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Comparative study on the functional outcome of ligamentotaxis in comminuted fractures of the distal end of radius and with that of conservative means of closed reduction and casting

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ABSTRACT

Background: Comminuted fractures of lower end of radius most often bring out unsatisfactory outcome, if treated by conservative means of closed reduction and casting. This study was aimed to compare the results of ligamentotaxis in comminuted fractures of the distal end of radius and with that of closed manipulative reduction and plaster cast immobilization.
Methods: Patients with comminuted fracture lower end of radius treated by ligamentotaxis or the conservative methods were included in the prospective study. Patients in group l treated by external fixator and in group 2 treated by conservative line of management. Postoperative check X-rays were taken. All the patients were evaluated on 3rd, 6th, 12th and 18th months after surgery. Functional results were assessed by Gartlands point score system and subjected to statistical analysis.
Results: Total fifty patients were included in the study. Twenty five were treated by external fixator and the remaining was treated by conservative line of management. Patients underwent ligamentotaxis had 88% excellent results whereas 52% of patients on conservative care had similar results. When the conservative methods gave poor results for severely comminuted fractures, ligamentotaxis could bring out excellent re-orientation of fragments back to near normal alignment.
Conclusions: Ligamentotaxis using a distracter is a better method to treat comminuted fractures of lower end of radius. Even though the initial reductions were excellent in a plaster cast, re-displacement rates are very high in a plaster cast. Fractures without intra articular extension always yielded far better results than intra articular fractures.

Keywords: Ligamentotaxis, Comminuted fractures, Colles' fractures, Osteodystrophy, Osteoarthritis

INTRODUCTION

Distal radial fractures continue to be one of the most common orthopedic injuries treated by orthopedic surgeons.[1] These fractures are associated with a colorful history since their first description by Ponteau in 1783 and Abraham Colles in 1814.[2] Among these fractures, the challenging type is comminuted distal radial fractures as they tend to displace within a plaster cast.[3] It is now clear that preservation of articular congruity is the principal prerequisite for the successful recovery following the distal radial fractures. Wide arrays of techniques from closed manipulation reduction followed by short arm cast, percutaneous pins, pin and plaster, open reduction and internal fixation to complex external fixators were evolved.[4-10]

Closed manipulative reduction and cast immobilization invariably leads to poor functional outcome due to re-displacement of fracture within the cast.[11] The purpose of the study was to evaluate the results of ligamentotaxis in comminuted fractures of the distal end of radius and to compare it with the results of closed manipulative reduction and plaster cast immobilization. The study evaluates complications and their management.

METHODS

Study design

This prospective study was conducted in the department of Orthopaedics, Amala Institute of Medical Sciences, Amala Nagar, Thrissur, Kerala, India during the period of January 2010 to 2013. The study protocol was approved by the Institutional Ethics Committee and according to the Declarations of Helsinki. Consent was obtained from each patient prior to the study.

Subjects

All closed fracture of lower end of radius with metaphyseal comminution was included in the study. Patients with open epiphyseal plate, those with vascular insult, intra articular fractures and open injuries were excluded from the study. Reduction of the fragments was achieved by the principle of Ligamentotaxis.

Fifty patients were taken for the study based on the comminution. The fractures were classified according to the Frykman classification.[12] Patients were divided into 2 groups, group l treated by external fixator and patients in group 2 were treated by conservative line of management. Dr. Joshys external stabilization system distractor (20 cm) and AO fixator were used for external fixation. 20 cm Joshi's external stablization system distractor was used in group l. Post-operative check X-rays were taken. If reduction was found to be unsatisfactory, distraction was adjusted to get a perfect alignment. The extremity was kept elevated in a sling and antibiotics were prescribed for one week. In group ll, after giving an intravenous sedation, a closed manipulative reduction and short arm slab was given. Re-manipulation was done if the reduction was not satisfactory on check X-rays. If there were no associated injuries, patients were discharged on the next day with a course of oral analgesics and advice regarding active finger movements.

On the first review after 1 week in the group l patients, check x-ray was taken. The pin track dressings were changed and movements of the extremity assessed. In group 2, check X-ray was taken and cast conversion done. Then every 2 weeks patients were reviewed. On the 6th week cast were removed, X-ray taken and mobilization started. In group l patients' fixator was removed in the 4th week. Dressings were applied over pin tract and a below elbow cast is applied which was removed after 2 weeks. All the patients were evaluated on 3rd, 6th, 12th and 18th months after surgery for analyzing results. Vander Linden's radiological criteria were used to assess the Anatomical results.[13] Functional results were assessed by Gartlands point score system.[14]

Statistical analysis

Statistical analysis was performed suing the SPSS (version 16, IBM, CA, USA). Chi-squared test and Fisher's exact test were used to represent the numerical and categorical data. $p < 0.05$ was considered as significant.

