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Conservative versus surgical management of intra-articular fractures of distal end of radius: A comparative clinical study

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Abstract

Background and Objectives: Distal radius fracture is one of the most common injuries to the musculoskeletal system, which are managed both conservatively and surgically. There are pitfalls, advantages and disadvantages in each method. The individual fracture analysis determines the therapeutic options.

The study was undertaken to compare the clinical and functional outcome of intra-articular fractures of distal end of radius with conservative management and surgical management. To infer the appropriate management by assessing the scope of conservative management in case of intra-articular fractures of distal end of radius.

Methods: This is a prospective study of 80 cases of intra-articular distal radius fracture admitted to Sri Siddhartha medical college, hospital and research centre between February 2015 and March 2017 treated with either conservative or surgical methods (K-wire, External fixation and Plating). Functional and radiological outcomes were evaluated.

Results: In our series of 80 patients, 48 were male and 32 were female. Most of the patients were between 20-30 years of age (Minimum 20, maximum 80 and mean 40.35 years). Most commonly the mode of injury, wrist involvement and fracture type were Road traffic accidents (45%), Right side (51.25%) and Frykman's type III (41.7%) and AO type C2.2 (19%) respectively.

Conclusion: From this study, we conclude that surgical management is better than conservative in the treatment of intra-articular fractures of distal end of radius.

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Keywords: Distal radius, plating, k-wire and external fixation

Introduction

Fractures of the distal radius remain the most common fractures approximately one-sixth of all fractures treated in emergency departments. There are three main peaks of fracture distribution: the first peak is in children ages 5 to 14, the second is in males under age 50 years and the third peak is in females over the age of 40 years. Risk factors are - decreased bone mineral density, female gender, ethnicity, heredity and early menopause have all been shown to be risk factors for this injury^[1].

Majority of the cases are being treated with plaster of Paris cast following closed reduction with local anaesthesia. However, other distal radial fractures require surgical management and many treatment methods are available currently.

The outcome of these fractures is not uniformly good regardless of the treatment instituted. A thorough understanding of the anatomy and biomechanics of the wrist is a prerequisite when treating these lesions. There is a strong relationship between the quality of anatomical reconstruction and the long-term functional outcome. No single treatment option is the solution for every type of fracture in every kind of patient. Based on the functional anatomy, we analyzed the actual treatment possibilities and try to develop strategies in the choice of treatment for different fracture types in different patient groups.

Treatment aims should be to reconstruct the anatomy as good as possible, to guarantee that there is no loss of reduction and to allow for function after treatment as soon as possible^[2].

Various classification systems have been described by David L Nelson^[3] for distal end of radius fractures.

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Methodology

We studied prospectively 80 Patients with Intra-articular distal radius fractures. 40 were treated with conservative management, 40 with surgical management. Out of 40 cases treated surgically, 10 were managed by Pinning, 10 with Ligamentotaxis with External fixator and 20 with Plating at Department of Orthopaedics, Sri Siddhartha medical college and research centre, tumkur between February 2015 and March 2017. (Table 1)

The study sample was 80 patients and all these patients were included with predefined inclusion and exclusion criteria in this study. The patients underwent either surgical or conservative management. Follow up was done for 6 months. Records available in the form of admission notes, operative notes, progress notes and follow up outpatient department records were analyzed. Patients not coming up for follow up at outpatient were interviewed on telephone. We considered a fracture united if there is no pain on palpation or attempted motion, no increase in warmth at the fracture site, no discomfort on carrying weights and serial roentgenograms demonstrated bony trabeculae crossing the fracture site. The functional, radiographic and overall results were recorded according to patient rated wrist evaluation (PRWE) [4] and Demerit point system Score. Functional grading was made depending on pain, mobility and work. Radiological grading was made based on varus or valgus deformity, shortening, signs of osteoarthritis and union of fracture. The final outcome was compared with the results available from the latest literature.

At our Hospital, most of the Intra-articular distal radius fractures are managed conservatively because the patients are not willing for surgical management of fractures. Surgical methods adopted were Pinning, Ligamentotaxis with External fixator and Plating. Most surgeons prefer plating over pinning or ligamentotaxis.

Inclusion criteria

1. Male and females of the age group 20 to 80 years with intra articular fracture of distal end of radius who has given consent for surgery.
2. Patients who are medically fit for surgery when required.

