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Comparison study for internal and external modes of fixation for fractures of distal end radius

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ABSTRACT

Background: Fractures of the distal radius continue to be one of the most common skeletal injuries. The methods which are commonly practiced are closed manipulation and plaster cast, pins and plaster, percutaneous pinning, external fixation and open reduction and internal fixation with or without bone graft. Surgeons are increasingly faced with the dilemma of when to consider operative management and when cast immobilization is the optimal treatment.
Methods: 47 cases of distal end radius fractures were operated in the orthopedic department of a tertiary care centre. The purpose of the present study was to compare the results of external and internal fixation methods for the treatment of fractures of distal end of radius. Patients operated by external fixation were classified as Group A and those operated by internal fixation were classified as group B. Patients were classified according to AO Classification. Patients were followed at regular intervals depending on the case and time of operation and evaluated by Gartland and Werley score.
Results: In our study, 29 patients were of extraarticular type, of which 86.20% had an excellent score and 18 patients were of intraarticular type, of which 83.33% had an excellent score. But when compared to groups A and B, the percentage of excellent score obtained in group B was more than that in group A in both extraarticular and intraarticular fractures. Yuan-kun et al did a study on intraarticular distal end radius fractures and evaluated the patients by Gartland and Werley point system, concluding that plating gives better results than external fixation supplemented by K wiring.
Conclusions: We concluded that no method of fixation can be said superior to the other. Each method has fracture-specific indication. The results of open reduction and internal fixation can be better than external fixation in initial months, but in the long run, both the methods can have excellent score, provided the fixation is good and properly indicated.

Keywords: Distal radius, Gartland and Werley, Volar plating

INTRODUCTION

Fractures of the distal radius continue to be one of the most common skeletal injuries treated by orthopedic or trauma surgeons. In fact, these injuries account for approximately one-sixth of all fractures seen and treated in emergency rooms.[1] These are most common fractures of the upper extremity.[2]

The most common cause of this type of fracture is a fall on an outstretched hand. In young adults this fracture is the result of moderate to severe force such as a fall from a

significant height or a motor vehicle accident. The risk of injury is increased in patients with osteoporosis and other metabolic bone diseases.

However, several issues remain regarding treatment considerations for patients with this injury.[1] The optimal management of distal radius fractures has changed dramatically over the previous two decades from almost universal use of cast immobilization to a variety of highly sophisticated operative interventions like distraction plating, a combination of external fixator and volar plating, and fixed angle locking volar plating. The methods which are commonly practiced are closed manipulation and plaster cast, pins and plaster, percutaneous pinning, external fixation and open reduction and internal fixation with or without bone graft.[3] Surgeons are increasingly faced with the dilemma of when to consider operative management and when cast immobilization is the optimal treatment.[3]

The ideal method of fracture fixation should produce good results and be able to be mastered by most orthopedic surgeons. So far, most studies have evaluated limited numbers of fractures that have been treated in a variety of ways.

The purpose of the present study was to compare the results of external and internal fixation methods for the treatment of fractures of distal end of radius. The two treatment groups were compared with use of standardized clinical and radiographic measures.[4]

METHODS

The present series included 47 cases of distal end radius fractures operated in the orthopedic department of VS hospital, Ahmedabad during the period of 2007 to 2009 with follow up from 3 months to 2 years. The purpose of the present study was to compare the results of external and internal fixation methods for the treatment of fractures of distal end of radius. The two treatment groups were compared with use of standardized clinical and radiographic measures**.** Written informed consent was obtained from each patient before enrollment into the study.

Patients fulfilling the following inclusion criteria were considered eligible for the study- 1) all patients with distal end radius # with unstable reduction by closed manipulation, 2) all patients with age ≥20 years, 3) patients fit for surgery.

Patients meeting up the following exclusion criteria were excluded from the study- 1) pediatric patients, 2) patients with stable reduction by closed manipulation, 3) patients not giving consent for surgery, 4) pathological fractures.

