

# EFFICACY OF PLASTER CASTING VERSUS EXTERNAL FIXATION IN COMMUNUTED DISTAL RADIUS FRACTURES

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## ABSTRACT

**Objective:** To compare the outcomes of plaster casting and external fixation in comminuted distal radius fractures.

**Methodology:** This prospective study was conducted at District Headquarter Teaching Hospital and Khalifa Gul Nawaz Teaching Hospital Bannu from February 2009 to September 2010. A total of 30 adult patients having comminuted distal radius fractures were included in this study. They were classified according to AO/ASIF-Classification. The patients were randomized to plaster casting and external fixation by lottery method. Follow-up of each case was done for a total duration of 12 weeks. Radiographic assessment and clinical evaluation was conducted during each visit. Any complications arising during this period were recorded. The outcomes were assessed at the end of 12 weeks. For grading the results, Green & O'Brien clinical scoring system was used.

**Results:** Out of 30 patients, 15 were treated with plaster casting and 15 with external fixation. The mean age of patients in plaster casting group was 49.80 years  $\pm$  16.05 SD and in external fixation group 51.47 years  $\pm$  15.01 SD. According to AO-Classification, there were 8 type- A, 10 type- B and 12 type- C fractures. Radiographic evaluation at 12 weeks in plaster casting group showed mean values of volar tilt 2.8667 °, radial height 6.0000 mm, radial inclination 14.2000 ° and articular step-off 1.5200 mm. In the external fixation group, mean value of volar tilt was 5.7333 °, radial height 8.2000 mm, radial inclination 18.8000 ° and articular step-off 1.0467 mm. Clinical evaluation based on Green & O'Brien scoring system showed 4 excellent, 3 good, 4 fair and 4 poor results in plaster casting group and 5 excellent, 6 good, 2 fair and 2 poor results in external fixation group.

**Conclusion:** External fixation is an acceptable surgical solution for the treatment of comminuted distal radius fractures as compared to cast immobilization.

**Key Words:** External fixation, distal radius fractures, plaster cast.

This article may be cited as: Ismatullah. Efficacy of Plaster Casting Versus External Fixation in Comminuted Distal Radius Fractures . J Postgrad Med Inst 2012; 26(3): 311-6.

## INTRODUCTION

The incidence of comminuted fractures of the distal radius is on rise because of increasing automobile accidents and increasing mechanization<sup>1</sup>. These injuries are also increasing with an increase in aging population as osteoporosis becomes prevalent in old age<sup>2</sup>.

These fractures present a challenging problem for the orthopedic community. Problems in management include difficulty in achieving and maintaining reduction in these cases<sup>3</sup>. Healing of these fractures usually takes place in deformed position, and pain and dysfunction may persist after treatment of these fractures.

Traditionally these fractures are managed by closed reduction and casting which is associated with a high rate of re-displacement. Its complications include compartment syndrome of forearm, carpal tunnel syndrome, reflex sympathetic dystrophy, wrist stiffness, deformity and secondary osteoarthritis causing pain and dysfunction<sup>4,5</sup>. To reduce the frequency of these complications, various surgical methods like external fixation, internal fixation with volar plate and percutaneous K-wire fixation techniques have been used for stabilizing these fractures<sup>6-8</sup>.

There is controversy in the literature regarding the best method of treatment of

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Date Received: August 4, 2011

Date Revised: March 19, 2012

Date Accepted: March 28, 2012

comminuted fractures of distal radius and most of the times decision making is difficult regarding selection of method of treatment in these cases<sup>3</sup>.

External fixation is the least invasive method used for stabilizing these fractures<sup>9</sup>. It maintains length and alignment of the fracture during healing and helps in restoring normal function.

This study was conducted to compare the efficacy of closed reduction and plaster cast immobilization with external fixation for the treatment of comminuted distal radius fractures.

## METHODOLOGY

This was a prospective study of 30 comminuted distal radius fractures in 30 patients. The study was conducted at District Headquarters Teaching Hospital and Khalifa Gul Nawaz Teaching Hospital, Bannu. The study period was from Feb 2009 to September 2010. Some of the patients had poly-trauma with associated fracture of distal radius. All the patients were adults, above 20 years of age. They were age-wise divided into two categories,  $\leq 40$  years and  $> 40$  years. Open fractures were not included. Fractures with

previous deformity of the wrist, paralysis, tendon or ligament injury or nerve injury were also excluded. Patients with serious systemic ailments were also excluded. Fractures were classified according to AO-ASIF system<sup>10</sup>.