Exclusion criteria

1. Patients who are medically unfit for surgery.
2. Patients not willing for surgery.
3. Open fractures.

After the initial resuscitation in the emergency, closed fractures were splinted and operated at the earliest. Preference was given for management of life threatening emergencies i.e. head injury, blunt trauma to abdomen, blunt trauma to chest and patients were taken up for orthopaedic procedure once they are out of danger. Till then fractures were managed with slab application and limb elevation.

The fracture cases which required surgery were admitted and all the necessary clinical details were recorded in the proforma prepared for this study. Most cases of distal radial fractures which were minimally displaced and non comminuted were opted for conservative group and they were managed on the outpatient basis, whereas the fractures which were displaced and Comminuted were chosen for surgical group. After the completion of hospital Treatment, the patients were discharged and called for follow up at the outpatient level, at Regular intervals for serial clinical and radiological evaluation.

Management of the patients

As soon as the patient with suspected distal radius fracture was seen, necessary clinical and radiological evaluation was done. X-Ray was taken. Most patients in the conservative group were treated on outpatient basis, but some were admitted. All patients planned for surgical management, Routine blood investigations were done. CT scan of distal radius with wrist was done for cases which required better appreciation of the fracture pattern.

All the patients were evaluated for associated medical problems and were referred to respective departments and treated accordingly. Associated injuries were evaluated and treated simultaneously. The patients were operated on the elective basis after overcoming the avoidable anaesthetic risks.

Implants used

Pinning	External Fixation	Plating
K-wires - 1 mm, 1.5 mm and 2 mm	Schanz pins - 2.5, 3.5mm, Clamps, Connecting rods	Ellis Plate, T Plate Distal radius Locking compression plate (LCP)

Surgical procedure

Anaesthesia – General or supra clavicular block or brachial block was given.

Position - Supine with affected wrist on side of the table

Pinning

Under image intensifier, fracture site was identified. Usually, the radial styloid is pinned to the proximal shaft in a reduced position. Once the lateral cortex is reconstituted, the intermediate column (lunate facet) is pinned from dorsal ulnar to proximal radial. Finally, the central impaction fragments can be supported using subchondral transverse wires. Plaster was applied if fracture fixation stability was doubtful.

External fixator application

Schanz pins were fixed to the lateral border of radius (Minimum 3 pins) after stab incision at the planned pin site and drilling it. Similar procedure was done on radial border of 2nd metacarpal. After traction and counter traction, the fracture reduction was done under image intensifier and pins fixed to the connecting rod with a clamp and all the nuts were tightened.

Palmar plate fixation

Operative technique

The skin incision centered over the FCR was applied. Flexor Carpi radialis (FCR) and radial artery

Interval was taken. The radial artery is mobilized and dissection is carried out radially by releasing the

Brachioradialis tendon from the radial styloid. The Pronator quadratus muscle is released from its

Radial attachment. Anatomical reduction of both the radial and the intermediate columns was done.

Once the columns were aligned, the fracture was fixed with the palmar plate. Screw fixation to the plate was done avoiding penetration into the articular surface. Wound was closed in layers.

Post operative care

Routine intravenous antibiotics and analgesics were given for 3 to 4 days and later oral antibiotics.

Were continued till the suture removal. Limb elevation was

advised and the postoperative X-ray were. Taken. Active finger, elbow and shoulder movements was encouraged from the 2nd post operative Day and sutures were removed after the 10th postoperative day. Patients were discharged from the hospital around 4 to 14th postoperative days depending upon their clinical and wound condition.

Follow-up assessment was as follows

- Assessment at 1 week: Clinical assessment of pain
- Assessment at 6 weeks: Clinical assessment of pain, Range of motion.
- Assessment at 3 months: Clinical assessment of pain, Range of motion, clinical and Radiological assessment of union
- Assessment at 6 months: Clinical assessment of pain, Range of motion, clinical and Radiological assessment of union, Clinical and functional capabilities with regard to Activities of daily living. Assessment of any complications.

Scoring system for functional results

Patient rated wrist evaluation ^[4]

How to Score the PRWE

Computing the subscales

Pain Score = Sum of the 5 pain items (out of 50), Best Score

= 0, Worst

Score = 50

Function Score = Sum of the 10 function items divided by 2 (out of 50) Best

Score = 0, Worst Score = 50

Computing the total score

Total Score = Sum of pain + function scores; Best Score = 0, Worst Score = 100

The questions below will help us understand how much difficulty the patients had with their wrist in the past week. They will be describing their average wrist symptoms over the past week on a scale of 0-10. Patients were told to provide an answer for all the questions. If they did not perform an activity, they were asked to estimate the pain or difficulty they would experience. If they have never performed the activity, you may leave it blank.