Patients were first attended in OPD (outpatient department). History was taken. Patient's age, sex, mode of injury, chief complaints and occupation were noted. Vitals were checked. Other associated injuries were assessed. Local examination was done. Tenderness, swelling, deformity, movements and local skin condition was looked for. Distal neurovascular status was assessed. The wounds, if any, were washed and dressed under aseptic precautions.

Anteroposterior and lateral radiographs of wrist with radius ulna were done. Patients were classified according to AO classification for distal end radius fractures. Management was started accordingly. First reduction slab was given. They were admitted and routine blood investigations were sent. Open fractures and fracture dislocations were treated as emergency. All the patients were operated after anesthetic fitness by appropriate method of fixation. Patients operated by external fixation were classified as Group A and those operated by internal fixation were classified as group B.

Implants

The following implants were used for our patients

1) Kirschner wire (K wire).
2) External Fixator consisting of 3.5 mm and 2.7 mm schantz pins, rods and clamps.
3) Volar buttress plate (T shaped Ellis plate).
4) Dorsal buttress plate.

The methods included for internal fixation are as follows

1) Percutaneous K wiring
2) Volar plating
3) Dorsal plating
4) Volar plating with K wiring
5) Distraction plating
6) External fixation with volar plating

The methods included for external fixation are as follows

1) External fixator
2) External fixator with K wiring
3) Intrafocal pinning

Method of fixation was decided chiefly on the fracture pattern as follows

For extraarticular unstable fractures with minimal comminution, Percutaneous K wiring was done. For extraarticular unstable fractures with dorsolateral comminution, K wiring by Kapandji technique was done. For Volar Barton fractures, volar buttress plate fixation was done. For patients with comminution, intraarticular unstable fractures, combined internal fixation and external fixation were done. Fractures with metaphyseal comminution and significant radial collapse were operated by external fixator alone or with K wiring. Fractures with dorsal tilt and articular involvement, dorsal plating was done.

Postoperative protocol

Patients were given below elbow posterior splint. Patients were given IV fluid, analgesic as per anesthetic advice. Antibiotics were given according to the intervention done. NBM (nil by mouth) was cancelled as per anesthetic advice. Postoperative X-ray was done. Patients with K wiring were discharged on the next day. Patients with external fixator were discharged after two to three days. Patients with Volar plating were discharged after 4 to 6 days after two dressings done with healthy stitch line. Stitches were removed after 12 to 14 days. Patients were followed at an interval of 1 week, 2 weeks, 4 weeks, 6 weeks, 8 weeks, 3 months, 6 months, 1 year and 2 years depending on the case and time of operation. Patients were assessed according to the Performa and evaluation was done according to the Gartland and Werley score.[5]

40 years male patient, a laborer with history of fall down had distal end radius fracture. He was operated by Volar locking plating with a k wire through styloid process. K wire was removed after 4 weeks and mobilization was started. Score is excellent.

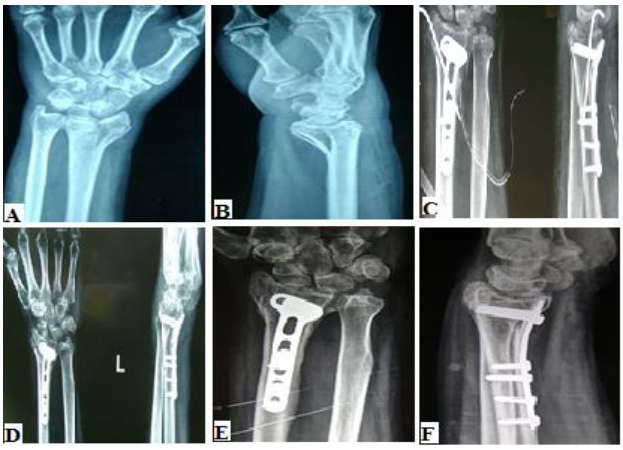

Figure 1: X-ray photographs of case 1.
A= Pre op AP, B= pre op lateral, C= Immediate post op, D= 3 month post op, E= 1 year follow up AP, F= 1 year follow up lateral.