RESULTS

Total of fifty patients with comminuted fracture lower end of radius were included in the study. The mechanism of injury in 30 cases was fall from height and in the rest 20 was due to road traffic accident (Figure 1). In 21 of the group l patients, fixator was applied on the first day, and in the rest of the 4 cases, within 3 days as a secondary procedure. Twenty five of them were treated by 25 by external fixator (Group l) and the remaining was treated by conservative line of management (Group 2).

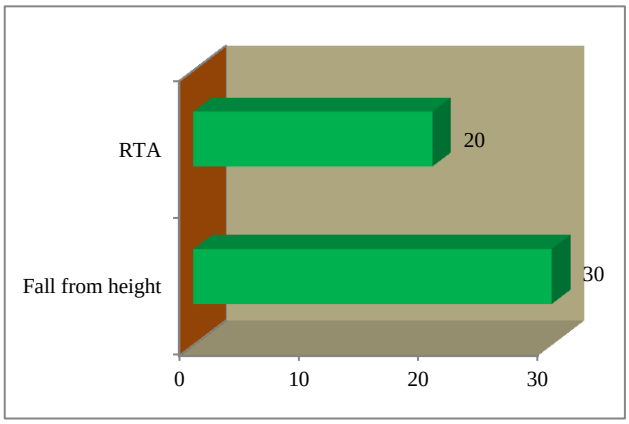

Figure 1: Distribution of causes for injury. RTA: Road traffic accidents.

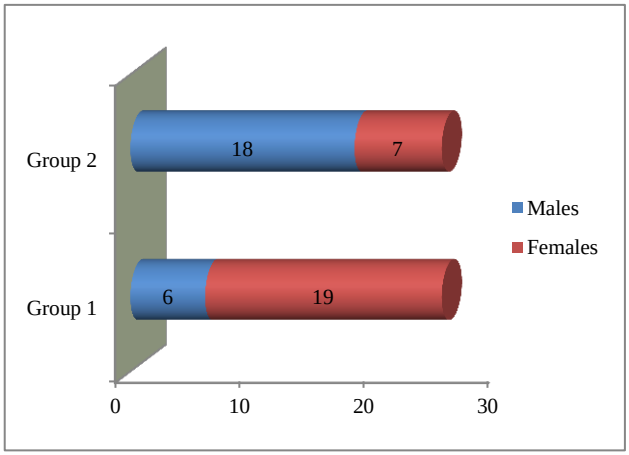

Figure 2: Distribution of gender.

Out of 25 patients in group 1, 6 were male and 19 were females (Figure 2). Of the 6 male patients, 5 got excellent results and 1 unsatisfactory result. Of the 19 females, 16 got excellent results, and 3 unsatisfactory results. Twelve patients in group 1 had right wrist injured whereas 13 had left wrist. Among the right wrist injured cases, 10/12 had good result and 2 had unsatisfactory results. Among the 13 with left sided injury, 10 had good results and 3 had bad results.

In group 2, of the 18 males, 10 had excellent results and 8 had unsatisfactory results. Of the 7 females, 4 had excellent and 3 had poor results. This shows that sex has got no significance in the final result (p value=0.4321). In group 2, 14 had right and 11 had left wrist affected. Among the right wrist affected cases 8/14 had good result, while 6/14 had unsatisfactory result. Among the 11 left wrist affected cases, 7 had excellent results and 4 had poor results. No statistical correlation was found between the side and result outcome (p value=0.7832).

Of the 25 patients in group 1, 22 had excellent results regarding residual deformity where as in the group 2, only 14 had, good or excellent results, which is statistically significant (P value=0.0054). Further, in group 1, 18/ 25 had good grip strength, whereas, only 11 had good or excellent grip strength in group 2, which is statistically significant (p value=0.0046).

Table 1: Values of dorsal angle.

Angle	Group 2					Group 1				
	Post Red		6wks		12 wks	Post Red		6 wks		12 wks
	No.	%	No.	%	No. %	No.	%	No,	%	No. %
-6 to -10	5	20								
0 to -5	5	20	1	4		2	8	1	4	
1 to 5	8	32	4	16	no	6	24	6	24	no
6 to 10	6	24	9	36	marked	12	48	11	44	marked
10 to 14	1	4	8	32	change	5	20	6	24	change
>15	-	-	3	12	-	-	-	1	4	

Table 2: Values of radial angle.