A. Pain

They were told to rate the average amount of pain in their wrist over the past week by circling the number that best describes their pain on a scale from 0-10. zero (0) means that they did not have any pain and ten (10) means that They had the worst pain they have never experienced or that they could not do the activity because of pain.

Pain scale form

Sample scale	0 1 2 3 4 5 6 7 8 9 10										
	No Pain					Worst					
Rate your pain											
At rest	0	1	2	3	4	5	6	7	8	9	10
When doing a task with a repeated wrist movement	0	1	2	3	4	5	6	7	8	9	10
When lifting a heavy object	0	1	2	3	4	5	6	7	8	9	10
When it is at its worst	0	1	2	3	4	5	6	7	8	9	10
How often do you have pain?	0	1	2	3	4	5	6	7	8	9	10

B. Function

Patients were asked to rate the amount of difficulty they experienced performing each of the items listed below over the past week, by circling the number that describes their

difficulty on a scale of 0-10. Zero (0) means they did not experience any difficulty and ten (10) means it was so difficult that they were unable to do it at all.

Function scale form

A. Specific Activities											
Sample scale	0 1 2 3 4 5 6 7 8 9 10										
	No Difficulty					Unable To Do					
Turn a door knob using my affected hand	0	1	2	3	4	5	6	7	8	9	10
Cut meat using a knife in my affected hand	0	1	2	3	4	5	6	7	8	9	10
Fasten buttons on my shirt	0	1	2	3	4	5	6	7	8	9	10
Use my affected hand to push up from a chair	0	1	2	3	4	5	6	7	8	9	10
Carry a 10lb object in my affected hand	0	1	2	3	4	5	6	7	8	9	10
Use bathroom tissue with my affected hand	0	1	2	3	4	5	6	7	8	9	10
B. Usual Activities											
Personal care activities (dressing, washing)	0	1	2	3	4	5	6	7	8	9	10
Household work (cleaning, maintenance)	0	1	2	3	4	5	6	7	8	9	10
Work (your job or usual everyday work)	0	1	2	3	4	5	6	7	8	9	10
Recreational activities	0	1	2	3	4	5	6	7	8	9	10

Interpretation

The total PRWE score rates pain and disability equally. Higher score indicates more pain and Functional disability (e.g., 0 = no disability).

Demerit point system (Saito) ^[5]

The functional results are determined using the demerit point

system of Saito. This system consisted of subjective evaluation, objective evaluation and complications and the subjective evaluation were graded as excellent, good, fair, or poor according to the demerit points. We used this system except for the residual deformity which is one of the objective evaluations for functional assessment.

Anatomical assessment

Radiographs are evaluated in a retrospective analysis, before reduction immediately after operation and at follow-up. The measurement parameters are radial tilt, ulnar variance, palmar

tilt and residual deformity. If each parameter shows out of normal range, the demerit point is 1 point. The maximum sum of demerit points is 3.

Demerit point system score

I			
Subject evaluation			
	Excellent	no pain, no disability, no LOM	0
	Good	occasional pain, no disability, slight LOM	2
	Fair	occasional pain, no disability if careful, some LOM, feeling weakness in the wrist, activities slightly restricted	4
	Poor	pain, disability, LOM, activities markedly restricted	6
II			
Objective evaluation			
1	Residual deformity	Out of Range of	
	Ulnar variance	0 +/- 2	1
	Palmar tilt	11 +/- 10	1
	Radial tilt	23 +/- 10	1
	Range of motion		1
	Dorsi-flexion	< 45 ⁰	1
	Palmar-flexion	< 30 ⁰	1
	Ulnar-deviation	< 15 ⁰	1
	Radial-deviation	< 15 ⁰	1
	Supination	< 50 ⁰	1
	Pronation	< 50 ⁰	1
2	Grip power		
	Dominant hand	< power of opposite hand	1
		< 2/3 rd power of opposite hand	2
	Non-dominant hand	< 2/3 rd power of opposite hand	1
		< 1/2 power of opposite hand	2
3	Arthritic changes		
	None		0
	Minimal	Irregularity / Sharpening of the articular margin	1
	Moderate	Narrow joint space/ Osteophytes	2
	Severe	Marked osteophytes / Ankylosis	3
III			
Complications			
	Nerve complications		1 - 2
	Stiff fingers		1 - 2
	Ruptured tendons		1 - 2
IV			
End result			
	Excellent		0-3
	Good		4-9
	Fair		10-15
	Poor		16-26

Statistical methods

Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean±SD (min-max) and results on categorical measurements are presented in number (%). Significance is assessed at 5% level of significance. Following assumptions are made:

- 1 Dependent variables should be normally distributed.
- 2 Samples drawn from the population should be random.
- 3 Cases of the samples should be independent.