Patients were randomized through lottery method into group A & group B. Closed reduction and plaster casting was done in patients of group A. External fixation was done in patients of group B. Closed reduction & plaster casting was done under hematoma block & sedation with medazolam. An above-elbow plaster cast was applied.

External fixation was done under general anesthesia. An external fixator (AO-ASIF type) with 4- pins was applied, placing distal pins in the second metacarpal. Fracture was reduced by the principle of ligamentotaxis. Radiological assessment was done with antero-posterior and lateral radiographs in both the groups before & after the procedure, as well as on each follow-up examination. Volar tilt, radial height, radial inclination and articular step- off were assessed in all cases.

Follow-up was done at weekly intervals

**Table 1: Green & O'Brien Scoring System**

No	Item	Score
1	Pain	
	1. Absent	25
	2. Occasional	20
	3. Moderate tolerable	15
	4. Severe intolerable	0
2	Functional Status	
	1. Resumed work	25
	2. Constrained work	20
	3. Able to work but failed to be employed	15
	4. Unable to work due to pain	0
3	Range of motion	
	1. 100%	25
	2. 75-99%	15
	3. 50-74%	10
	4. 25-49%	5
	5. 0-24%	0
4	Grip strength	
	1. 100%	25
	2. 75-99%	15
	3. 50-74%	10
	4. 25-49%	5
	5. 0-24%	0

Excellent: 90-100; Good: 80-89; Fair: 65-79; Poor: <65  
Statistical analysis of the results was done with SPSS version 10.

for the first 2 weeks & then at fortnight intervals, up to a total period of 12 weeks. Any complications arising during this whole period were recorded. Grading of the results was done using Green & O'Brien Criteria as follows:<sup>11</sup> (Table 1).

## RESULTS

Out of 30 patients, 15 underwent plaster casting and 15 external fixation. The mean age of patients in the plaster casting group was 49.80 years  $\pm$  16.05 SD and in external fixation group 51.47 years  $\pm$  15.01 SD. Out of 30 patients, there were 13 males and 17 females. The male to female ratio in group A was 7:8 and in group B 6:9. In 11 patients, the age was  $\leq$  40 years and in 19

patients, it was  $>$  40 years. The frequency of this fracture is high in patient above 40 years of age, especially in females due to post-menopausal osteoporosis. Classification of fractures based on AO-ASIF system is shown in Table 2. Pre- & post-reduction radiological findings (mean volar tilt, radial height, radial inclination and articular step-off) are presented in Table 3.

Results were categorized according to Green & O'Brien criteria. In group A there were 4 excellent, 3 good, 4 fair and 4 poor results. In group B, there were 5 excellent, 6 good, 2 fair and 2 poor results (Table 4). The effect of age on the results is shown in Table 5. The complications of both the groups are shown in Table 6.

**Table 2: AO-ASIF Classification of Fractures**

Classification	Number of patients (Group A: Plaster casting)	Number of patients (Group B: Ext. fixation)	Total
A	4 (26.7%)	4 (26.7%)	8 (26.7%)
B	6 (40.0%)	4 (26.7%)	10 (33.3%)
C	5 (33.3%)	7 (46.7%)	12 (40.0%)
Total	15 (100%)	15 (100%)	30 (100%)

**Table 3: Radiological Findings in Both Groups**

Radiological parameter	Group	Mean value	Std. Deviation	P-value
Volar tilt (in degrees)	A:Plaster casting B:Ext.fixation	2.8667 5.7333	10.1409 6.5951	.367
Radial height (in millimeters)	A:Plaster casting B:Ext.fixation	6.0000 8.2000	2.4495 1.7403	.008
Radial inclination (in degrees)	A:Plaster casting B:Ext.fixation	14.2000 18.8000	3.5295 1.7809	.000
Articular step-off (in millimeters)	A:Plaster casting B:Ext.fixation	1.5200 1.0467	.9096 .9650	.178

**Table 4: Results According to Green & O'Brien Scoring System**

Results	Group A: Plaster casting	Group B: Ext. fixation	Total	P-value
Excellent	4 (26.7%)	5 (33.3%)	9 (30.0%)	0.485
Good	3 (20.0%)	6 (40.0%)	9 (30.0%)	
Fair	4 (26.7%)	2 (13.3%)	6 (20.0%)	
Poor	4 (26.7%)	2 (13.3%)	6 (20.0%)	
Total	15 (100.0%)	15 (100.0%)	30 (100.0%)	

