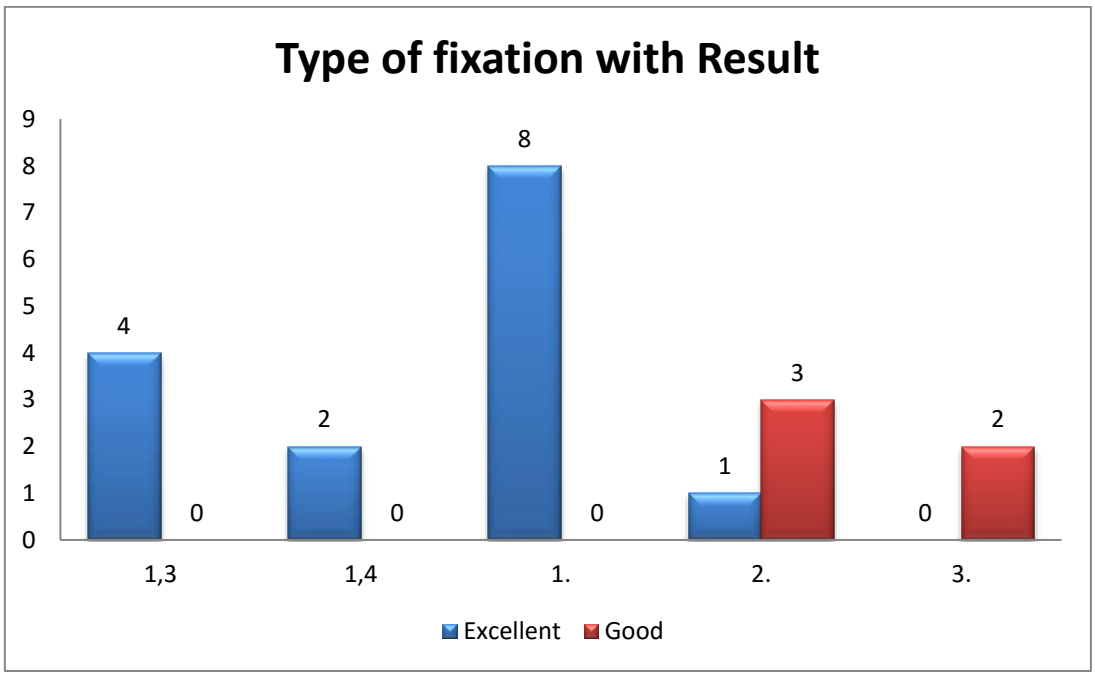
TYPE OF FIXATION * RESULT

		Result		Total
		Excellent	**Good**	
Type of fixation	1,3	4	0	4
	1,4	2	0	2
	1.	8	0	8
	2.	1	3	4
	3.	0	2	2
Total		15	5	20

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	16.000[a]	4	.003
Likelihood Ratio	17.995	4	.001
N of Valid Cases	20		

a. 9 cells (90.0%) have expected count less than 5. The minimum expected count is 0.50.



DISCUSSION

There are many treatment options for distal radius fractures.Undisplaced stable fractures can be treated conservatively with casting.Unstable fractures can be treated with percutaneous K wire fixation.Communited fractures can be treated with external fixation.But there is a period of immobilisation for the wrist joint when treated with external fixation which can lead to wrist stiffness[18].There are dynamic external fixators available to treat communited distal radius fractures but the reduction achieved with this method is frequently not satisfactory.Furthermore reduction of intra articular fragments could not be achieved to a satisfactory degree with an external fixator.

Open reduction and plating is a very good option to treat communited intra articular fractures of the distal radius.Plates provide stable fixation throughout the entire healing process and also satisfactory articular reduction could be obtained with open reduction[16].However the plates available are of fixed designs and may not be suitable for all fracture patterns.Bulky plates especially in the dorsal aspect can cause irritation of tendons necessitating even implant removal.

Regonazzi introduced the double plating technique for the distal radius using low profile plates at an angulation of 60 degrees to each other[11].On experimentally induced dorsally tilted distal radius fractures in a cadaver, this method showed superior biomechanical stability when compared to 3.5mm AO ‘T’ locking plate.

Fragment specific fracture fixation is another method to approach distal radius fractures, based on Medoff classification which seeks to address all fragments involved in the distal radius individually and gives rigid fixation to all of them after anatomically aligning them perfectly[19].This allows immediate wrist mobilisation and reduces chances of stiffness.

