INTERNATIONAL JOURNAL OF MEDICAL AND APPLIED SCIENCES
Earthjournals Publisher
eISSN:2320-3137
www.earthjournals.in

RESEARCH ARTICLE

A STUDY OF CLINICAL AND FUNCTIONAL OUTCOME OF INTRA-ARTICULAR FRACTURE OF DISTAL END OF RADIUS TREATED WITH OPEN REDUCTION AND INTERNAL FIXATION WITH PLATING

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Publication history: Received on 27/09/2017, Published online 15/10/2017

ABSTRACT:

INTRODUCTION: fracture of distal end radius is most common fracture of upper extremity comprises approximately 8%-15% of all bony injuries of body. Range of fracture extends from simple extra-articular fracture to open crushing type of fractures. Fractures of the distal aspect of the radius continue to pose a therapeutic challenge and are associated with a high prevalence of complications, so poses therapeutic challenge.
AIMS & OBJECTIVES: To assess the role of open reduction and plate fixation followed by early mobilization of wrist joint in the management of fracture distal end radius and to assess the clinical and functional results and complications of this technique.
MATERIALS AND METHODS: The present study consists of 50 cases of intraarticular distal radius fractures treated with open reduction and internal fixation at Surat Municipal Institute of Medical Education and Research (SMIMER) between august 2013 to august 2015. All cases were followed up-periodically during the study period.
CONCLUSION: 100% anatomical and 96% functional, excellent to good results, suggests that stabilizing the fracture fragments with volar plate and screws in the management of the fractures of distal radius, is an effective method to maintain the reduction till union and prevent collapse of the fracture fragments with excellent functional outcome**.**
KEY WORDS: fracture distal end radius, volar plating

INTRODUCTION

Hand is the most important tool of human being and for well-functioning hand well-functioning wrist is always necessary. The fractures of distal end radius crush the mechanical foundation of man's most elegant tool, the hand. Whether it is intraarticular or extraarticular malunion of distal end radius fracture which leads to the residual deformity of wrist adversely affects wrist motion and hand function by interfering with the mechanical advantage of the extrinsic hand musculature. It may cause pain, limitation

of forearm motion, and decreased grip strength as a result of arthritis of the radio carpal and distal radioulnar joints.

Fractures of distal end of radius are the commonest fractures occurring in the upper extremity comprising 8%-15%[1]. Range of fracture extends from simple extra-articular fracture to open crushing type of fractures[2].

Fractures of the distal aspect of the radius continue to pose a therapeutic challenge and are associated with a high prevalence of complications of post-traumatic osteoarthritis is after intraarticular fracture of the distal aspect of the radius[3]. It is also known that extra-articular misalignment can lead to decreased grip strength and endurance as well as limited motion and carpal instability. The results of closed reduction, percutaneous pin fixation, pins and plaster, and internal and external fixation have been variable and have been determined largely by the pattern of the fracture.

The ultimate goal is to provide the patients with the most functional and comfortable wrist and restoring anatomical articular congruency of the distal radius.

AIMS AND OBJECTIVES

1. To assess the role of open reduction and plate fixation followed by early mobilization of wrist joint in the management of fracture distal end radius.
2. To assess the clinical and functional results and complications of this technique.

MATERIALS AND METHODS

The present study consists of 50 cases of intraarticular distal radius fractures treated with open reduction and internal fixation at Surat Municipal Institute of Medical Education and Research (SMIMER) between august 2013 to august 2015. All cases were followed up-periodically during the study period.

RESULTS

The following are the observations made to the available data analysed as follows.

AGE DISTRIBUTION

Age in Years	No. of Cases	Percentages (%)
21 – 30	10	20
31- 40	20	40
41 – 50	07	14
51 – 60	11	22
61 – 70	02	04

As far as frequency is concerned maximum numbers of cases are between 31-40 years of age group.

SEX DISTRIBUTION

SEX	No. of Cases	Percentages (%)
Male	28	56
Female	22	44

In our study there was no significant difference in sex distribution.

SIDE OF INVOLVEMENT

SIDE	No. of Cases	Percentages (%)
Right	32	64
Left	18	36

As far as frequency is concerned 64% patient having injury to right side of extremity which was dominant side in most of the patients.

MODE OF INJURY

Mode of Injury	No. of Cases	Percentages (%)
Road traffic accident (RTA)	23	46
Fall on outstretched hand (FOOH)	27	54

In our study there was no significant difference in mode of injury.

AGE – MODE OF INJURY

Age in Years	No. of Cases	Rode traffic injury		Fall on outstretched hand	
		No.	(%)	No.	(%)
21 – 30	10	7	70%	3	30%
31- 40	20	11	55%	9	45%
41 – 50	07	2	28.5%	5	71.5%
51 – 60	11	3	27.3%	8	72.7%
61 – 70	02	0	0%	2	100%

In our study predominant mode of injury in younger age group was due to high energy trauma due to road traffic accidents and as ages advances predominant mode of injury was due to fall.