Student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between the two groups (inter group analysis) on metric parameters. Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups.^[6]

The assumptions of Chi-square test are as follows.^[7, 8, 9]

Random sample: A random sampling of the data from a fixed distribution or population

Sample size: A sample with a sufficiently large size is assumed. If chi square test is conducted on a small sample

size, then the test will yield an inaccurate inference. The researcher, by using chi square test on small samples, might end up committing a type 2 error.

Association between two qualitative variables was seen by using Chi square/Fischer's exact test. Comparison of mean and Standard Deviation between two groups was done by using unpaired t test to assess whether the mean difference between the groups is significant or not. A p value of <0.05 was considered as statistically significant whereas a p<0.001 was considered as highly significant.

Statistical software: The statistical software namely SAS 9.2, SPSS 15.0, Stats 10.1, MedCalc 9.0.1, System 12.0 and R environment ver. 2.11.1 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs and tables.

Results

In our series of 80 patients (80 distal Radius fractures), There were 48 male (60%) and 32 female (40%). Minimum age was 20 years, maximum 80 years with mean age of 40.35 years. Most common age group was 41-50 years (35%) with mean age being 43.5 years in conservative group. In surgical group most common age group was 20-30 years (32.5%) with mean

age being 39.97 years.

Road traffic accidents (RTA) were most common mode of injury (45%). Right side was more common (51.25%). Frykman's type III (41.7%) and AO type C2.2 (19%) was most common fracture pattern. Mean time of union at 6 weeks was seen in 45% of cases in conservative group and 87.5% in surgical group and at 3 months was seen in 50% in conservative group and 12.5% in surgical group. (Table 2)

Mean pain score for conservative group was 20.3 and 16.7 for surgical group. (Table 3) The mean functional score for conservative group was 29.2 and 20.7 for surgical group. (Table 4) Mean Dorsi-flexion for conservative group was 55° and 68° for surgical group. The mean Palmar-flexion for conservative group was 61° and 69° for surgical group. Mean Radial deviation for conservative group was 8° and 8.5° for surgical group. The mean ulnar deviation for conservative group was 16° and 18° for surgical group. Mean Pronation for conservative group was 71° and 70° for surgical group. The mean Supination for conservative group was 71° and 68° for surgical group. Average Arc of dorso-palmar flexion for conservative group was 116° and 137° for surgical group. Average Arc of pronation-supination for conservative group was 142° and 138° for surgical group. Average Arc of radio-ulnar deviation for conservative group was 23.7° and 28.8° for surgical group. (Table 5)

Grip strength was >50% compared to the normal wrist in 35% in conservative group and 62% in surgical group and it was < 50% compared to the normal wrist in 65% in conservative group and 38% in surgical group.

Average loss of movements for conservative group was 35.2% and 30.55% for surgical group. Loss of Radial Inclination in conservative group was 45% and 31.2% in surgical group. Loss of Radial length in conservative group was 45% and 33.33% in surgical group. Intra-articular step in conservative group was 30% and 41.7% in surgical group. Late Complications like Mal-union in conservative group was 30% and 13.33% in surgical group. (Table 6)

Functional results

Excellent results were seen in 30% of cases in conservative group and 45% in surgical group.

Good results were seen in 15% of cases in conservative group and 32.5% in surgical group.

Fair results were seen in 35% of cases in conservative group and 20% in case of surgical group.

Poor results were seen in 20% of cases in conservative group and only 2.5% in surgical group. (Table 7)

Complications

Malunion was a common complication in both the study groups. Stiffness of wrist and fingers was seen in 10% in both the groups. Shoulder hand syndrome was seen in 10% in conservative group and none in case of surgical group. Osteodystrophy was seen in 5% of cases in conservative group and none in surgical group. In the surgical group, plating cases did not have any procedure related complication. K-wire and external fixator group had pin tract infection in 10 percent of cases, but were managed with pin-tract care and oral antibiotics. We did not have any deaths till completion of the study.