The efficacy of fragment specific fracture fixation was initially studied by Dodds et al[8].They compared fragment specific fracture fixation with augmented external fixation in a experimentally induced communited fracture in a cadaver.The biomechanical study showed superior stability in fragment specific fracture fixation in comparison with augmented external fixators.

A study done by Chang et al[2] where fragment specific fracture fixation was done for a sample of 30 patients with communited intra articular distal radius fractures and Gartland and Werley scoring was used

to analyse functional outcome, showed 13 excellent results,12 good reults and 5 fair results. In our study we used Gartland and Werley scoring system to assess patients at the end of the study. Among the 20 patients studied we had 15 excellent reults and 5 good results. The average range of motion achieved in our study far exceeded 10 degrees of palmar flexion and 35 degrees of dorsi flexion which is essential for activities of daily living.

SUMMARY

At the end of our study, we had 20 patients of which 11 were male and 9 were female.The age of the patients ranged from 24 to 59 with an average of 39.8.

The mean time taken for surgery after injury was 3 days with a minimum of 2 days and a maximum of 5 days.

The commonest fragment involved was the volar rim which was involved in 14 cases either alone or in combination with other fragments.The other fragments were also involved either alone or in combination with volar fragment.

The average time of union for fractures was 9.05 weeks ranging from 7 to 14 weeks.

Only 2 patients had associated fractures.1 patient had #shaft of humerus on the ipsilateral side and another patient had #both bones forearm on the contralateral side. Both of these fractures were treated surgically at the same sitting.

Gartland and Werley scoring was done for all patients and the score ranged from 0 to 4.

15 patients(75%) had excellent results and 5 patients(25%) had good results according to Gartland and Werley scoring system.

There were no other complications for any patients like superficial infection,non union,mal union,neurovascular injury etc.

CONCLUSION

Hence we conclude that fragment specific fracture fixation is an excellent method to treat communited intra articular distal radius fractures.We recommend fragment specific fracture fixation for communited intra articular distal radius fractures because of the following advantages :

Good articular reduction

Early mobilisation and rehabilitation

Less hardware complications

Lesser morbidity

MASTER CHART

S.No	Age	Sex	Mode of injury	Side	Medoff classification	Days before surgery	Type of fixation	Associated fractures	Time for union in weeks	Comorbidities
1	45	M	1	R	1,2	3	1,4	No	10	No
2	31	F	1	L	1	2	1	No	8	No
3	46	F	1	R	1,3	4	1,3	Yes	8	No
4	51	M	2	L	3	2	3	No	9	No
5	34	F	1	L	1	3	1	No	8	No
6	41	M	1	R	1	3	1	No	9	No
7	25	M	1	L	1	2	1	No	7	No
8	29	F	1	L	1,3	2	1,3	No	8	No
9	56	M	1	R	2	4	2	No	9	Yes
10	33	F	2	R	1	2	1	No	10	No
11	49	M	1	R	2	3	2	Yes	14	No
12	28	F	1	L	1,3	2	1,3	No	8	No
13	36	M	1	R	1	3	1	No	8	No
14	59	F	2	L	3	5	3	No	11	Yes
15	44	M	1	R	1	4	1	No	9	No
16	24	F	1	R	1,3	2	1,3	No	7	No
17	41	F	2	L	2	4	2	No	8	No
18	36	M	1	R	1	3	1	No	8	No
19	33	M	1	R	1,2	3	1,4	No	10	No
20	55	M	2	R	2	4	2	No	12	Yes

S.No	Age	Sex	Palmar flexion	Dorsiflexion	Radial deviation	Ulnar deviation	Gartland and Werley score	Result
1	45	M	59	64	18	27	1	Excellent
2	31	F	54	61	13	24	1	Excellent
3	46	F	56	62	16	24	1	Excellent
4	51	M	51	59	19	26	3	Good
5	34	F	57	66	16	25	1	Excellent
6	41	M	53	59	17	24	1	Excellent
7	25	M	61	68	24	30	0	Excellent
8	29	F	58	60	18	23	0	Excellent
9	56	M	54	59	14	19	4	Good
10	33	F	56	63	17	22	0	Excellent
11	49	M	56	62	13	21	3	Good
12	28	F	58	66	17	22	0	Excellent
13	36	M	62	63	18	26	0	Excellent
14	59	F	52	59	14	17	3	Good
15	44	M	61	66	20	24	0	Excellent
16	24	F	60	64	21	27	0	Excellent
17	41	F	58	68	19	26	2	Excellent
18	36	M	59	66	20	28	0	Excellent
19	33	M	64	68	24	31	2	Excellent
20	55	M	53	63	14	16	4	Good