	Group 2					Group 1				
Angle	Post Red		6wks		12 weeks	Post Red		^K. 6 weeks		12 weeks
in degrees	No.	%	No.	%	No. %	No.	%	No.	%	No. %
> 20	10	40	1	4	no	12	48	10	40	no
15-19	11	44	4	16	change	10	40	10	40	change
Oct-40	3	12	14	56	> 5°	2	8	3	12	> 5°
9-May	1	4	6	24		1	4	2	8	

The dorsal angle in each patient was depicted in Table 1. Though the initial correction was better in group 2, the displacement in the cast was marked. The average dorsal angles were 2.66 and 8.32 in group 2 and 1, respectively. The values of radial angle were given in Table 2. Intra articular was seen in 16 cases (64%) in group 1 and 10 cases (40%) in group 2. They were again sub classified by Melones classifications. Of the 16 cases in group 1, 14 had excellent or good results. Of the 10 cases in group 2, only 6 had good or excellent results (p value=0.0062).

Movements of joints

In group 1, 88% of patients showed good or excellent movements of wrist and forearm. In group 2, 48% of the patients showed good or excellent movement of wrist and forearm. Palmer flexion is most affected followed by limitations of dorsiflexion and supination.

Pin loosening

In group 2, 3 patients had pin each loosened but the fixator was stable it was noticed on removal.

Pin tract infection

In group 1, 7 patients had mild pin tract infection which was completely controlled by short course oral cefuroxime and proper pin tract care.

Malunion / nonunion

No nonunion was observed. In 4 cases of group 1 and 6 cases of group 2 had some tenderness over the fracture site they were treated by additional two weeks of cast.

Sudeks osteodystrophy

No case of sudeks osteodystrophy was noticed in either group in this study.

Neuro vascular complications

In group 1, 2 cases had median nerve affection and 2 patients had numbness over the radial nerve superficial branch distribution. In group 2, no median nerve affection

was seen but 3 patients had numbness along the radial nerve distribution and 2 had neuralgia along the radial nerve distribution.

Post traumatic osteoarthritis

No severe cases of osteoarthritis were noticed in the group 1 patients, while 2 patients in group 2 had moderate osteoarthritic changes. But mild moderate articular incongruity was noticed in 6 of group I and 15 of group 2 patients.

Result based on treatment

When both group 1 and group 2 were compared, group 1 had 52% good or excellent results and group 2 had 88% of good or excellent results. The treatment in group 2 was better than group 1 which was statistically significant (t=2.02, P = 0.0053).

Complications

Finger stiffness, inferior-radio ulnar instability, pin loosening, pin tact infections, mal union/ nonunion, sudeks osteodystrophy, neurovascular complications (median nerve involvement) and post traumatic osteoarthrosis were the complications seen with this study.

DISCUSSION

In the study, most of the cases were in the younger age group. As stated by Melone, there is an increased frequency for the comminuted fractures of lower end of radius in younger age groups in recent years due to increased incidence of road traffic accidents.[15] Among the study groups, group 1 had high incidence in young males since the females were reluctant to surgery. There is a right sided predominance in this study. It is observed that the right hand is affected in almost all series may probably due to the dominant hand.[16] In this study, 96% of patients in group I had no or mild deformity at the end of follow-up, whereas only 52% in group 2 had no or mild deformity. The treatment with external fixator is better to maintain the reduction and to prevent the recurrence of deformity. It reduces the rate of malunion, which is evident by radiological analysis.

Other than fracture of lower end of ulna no other skeletal injuries were noted in the same upper limb in the present series. The previous study showed, fracture Scaphoid as a common association.[9] Excellent grip strength in group 2 patients was better than that of group I. Stiffness of joints was more in conservatively treated patients. Intra articular fractures carried poorer results. Post traumatic Osteo Arthrosis was assessed according to Kirk Jupiter Scale16. Osteoarthritis was found less in the group 1 than group 2. Pin track infection was noted in 7 patients (28%), which responded to a short course of oral antibiotics. Pin loosening found was less than the frame pin junction loosening. The difficulties met with during these procedures were 1) patient motivation is essential; 2) non-threaded wire had less purchase than threaded and 3) readjustment was difficult with a static fixator.

CONCLUSION

Comminuted fracture lower end of radius is seen in middle aged, commonly with slight female preponderance. The common causes are fall from height and road traffic accidents. Conservative management with a plaster slab after closed manipulative reduction often gives unsatisfactory results due to re-displacements, whereas, Ligamentotaxis using a distractor is a better treatment option. Anatomical restoration of the joint is a must for the excellent functional result. Commonest complication is Malunion which in later age may lead to arthritic change. Intraarticular fractures give poorer results compared to non-articular fractures. As the chance of collapse after removal of external fixator is found an additional bone grafting or focal pinning may be needed. Early active exercise can avoid stiffness of joints.

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