Discussion

We studied prospectively 80 Patients with Intra-articular distal radius fracture. 40 cases were treated with conservative

management and 40 with surgical management. Out of the 40 surgical cases, 10 were managed by Pinning, 10 by Ligamentotaxis with External fixator and 20 with plating.

Age distribution

Mean age and most common age was less in surgical group. Most common age group was 41-50 years (35.0%) with mean age being 43.5 years in conservative group. Where as in surgical group most common age group was 20-30 years (32.5%), with mean age being 39.97 years, similar to Harish Kapoor *et al.*^[10] study. The best outcome or functional results were seen among young individuals.

Sex distribution

In our series of 80 patients, there were 48 males (60%) and 32 females (40%). Gender was a confounding factor as in surgical group males were 33 (82.5%) and females were 7 (17.5%), where as in conservative group male and female were equal.

Mode of injury and fracture pattern

Road traffic accidents were the most common mode of injury in this study accounted for 45% of cases similar to study of Harish Kapoor *et al.*^[10]. But self fall (65%) in conservative and RTA (65%) in surgical group was more common. Frykman's type III were the most common fracture in both the groups followed by type VIII. AO type C3.2, C3.3 and B2.2 were more common among RTA cases and among surgical group.

Excellent and good outcome in conservative group was seen only in stable, minimally comminuted and minimally displaced fracture pattern. Excellent and good outcome were seen in many of such fracture pattern among surgical group.

Side of fracture

Overall Right side was more commonly injured (51.25%). Right side was more affected among surgical group (57.5%) and left in conservative group (55%).

Time of union

Is significantly less (6 weeks) associated with Surgical management (87.5%) similar to results of Toshiko Hiroshima^[11], where as it was more (3 months) in conservative group (50%). 5% had union at 6 months in conservative and none in surgical. Delayed union was seen more among postmenopausal females and aged males.

The percentage of loss of movements did not correlate very well with time of union. Even the patients with Time of Union of 6 weeks had greater percentage of loss of movements and also patients with Time of Union of 3 months had good range of movements. Similarly pain and function score at 6 months follow up did not correlate with time of union.

Mean pain score was significantly less associated with surgical management with (P=0.07), values being 20.3 in conservative and 16.7 in surgical group. (Table 3) In the surgical group least being in Plating group (12) and more in K-wire group (23.1) [more than conservative group] similar to other studies of Chin-En Chen *et al.*^[12] and Carrozzella J^[13]

Mean function score was significantly less in patients with surgical management (P = 0.004). Values being 29.2 for conservative group and 20.7 for surgical group (Table 4). In the surgical group it was least in External fixator group (8.7) and more in K-wire group (35.4). Functional score was poor among the patients who delayed physiotherapy.

Movements

Mean loss of movements was less in surgical group 30.55% than conservative group 35.2%. Among surgical group least was in plating (30%) and more in K-wire (35%). The mean dorsiflexion, palmar flexion, radial deviation, ulnar deviation, pronation and supination were similar to the movements in the study done by Harish Kapoor *et al.* [10] In surgical group, all movements were maximum in plating group and minimum in K-wire group.

Mal-union was seen in 30% cases of conservative group and 13.33% in surgical group. In K-wire group 30% had malunion and none in plating. Mal-union was seen in case of fractures with excess initial displacement and excess comminution treated conservative or with a K-wire.

Intra-articular step was seen in 30% cases of conservative group and 41.7% in surgical group. In contrast to other studies of Knirk-JL *et al.* [14] and Harish Kapoor *et al.* [10] it was best corrected with plating and least with external fixator. The percentage of patients having step were 10%, 60% and 50% in plating, external fixator and K-wire groups respectively.

Radial inclination was lost in 45% cases of conservative group and 31.2% in surgical group. Radial inclination was best restored with plating (75%) in our study and least with K-wire (30%).

Radial length was lost in 45% cases of conservative group and 33.33% in surgical group. Radial length was best restored with plating (75%) in our study and least with K-wire (70%) in contrast to other studies of Horesh *et al.* [15] and Harish Kapoor *et al.* [10] where it is best restored with external fixation.