KEYS TO MASTER CHART

Mode of injury

1 – Road traffic accident

2 – Slip and fall

Medoff classification

1 – Volar rim

2 – Dorsal wall

3 – Radial column

4 – Ulnar corner

5 – Central

Type of fixation

1 – Volar plate

2 – Dorsal plate

3 – Radial plate

4 – K wire

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PROFORMA

Name:

Age / Sex:

IP number:

Address:

Contact Number:

Date of Admission:

Date of Surgery:

Date of Discharge:

Occupation:

Education:

Socioeconomic Status:

Diagnosis:

HISTORY:

1. Mode of injury: Road traffic accident / fall at home / fall from

Height / Assault

2. Presenting complaints:

a. Pain – site / duration

b. Swelling – site / extent

c. Deformity

d. Disturbances in function – movements

e. Other associated injuries – head injury / limb injuries / spine

Injuries

3. Comorbid illnesses:

Diabetes mellitus

Hypertension

Coronary heart disease

Renal disorder

Seizures

Bronchial Asthma

Chronic Obstructive lung diseases

Neoplastic disorders

4. Drug history: Steroids / Disease modifying anti-rheumatoid drugs /

Immunosuppressant

PAST HISTORY:

Any similar injuries

Previous surgeries or hospitalisations

Any major illnesses

PERSONAL HISTORY:

TREATMENT HISTORY:

FAMILY HISTORY:

CLINICAL EXAMINATION:

GENERAL EXAMINATION:

Appearance and built

Pallor

Icterus

Cyanosis

Clubbing

Lymphadenopathy

Pedal edema

VITALS:

1. Pulse:

2. BP:

3. Respiratory rate:

4. Temperature:

SYSTEMIC EXAMINATION:

Cardiovascular system :

Respiratory system :

Abdomen :

REGIONAL EXAMINATION

RIGHT / LEFT WRIST

OTHER INJURIES

X – RAY FINDINGS:

FINAL DIAGNOSIS:

INITIAL TREATMENT GIVEN:

TIME INTERVAL BETWEEN INJURY AND SURGERY:

PROCEDURE DONE:

MOBILIZATION STARTED ON:

COMPLICATIONS:

POST OP PERIOD:

1ST WEEK			
6TH WEEK			
3 MONTHS			
6 MONTHS			

FOLLOW UP PERIOD:

GARTLAND AND WERLEY SCORE:

FUNCTIONAL OUTCOME:

INSTITUTIONAL ETHICAL COMMITTEE
GOVT.KILPAUK MEDICAL COLLEGE,
CHENNAI-10
Protocol ID. No. 1/2016 Dt: 23.01.2016
CERTIFICATE OF APPROVAL

The Institutional Ethical Committee of Govt. Kilpauk Medical College, Chennai reviewed and discussed the application for approval "Functional outcome of communited intra articular distal radius fractures managed by fragment specific fracture fixation" - For Project Work submitted by Dr.M.Nirmal, PG Student of MS (Orhto), Govt. Kilpauk Medical College, Chennai-10.

The Proposal is APPROVED.

The Institutional Ethical Committee expects to be informed about the progress of the study any Adverse Drug Reaction Occurring in the Course of the study any change in the protocol and patient information /informed consent and asks to be provided a copy of the final report.

DEAN,
Govt.Kilpauk Medical College,
Chennai – 10.