SEX-MODE OF INJURY

SEX	No.	Rode traffic injury		Fall on outstretched hand	
		No.	(%)	No.	(%)
Male	28	18	64.3%	10	35.7%
Female	22	5	22.7%	17	77.3%

In our study predominant mode of injury in male patients was road traffic accident and in female patients it was due to fall.

AO CLASSIFICATION

AO TYPE	**No. of Cases**	**Percentages (%)**
B1	0	0
B2	4	8
B3	17	34
C1	14	28
C2	15	30
C3	0	0

In our study maximum number of cases is of AO type B3,C1, AND C2 type fractures.

ASSOCIATED ULNAR STYLOID INJURY

Ulnar styloid injury	**No. of Cases**	**Percentages (%)**
Yes	28	56
No	22	44

In our study 56 % of cases having associated injury to ulnar styloid.

DURATION OF OPERATION FROM DATE OF INJURY:

Duration	**No. of Cases**	**Percentages (%)**
1-5 days	36	72
6-9 days	12	24
10 days or more	2	4

In our study most of the cases were operated within first 5 days of injury. In remaining number of cases there were medical problems or component of poly trauma or other system injury which had to be investigated or given priority than fracture fixation.

DURATION OF FRACTURE UNION:

Time of Union	**No. of Cases**	**Percentages (%)**
2-3 months	46	92
4-5 months	4	8
>5 months	0	0

In 92% of cases clinical and radiological signs of union were present at 3 months of duration.

TYPE OF FIXATION:

Type of fixation	**No. of Cases**	**Percentages (%)**
Volar plating	38	76
Volar plating with radial styloid k-wire	5	10
Double buttress plating	1	2
Dorsal plating	6	12

In our study 86 % of the patients were treated with volar plating with or without radial styloid k-wire.

RANGE OF MOTION:

Movement (within normal functional range)	**No. of Cases**
Loss Of Dorsiflexion (<45 degrees)	0
Loss Of Palmer Flexion (<30 degrees)	2(4%)
Loss Of Supination (< 50 degrees)	0
Loss Of Pronation (< 50 degrees)	0
Loss Of Ulnar Deviation (< 15 degrees)	0
Loss Of Radial Deviation (< 15 degrees)	0
Pain in distal radioulnar joint	0
Grip Strength ≤ 60% of opp. side	0

In our study 96 % of patient achieved movement within normal functional range. Only 4 % patients were not able to achieve palmer flexion within normal functional range.

COMPLICATIONS

Complications	**No. of Cases**	**Percentages (%)**
Joint stiffness	02	04
Reflex sympathetic dystrophy	00	00
Impingement of tendon	00	00
Carpal tunnel syndrome	00	00
Arthritis	00	00
Infection	01	02

In our study there were no complication in 94% of patients and 4% of patients had joint stiffness and 2% patients had infection.

EVALUATION OF RESULTS

Results	**Functional (DASH)**	**Percentages (%)**	**Anatomical (sarmiento)**	**Percentages (%)**
Excellent	38	76	45	90
Good	10	20	05	10
Fair	2	04	00	00
Poor	0	00	00	00

In our study 76% of patients having excellent results according to DASH score and 90% of patients having excellent results due to sarmiento score.

DISCUSSION

The present study was undertaken to assess the clinical and functional outcome of operative management of intraarticular distal radial fractures using by plating and early mobilisation.

We evaluated our results and compared them with those obtained by various other studies utilizing same and different modalities of treatment. Our analysis is as follows.

1)Age distribution:

SERIES	**Minimum age in years**	**Maximum age in years**	**Average in Years**
Rozental TD[4] 2006	19	77	51
Otman AY[5] 2009	18	78	46
Ayan Kilic[6] 2003	18	77	45
K K Wong[7] 2005	35	92	58.6
Erika Baun[8] 2006	18	89	54.3
Our study	21	70	41

The average age in our study is comparable to the studies of Ayan Kilic 2003 and Otman AY 2009 who had an average age of 45 years, 46 years respectively.

2) **Sex distribution:**

SERIES	**Males (%)**	**Females (%)**
Rozental TD[4] 2006	30	70
Ayan Kilic[6] 2003	55.55	44.45
K K Wong[7] 2005	36.67	63.33
Erika Baun[8] 2006	41.98	58.02
our study	56	44

The average sex distribution in our study is comparable to the studies of Ayan Kilic 2003.

3) **Involved side:**

The right side (dominant wrist) was involved in 64% of the cases in our study.

SERIES	**RIGHT (%)**	**LEFT(%)**
Rozental TD[4] 2006	78	22
K K Wong[7] 2005	50	50
Our study	64	36

4) **Mode of injury:**

SERIES	**Road traffic accident (%)**	**Fall on the out stretched Hand (%)**
Erika Baun[8] 2006	27	73
Pattanashetty OB[9] 2013	40.6	59.4
Our study	46	54

Our series is comparable to that of Pattanashetty OB 2013) as it was also done in the Indian subcontinent and in a similar setup.