Excellent results were seen in 30% of cases in conservative group and 45% in surgical group. Excellent and good results were seen in 90% of cases in plating and 50% in K-wire among the surgical group. Results are similar to other studies Knirk J L *et al.* [14], Kapoor H *et al.* [10] and Arora J *et al.* [16]

Comparable Studies in other series

Knirk-JL *et al.* [14] had results comparable to our study (Table 8).

Harish Kapoor *et al.* [10] had results as follows which is similar to ours in terms of mode of injury, mean age, results in external fixator and plating group but different in results of conservative management. (Table 9 and Table 10).

Horesh Z *et al.* [15] results of external fixator were comparable to our study. (Table 11). Altissimi M *et al.* [2] results were different from our study. (Table 12) and Charles S. Day *et al.* [17] study was comparable to our study. (Table 13)

Helen HG Handoll, James S Huntley, Rajan Madhok evaluated the evidence from randomized controlled trials comparing external fixation with conservative treatment for fractures of the distal radius in adults. External fixation maintained reduced fracture positions (Redisplacement requiring secondary treatment, relative risk 0.17, 95% confidence interval 0.09 to 0.32) and prevented late collapse

and mal-union compared with plaster cast immobilization. External fixation was associated with a high number of complications, such as pin-track infection, but many of these were minor. External fixation reduces redisplacement, gives improved anatomical results and most of the surgical related complications are minor [18].

Karl M. Koenig *et al.* [19] compared early internal fixation with use of a volar plate and non-operative management of a displaced, potentially unstable distal radial fracture with an acceptable closed reduction. Internal fixation with use of a volar plate for potentially unstable distal radial fractures provided a higher probability of painless union. This long-term gain in quality-adjusted life years outweighed the short-term risks of surgical complications, making early internal fixation the preferred treatment in most cases. However, the difference was quite small. Patients, especially those over sixty-four years, will have painful mal-union outcome states and patients with more sedentary lifestyle may prefer non-operative treatment.

Conclusion

From the study, we conclude conservative management is better in managing undisplaced, non-comminuted fractures and fractures with minimal initial displacement. For fractures with minimal comminution, K-wires appeared to be better suited and gave better results if used with plaster. For highly comminuted and displaced fractures, where no reconstruction was possible without sufficient purchase for screws, External fixator was found to be a better option. For Barton fractures and comminuted fractures where articular reconstruction was still possible, Plating gave better results.

The conclusion is that surgical management is better than conservative in the treatment of comminuted and displaced intra articular fractures of distal end of radius. Therefore, we cannot generalize one treatment method for all fracture patterns and treatment should be individualized to a particular fracture. Also the complications were less and gave better functional results with surgical options.

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Declarations

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Conflict of interest: none

Ethical approval: Approved by ethical committee

Table 1: Distribution for Management in two groups

Management	Conservative management		Surgical management	
	No	%	No	%
Conservative	40	100.0	0	0.0
External Fixator	0	0.0	10	25.0
K-wire	0	0.0	10	25.0
Plating	0	0.0	20	50.0
Total	40	100.0	40	100.0

Table 2: Comparison of Time of union in two groups

Time of union	Conservative management		Surgical management	
	No	%	No	%
6 weeks	18	45.0	35	87.5
3 months	20	50.0	5	12.5
6 months	2	5.0	0	0.0
Total	40	100.0	40	100.0

Time of union is significantly less (6 weeks) associated with Surgical management with P=0.002**

Table 3: Comparison of Pain Score in two groups

Pain Score	Conservative management		Surgical management	
	No	%	No	%
1-10	12	30.0	19	47.5
11-20	14	35.0	12	30.0
21-30	6	15.0	5	12.5
31-40	4	10.0	4	10.0
>40	4	10.0	0	0.0
Total	40	100.0	40	100.0
Mean ± SD	20.30±12.19		16.7±8.97	

Mean pain score is significantly less associated with surgical Management with P = 0.07

Table 4: Comparison of function score in two groups

Function score	Conservative management		Surgical management	
	No	%	No	%
1-10	4	10.0	7	17.5
11-20	10	25.0	18	45.0
21-30	6	15.0	11	27.5
31-40	8	20.0	1	2.5
>40	12	30.0	3	7.5
Total	40	100.0	40	100.0
Mean ± SD	29.20±15.67		20.7±10.41	

Mean functional score is significantly less in patients with surgical Management with P = 0.004**