**Table 5: Age-Wise Distribution of the Results**

Results	Age (in years)		Total	P-value
	= 40	>40		
Excellent	6	3	9	0.07
	54.5%	15.8%	30.0%	
Good	3	6	9	
	27.3%	31.6%	30.0%	
Fair	2	4	6	
	18.2%	21.1%	20.0%	
Poor	0	6	6	
	.0%	31.6%	20.0%	
Total	11	19	30	
	100.0%	100.0%	100.0%	

**Table 6: Complications**

Complication	Group A: Plaster Casting	Group B: Ext. Fixation
Carpal Tunnel Syndrome	2	0
Mal-union	5	2
Reflex Sympathetic Dystrophy	3	1
Pin tract infection	---	2
Wrist stiffness	3	4

## DISCUSSION

In comminuted fractures of the distal radius, there is a high risk of mal-union when treated with traditional method of closed reduction and casting. External fixation is the most popular & least invasive type of operation for such kind of fractures<sup>9</sup>.

Various national and international studies have shown superior results of external fixation as compared to plaster casting in these fractures and our results are comparable with other series. In a study conducted by Abbaszadegan-H & Jonsson-U SO (1990), there were 19 excellent or good results out of 22 cases, with external fixation, and 12 excellent or good results out of 19 cases, with plaster casting<sup>12</sup>. In our study there were 11 excellent or good results out of 15 cases, with external fixation and 7 excellent or good results out of 15 cases, with plaster casting. In another study conducted by Kakar HK, et al (2010), there were 64.2% excellent, 21.4% good, 14.2% fair and no poor results with external fixation and 31.3% excellent, 43.1% good, 15.6% fair and 9.8% poor results<sup>13</sup>. In our series there were 33.3% excellent,

40.0% good, 13.3% fair and 13.3% poor results with external fixation, and 26.7% excellent, 20.0% good, 26.7% fair and 26.7% poor results with plaster casting. Our results, like the two series mentioned above, indicate that external fixation is preferable to plaster casting in comminuted fractures of the distal radius.

Anderson TJ, Lucas GL and Buhr BR have reported complications of external fixation in a series of 24 patients as: 5 (21%) neuropathies (3 involving the median nerve (carpal tunnel syndrome) and 2 involving the superficial branch of the radial nerve), 9 (37.5%) pin tract infections, 2 (8.3%) pin loosening, 1 (4.2%) non-union and 2 (8.3%) mal-union<sup>14</sup>. Reflex sympathetic dystrophy was not documented in their series. In our study, with external fixation in 15 cases, there were 2 (13.3%) mal-union, 2 (13.3%) pin tract infection, 4 (26.6%) wrist stiffness and 1 (6.6%) reflex sympathetic dystrophy. No case of post-operative neuropathy like carpal tunnel syndrome was found with external fixation. We did not encounter the complications like tendon rupture and pin fracture as documented in other series<sup>15</sup>. Most of the complications of external fixation are avoidable if

proper aseptic technique is used and physiotherapy exercises are instituted.

In the study conducted by Kakar HK, et al, the complications of plaster casting in 51 patients were: 13(25.4%) mal-union, 2(3.9%) carpal tunnel syndrome and 5(9.8%) reflex sympathetic dystrophy. In our plaster casting group of 15 cases, the complications were: 5(33.3%) mal-union, 2(13.3%) carpal tunnel syndrome, 3(20%) wrist stiffness and 3(20%) reflex sympathetic dystrophy. The high rate of mal-union with plaster casting is compelling evidence to adopt alternative methods like external fixation because it may be difficult to treat once it develops.

In recent years the popularity of open reduction and internal fixation with volar locked plate has increased for unstable fractures of the distal radius<sup>16</sup>. The current literature do not support the use of internal rather than external fixation in the treatment of comminuted distal radius fractures<sup>17</sup>. However in some comminuted intra-articular fractures, where articular congruity cannot be restored by ligamentotaxis with external fixator, the alternative option of open reduction and plate fixation is a valid consideration<sup>3</sup>.

The limitation of our study is that it has been conducted in a small group of patients. But it still provides some evidence that in comminuted and unstable fractures of the distal radius, external fixation is a useful procedure.

## CONCLUSION

We recommend external fixation in comminuted fractures of the distal radius, which are potentially unstable fractures. It decreases the complications of re-displacement and shortening which may occur when these fractures are managed with closed reduction and casting. It gives more satisfactory radiological, functional and clinical outcome as compared to cast immobilization.

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