Type of fracture

Series	B1 (%)	B2 (%)	B3 (%)	C1 (%)	C2 (%)	C3 (%)	
Rozental TD[4] 2006	0	9	35	9	47	0	
Ayan Kilic[6] 2003	0	11.1	7.4	7.4	51.9	22.2	
K K Wong[7] 2005	0	0	0	16.67	46.67	36.67	
Erika Baun[8] 2006	1.2	1.2	3.7	14.8	27.1	27.2	24.7-A
Our study	0	8	34	28	30	0	

Fracture pattern of most of the study involving unstable intraarticular distal end radius fracture most of them are ao type c-2

6) Type of fixation

In our study in 76% cases we achieved anatomical reduction with the use of volar locking plate and in 10% cases we required additional radial styloid k wire fixation to maintain radial length. In 2% cases double buttress plating (styloid buttress plate was done in addition to volar plate) with good result. But we can't comment more about double buttress plating as no. of cases were few and long term follow up are not available.

We also did 6 cases of dorsal plating 2 of them are lunate die punch variety and 2 of them are dorsally displaced partially articular fracture which are absolute indication of dorsal plating and in 2 cases dorsal plating were done because patient having deep abrasion over volar aspect. Fortunately we didn't have any tendon related complication may be because availability of 2.0 mm low profile plates.

7) Complication

Series	Complication rate (%)	
Rozental TD[4] 2006	21.95	Collapse 4, hardware removal 3, wound dehiscence 1 and joint stiffness 1
Ayan Kilic[6] 2003	11.1	Loss of alignment 2 and screw related 1
K K Wong[7] 2005	10	Carpal tunnel syndrome 2 and Extensor pollicis longus rupture 1
Erika Baun[8] 2006	3.7	Infection 1, sudeck's dystrophy 1 and Extensor pollicis longusrupture 1
Pattanashetty OB[9] 2013	56.25	Malunion 3, restricted movement 8 and finger stiffness 7
Our study	6	Joint stiffness 2 and infection 1

We encountered a complication rate of 6%, out of which 2(4%) patient having joint stiffness and 1(2%) patient had delayed deep infection for which implants were removed later on.

We did not have nonunion, median nerve related complications, tendon attrition or arthritis

8) Results:

In our series, we had 76% excellent, 20% good, and 4% fair. Patients, who obtained excellent and good results, had no residual deformities or pain. Range of motion was within the normal functional range. They had no arthritic changes or other complications. Radial length, volar tilt and articular step-off were within acceptable limits. They were co-operative to physiotherapy. Patients with fair results, along with residual deformity, pain and limitation also had pain in the distal radio-ulnar joint and minimal complications. Few of their movements were less than that required for normal function. Fortunately none of our patient got poor result.

SERIES	EXCELLENT (%)	GOOD(%)	FAIR(%)	POOR (%)	
Rozental TD[4] 2006	60.9	9.7	7.3	21.9	Gartland and Werley
Otman AY[5] 2009	82	8	10	-	Gartland and Werley
Ayan Kilic[6]2003	44.4	44.4	11.2	-	Gartland and Werley Mean QDASH- 8.3
K K Wong[7] 2005	80	16.66	3.34	-	Gartland and Werley
Pattanashetty OB[9] 2013	41.5	47.3	9.8	1.4	Gartland and Werley
					DASH 15
Our study	76	20	4	0	DASH
	90	10	0	0	Sarmiento

Our series is comparable to K K Wong 2005 and Otman AY 2009 who had similar percentage of results.

Due to their intraarticular and unstable nature, AO type B and C type are treated surgically. Today open positioning and plate fixation are widely recognised surgical methods. Locked plates are already replaced conventional buttress plates. While facilitating the positioning, those anatomical plates with screw-plate interlocking feature have more biomechanical strength, locked plates are preferred in osteoporotic and/or multiple fracture. During the recent years, volar approach has become more popular.

CONCLUSION

The present study was undertaken to assess the role of open reduction and plate fixation followed by early mobilization of wrist joint in the management of fracture distal end radius and to assess the functional results and complications of this technique.

100% anatomical and 96% functional, excellent to good results, suggests that stabilizing the fracture fragments with volar plate and screws in the management of the fractures of distal radius, is an effective method to maintain the reduction till union and prevent collapse of the fracture fragments, even when the fracture is grossly comminuted/intra-articular/unstable and/or the bone is osteoporosed.

The technique emphasises that open reduction and internal fixation with volar plating has excellent functional outcome with minimal complications thus proving that it is the prime modality of treatment for distal radius fractures[10]. The procedure is applicable for AO types A, B and C fractures of the distal radius, in young patients with a good bone stock as well as in elderly osteoporotic patients.

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Paper cited as: **JANAK A. RATHOD, VIVEK KUMAR. A STUDY OF CLINICAL AND FUNCTIONAL OUTCOME OF INTRA-ARTICULAR FRACTURE OF DISTAL END OF RADIUS TREATED WITH OPEN REDUCTION AND INTERNAL FIXATION WITH PLATING. International Journal of Medical and Applied Sciences. 2017;6(3): 1-9.**