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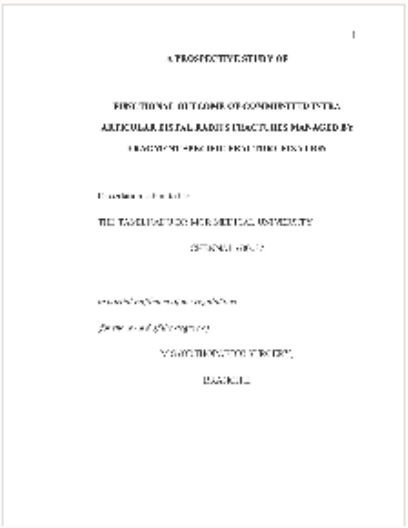

A PROSPECTIVE STUDY OF

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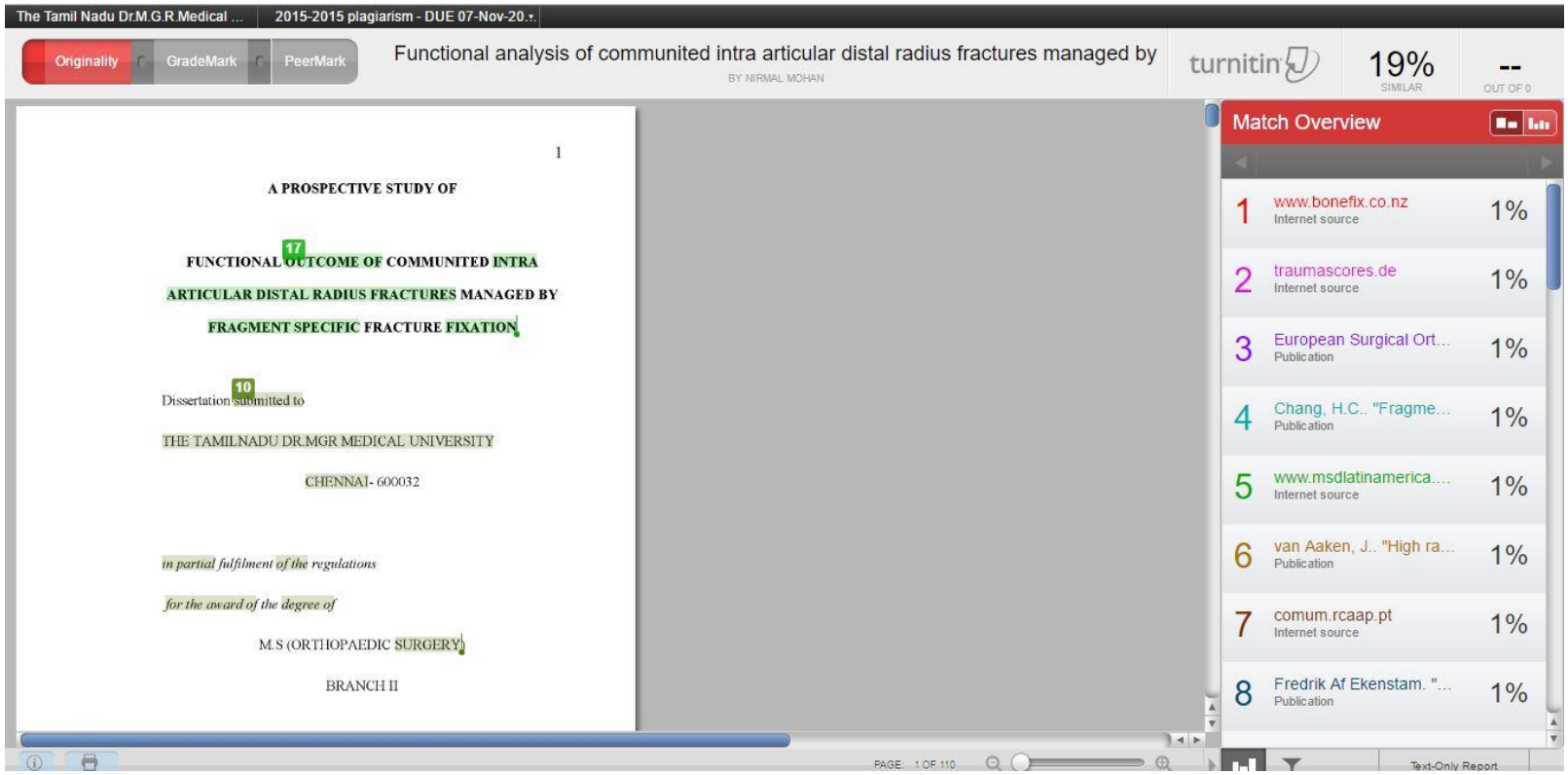
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Dissertation submitted to
THE TAMILNADU DR.MGR MEDICAL UNIVERSITY
CHENNAI- 600032
in partial fulfilment of the regulations
for the award of the degree of
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Text-Only Report

நோயாளி ஒப்புதல் படிவம்

ஆராய்ச்சியின் விவரம்: மணிக்கட்டில் நொறுங்கிய எலும்பை நோருங்களுக்கு ஏற்ப தட்டுகளும் திருகுகளும் வைத்து அறுவை சிகிச்சை செய்வதின் செயல்பாடு
ஆய்வறிக்கை.