Table 5: Comparison of movements in two groups

Movements (in degrees)	Conservative management		Surgical management		Conservative management (Average)	Surgical management (Average)	P value
	Min	Max	Min	Max			
Dorsi-flexion	10	80	15	80	55.75±22.62	68.12±17.19	0.013*
Palmar Flexion	0	90	30	90	61.31±20.80	69.75±14.70	0.119
ADP	10	160	45	170	116.25±42.48	137.88±29.02	0.031*
Radial Deviation	0	20	0	20	8±5.42	8.5±5.24	0.961
Ulnar Deviation	0	30	0	30	16.31±7.96	18.87±6.78	0.439
PRO	0	90	10	90	71.75±12.65	70.13±9.30	0.413
SUP	0	90	15	90	71.00±25.98	68.13±23.44	0.667
APS	0	180	15	180	142.00±26.57	138.13±16.74	0.365

Table 6: The results of the parameters evaluated were as follows

Parameter (mean values)	Conservative group	Surgical group
Time of union (6 weeks)	45%	87.5%
(3 months)	50%	12.5%
Pain score	20.3	16.7
Function score	29.2	20.7
Loss of movement	35.2%	30.55%
Dorsi-flexion	55 ⁰	68 ⁰
Palmar flexion	61 ⁰	69 ⁰
Radial Deviation	80	8.5 ⁰
Ulnar Deviation	16 ⁰	18 ⁰
Mal-union	30%	13.33%
Intra-articular step	30%	41.7%
Loss of Radial inclination	45%	31.2%
Loss of Radial length	45%	33.33%
Excellent results	30%	45%

Table 7: Comparison of Results in two groups

Results	Conservative management		Surgical management	
	No	%	No	%
Excellent	12	30.0	18	45.0
Good	6	15.0	13	32.5
Fair	14	35.0	8	20.0
Poor	8	20.0	1	2.5
Total	40	100.0	40	100.0
Inference	Distribution of outcome based on results is statistically significant for Fair/Poor in Conservative management with p=0.046*			

Table 8: Mean age and result comparison between our and other study

		Mean Age	Excellent	Good	Fair	Poor
Knirk-JL [14]	Retrospective study	27.6 years	26	35	33	6
Present study	Prospective study	40.35 years	37.5	23.8	27.5	11.2

Table 9: Sex distribution, mode of injury and mean age compared to other study

	Male	Female	M.C. Mode of Injury	Mean Age
Harish Kapoor [10]	72.2%	27.8%	RTA	39 yrs
Present study	60.0%	40.0%	RTA	40.35 yrs

Table 10: Results of different modalities of treatment in comparison with similar study series

Management	Excellent		Good		Fair		Poor	
	Harish Kapoor [10]	Present study	Harish Kapoor	Present study	Harish Kapoor	Present study	Harish Kapoor	Present study
Plaster	8.6%	30.0%	34.4%	15%	50%	35%	67%	20%
Fixator	34.2%	40%	45.8%	30%	10%	20%	10%	10%
Open reduction	36.8%	60%	26.2%	35%	26%	5%	11%	0

Table 11: External fixator result compared with other case series

External Fixator	Excellent & Good	Fair	Poor
Horesh Z [15]	90%	10%	-
Present study	70%	20%	10%

Table 12: Results of our plaster cast treatment compared to other similar study

	Excellent	Good	Fair	Poor
Altissimi M [2]	38%	49%	11.5%	1.5%
Present study	30%	15%	35%	20%

Table 13: Range of movements compared with other study

	Av DF	Av PF	Av Pr	Av Sup
Present study	61.5 ⁰	65 ⁰	70.5 ⁰	69.5 ⁰
Charles S [17]	73 ⁰	75 ⁰	87 ⁰	88 ⁰

X-Rays and Photos

Conservative treatment: Case 25



Pre-reduction – AP

Pre-reduction – Lat

Post-reduction – AP



Post-reduction - Lat

6M Follow up - AP

6M Follow up - Lat view

External fixator: Case 11



Pre-reduction - AP

Pre-reduction - Lat

Post-reduction - AP



Post-reduction - Lat

6M Follow up - AP view

6M Follow up - Lat view

Plating: Case 2



Pre-reduction - AP

Pre-reduction - Lat

Post-reduction - AP



Post-reduction Lat

6M Follow up - AP

6M Follow up



6M Follow up - Dorsi-flexion



6M Follow up - Palmar flexion

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