Figure 2: Clinical results of case 1.

35 years male patient, with history of RTA was operated for external fixator. Fixator was kept for 6 weeks. At 6 months, he had full range of motion.

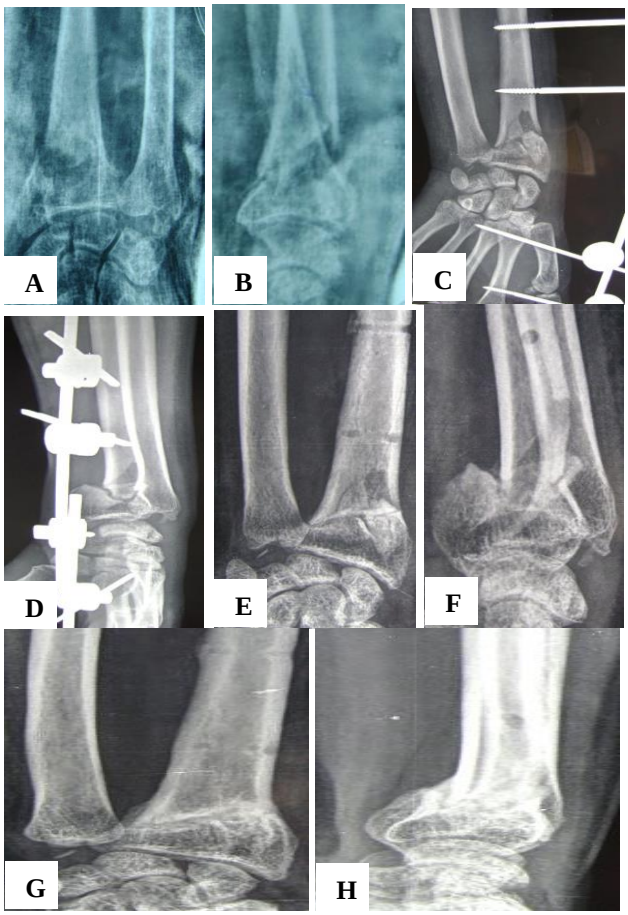

Figure 3: X-ray photographs of case 2.
A= pre op AP, B= Pre op Lat, C= Immediate post op AP, D= Immediate post op Lateral, E= 3 month post op AP, F= 3 month post op Lat, G= 6 month post op AP, H= 6 month post op lat.

Figure 4: Clinical results of case 2.

RESULTS

We have evaluated total 47 cases of lower end radius fractures and found following observations.

Table 1: Age incidence.

Age (in years)	No of patients	Percentage (%)
20-30	10	21.27
31-40	15	31.91
41-50	12	25.53
51-60	6	12.76
61-70	4	8.51
Total	47	

In our study, majority of the patients belonged to the age group 31-40.

Table 2: Sex incidence.

Sex	No of patients	Percentage (%)
Male	33	70.21
Female	14	29.78
Total	47	

The above mentioned table indicates that in our study population, distal end radial fractures were more common in males compared to females.

Table 3: Side affected.

Side	No of patients	Percentage (%)
Right	26	55.31
Left	19	40.42
Bilaterally	2	4.25

The results described above indicate that in 55% of the cases, right side was affected.

Table 4: Mode of injury.

Mode of Injury	No of patients	Percentage (%)
Fall Down	36	76.59
RTA	11	23.40

The main mode of injury, in the present study was fall down, either at work or at home or from height.

Different type of associated injuries was present in different patients like femur condyle #, Patela #, Tibia shaft #, humerus shaft # etc.

Table 5: Associated injuries.

Total	Patients with associated injuries	Percentage (%)
47	11	23.40

Table 6: Classification of fracture.

Universal classification	No of patients	Percentage (%)
Type 4	18	38.29
Type 2	29	61.70

In the present study, majority of patients fell into the Type 2 fracture classification.

In our study, all cases were displaced fractures, as undisplaced fractures were treated with cast immobilization.

Table 7: Methods of fixation.

Methods of fixation	No of patients	Percentage (%)
External fixation (Group A)	25	53.19
Internal fixation (Group B)	24	51.06

In our study, 25 cases were operated by external fixation. 24 cases were operated by internal fixation. Two of our patients had bilateral fractures that were operated by external fixation on one side and internal fixation on the other side.

Complications

It was observed that 4 (8.51%) patients had post-operative stiffness. 2 (4.52%) patients were infected. 1 (2.12%) patient who had infection, went into malunion**.**

Table 8: Duration of hospital stay.

Duration	Group A	Group B
1 day	4 (8.5%)	12 (25.53%)
2 days	11 (23.40%)	6 (12.76%)
3 -5 days	2 (4.25%)	4 (8.5%)
6 -10 days	2 (4.25%)	2 (4.25%)
11-15 days	1 (2.12%)	0
>15 days	1 (2.12%)	2 (4.25%)
Average	2	4

About 60 % of the cases were discharged within 2 days. Patients with associated injuries had longer stay. Patients with open reduction and internal fixation were kept longer than external fixation or percutaneous_fixation.

Table 9: Residual deficit.

Residual disability	Group A	Group B
Radial deviation of head	2(4.25%)	0
Dorsal tilt	1(2.12%)	0
Loss of supination	4(8.51%)	0
Grip weakness	2(4.25%0	0
Total	9(19.13%)	0

All the patients having some residual deficit were treated by external fixation.

Table 10: Gartland and Werley score.

Score	Group A	Group B
Excellent	20(42.55%)	18(38.29%)
Good	5(10.63%)	2(4.25%)
Fair	1(2.12%)	0
Poor	1(2.12%)	0

81% of the cases had excellent score. All patients operated by open reduction and internal fixation had an excellent score. 2 patients of group A had fair and poor results.

Table 11: Scoring in extra articular and intra articular fractures.

	No. of patients	Excellent score (%)
Extraarticular	29	86.20
Intraarticular	18	83.33

There is not much difference between the percentage of excellent scores obtained in intra articular and extra articular fractures.

Table 12: Group A and Group B in extraarticular and intraarticular fractures.

	No. of patients in group A	Percentage of excellent score	No. of patients in group B	Percentage of excellent score
Extraarticular	14	64.28	15	86.66
Intraarticular	9	77.77	9	88.88

The percentage of excellent scores obtained in group B is more in both extraarticular and intraarticular fractures.

DISCUSSION

Following a distal radial fracture, the attainment and maintenance of anatomical reduction of the articular surface is crucial to the preservation of wrist function. Trumble et al stated that the degree to which articular step-off, gapping between fragments, and radial shortening can be improved with surgery correlates strongly with improved outcome.[6] Hence, a treatment method that is more likely to achieve these goals will result in better function.[4]

Bridging external fixation of distal radial fractures has been part of the surgeon's armamentarium far longer than have locked plates. External fixation continues to be employed by many surgeons as a familiar technique requiring minimal exposure. External fixation is used to maintain axial length while reduction is attained by manipulation of fracture fragments with supplemental Kirschner wires and ligamentotaxis in intra-articular and extra-articular fracture patterns. However, external fixation is limited by the inability to directly reduce intra-articular fracture fragments in complex unstable fracture patterns.[7]

Over the last decade, there has been a shift in the surgical approach for the treatment of distal radial fractures in favor of open reduction and internal fixation. Koval et al. recently documented the increasing popularity of open reduction and internal fixation, especially since the introduction of volar locking plates.[8]

We have done a comparative study of external and internal fixation methods used in the treatment of distal radius fractures during the period of 2007 to 2009 at VS hospital, Ahmedabad.

We have studied 47 cases of distal end radius fractures. Majority of patients were of age group 31 to 40 years with male predominance (70%), which matches with the study done by Kreder and McKee et al with average 39 years and male predominance (68%).[6] 26 of our patients had fracture on the right side, which is about 55.31% and 19 had fracture on the left side, which is about 40.42%. We had classified the patients in our study according to universal classification. The average duration of hospital stay in group A patients was 2 days, and in group B patients was 4 days. This shows that the patients operated by internal fixation had to stay longer in the hospital.

In group A patients, 10 patients had complications like postoperative stiffness, infection malunion and radiological malalignment. There were no complications in our group B patients. Postoperative stiffness was treated by vigorous active and passive physiotherapy. Only two patients got infected in our study. They had open grade fracture. One patient went into infected Malunion and was operated by distraction plating. In 4 patients of group A, radiological malalignment was corrected by readjustment of external fixator. The patients operated by plating and percutaneous fixation have acceptable radiological alignment. Seven of the patients operated by external fixator did not have acceptable alignment. These were the candidates who did have postoperative stiffness or residual deficits like radial deviation of hand and loss of full supination. This shows that complications are more in patients treated by external fixation. This was also observed in the study done by Leung et al.[6] Active and passive physiotherapy was of utmost importance for acquiring good range-of-motion. Grip strength, and full supination took a longer time to

recover in many of the patients, chiefly because they did not mobilize well.

In our study, 20 patients in group A and 18 patients in group B had an excellent score according to the demerit point system of Gartland and Werley.[5] This explains no consistent benefit of one treatment over the other. This result is also obtained in 4 randomized controlled trials done by Grewal et al, Kreder et al, Kapoor et al, and Leung et al.[4,9-11]

In our study, some patients in group A had fair or poor grip and inability to fully supinate in initial 3 to 5 months. But later they did achieve an excellent score. Many patients in group B achieved an excellent score in earlier months. This proves that patients operated by internal fixation can have better functional outcome in earlier months, but later on, both methods of fixation show similar results. This was comparable with results obtained by David and Robert et al, in which they concluded that use of a volar plate predictably leads to better patient-reported outcomes (DASH scores) in the first three months after fixation.[7,12] However, at six months and one year, the outcomes were found to be excellent, with minimal differences among them in terms of strength, motion, and radiographic alignment. This result also matches with the result obtained by Rozental et al that there is no difference between the two treatment groups with regards to functional or radiographic outcomes, at 1 year after the injury.[13] Egol et al demonstrated better outcomes in the open reduction and internal fixation group at 3 months but similar outcomes at six and twelve months after treatment.[14]

In our study, one patient with type 4 fracture having radial collapse, volar tilt and bone loss due to comminution was operated by external fixator as a temporary stabilizer to maintain radial height, volar plating to buttress the fragment and bone grafting to fill the gap. Patient had an excellent score at 1 year follow up. So in cases having bone loss due to comminution, additional procedure like bone grafting can be done.

In our study, 29 patients were of extraarticular type, of which 86.20% had an excellent score and 18 patients were of intraarticular type, of which 83.33% had an excellent score. So there is no remarkable difference in the percentage of excellent scores obtained in both types. This shows that the method of fixation that we selected based on fracture pattern was appropriate. But when compared to groups A and B, the percentage of excellent score obtained in group B was more than that in group A in both extraarticular and intraarticular fractures. Yuan-kun et al did a study on intraarticular distal end radius fractures and evaluated the patients by Gartland and Werley point system. They concluded that plating gives better results than external fixation supplemented by K wiring.[4]

CONCLUSION

No method of fixation, external or internal, cannot be said superior to the other. Each method has fracture-specific indication. The results of open reduction and internal fixation can be better than external fixation in initial months, but in the long run, both the methods can have excellent score, provided the fixation is good and properly indicated. For intra-articular fractures with volar tilt or displacement with or without comminution, open reduction and internal fixation is a preferable method. For simple, displaced, extra-articular, unstable fractures, percutaneous fixation is a preferable method. For metaphyseal comminution, external fixator is a preferable method. For intra-articular fractures, external fixator should be supplemented with K wire fixation for manipulation of fracture fragments. New era of locking plates has extended the indications of open reduction and internal fixation in comminuted intraarticular fractures. Although, temporary ligamentotaxis with plating is more balanced and advisable approach to avoid collapse of fracture. Post-operative radiological alignment and mobilization are important considerations for better functional results.

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