ஆராய்ச்சி மையம்: அரசு கீழ்பாக்கம் மருத்துவக் கல்லூரி மருத்துவமனை

நோயாளியின் பெயர்: நோயாளியின் வயது:

பதிவு எண்:

நோயாளி கீழ்கண்டவற்றுள் கட்டங்களை (✔) செய்யவும்

1. மேற்குறிப்பிட்டுள்ள ஆராய்ச்சியின் நோக்கத்தையும் பயனையும் முழுவதுமாக புரிந்துகொண்டேன். மேலும் எனது அனைத்து சற்தேகங்களையும் கேட்டு அதற்கான விளக்கங்களையும் தெளிவுபடுத்திக் கொண்டேன். ☐

2. மேலும் இந்த ஆராய்ச்சிக்கு எனது சொந்த விருப்பத்தின் பேரில் பங்கேற்கிறேன் என்றும், மேலும் எந்த நேரத்திலும் எவ்வித முன்னறிவிப்புமின்றி இந்த ஆராய்ச்சியிலிருந்து விலக முழுமையான உரிமை உள்ளதையும், இதற்கு எவ்வித சட்ட பிணைப்பும் இல்லை என்பதையும் அறிவேன். ☐

3. ஆராய்ச்சியாளரோ, ஆராய்ச்சி உதவியாளரோ, ஆராய்ச்சி உபயத்தாரோ, ஆராய்ச்சி பேராசிரியரோ, ஒழுங்குறெறி செயற்குழு உறுப்பினர்களோ எப்போது வேண்டுமானாலும் எனது அனுமதியின்றி எனது உள்நோயாளி பதிவுகளை இந்த ஆராய்ச்சிக்காகவோ அல்லது எதிர்கால பிற ஆராய்ச்சிகளுக்காகவோ பயன்படுத்திக்கொள்ளலாம் என்றும், மேலும் இந்த நிபந்தனை நான் இவ்வாரய்ச்சியிலிருந்து விலகினாலும் தகும் என்றும் ஒப்புக்கொள்கிறேன். ஆயினும் எனது அடையாளம் சம்பந்தப்பட்ட எந்த பதிவுகளும் (சட்டபூர்வமான தேவைகள் தவிர) வெளியிடப்படமாட்டாது என்ற உறுதிமொழியின் பெயரில் இந்த ஆராய்ச்சியிலிருந்து கிடைக்கப்பெறும் முடிவுகளை வெளியிட மறுப்பு தெறிவிக்கமாட்டேன் என்று உறுதியளிக்கின்றேன். ☐

4. இந்த ஆராய்ச்சிக்கு நான் முழுமனதுடன் சம்மதிக்கின்றேன் என்றும் மேலும் ஆராய்ச்சிக் குழுவினர் எனக்கு அளிக்கும் அறிவுரைகளை தவறாது பின்பற்றுவேன் என்றும் இந்த ஆராய்ச்சி காலம் முழுவதும் எனது உடல் நிலையில் ஏதேனும் மாற்றமோ அல்லது எதிர்பாராத பாதகமான விளைவோ எற்படுமாயின் உடனடியாக ஆராய்ச்சி குழுவினரை அணுகுவேன் என்றும் உறுதியளிக்கின்றேன். ☐

5. இந்த ஆராய்ச்சிக்குத் தேவைப்படும் அனைத்து மருத்துவப் பரிசோதனைகளுக்கும் ஒத்துழைப்பு தருவேன் என்று உறுதியளிக்கின்றேன். ☐

6. இந்த ஆராய்ச்சிக்கு யாருடைய வற்புருத்தலுமின்றி எனது சொந்த விருப்பத்தின் பேரிலும் சுயஅறிவுடனும் முழுமனதுடனும் சம்மத்திக்கின்றேன் என்று இதன் மூலம் ஒப்புக்கொள்கிறேன். ☐

நோயாளியின் கையொப்பம் / பெருவிரல் கைரேகை ஆராய்ச்சியாளரின் கையொப்பம்

இடம்: தேதி: