



A STUDY OF FUNCTIONAL OUTCOME OF DISTAL RADIUS FRACTURES TREATED BY LOCKING COMPRESSION PLATE

ORTHOPAEDICS

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KEYWORDS:

INTRODUCTION

Fractures of distal end radius are most common fractures of the upper extremity, encountered in practice and constitute 17 % of all fractures and 75% of all forearm fractures[1].

Closed reduction and cast immobilization has been the mainstay of treatment of these fractures but malunion of fracture and subluxation /dislocation of distal radioulnar joint resulting in poor functional and cosmetic results is the usual outcome [2]. The residual deformity of wrist adversely affects wrist motion and hand function by interfering with the mechanical advantage of the extrinsic hand musculature [3]. It may cause pain, limitation of forearm motion, and decreased grip strength as a result of arthrosis of the radiocarpal and distal radioulnar joints[4].

As open reduction and volar plating ensures more consistent correction of displacement and maintenance of reduction, this study evaluates the anatomical and functional outcome of open reduction and plate fixation in the management of fracture distal end radius in thirty patients.

MATERIAL AND METHODS

This is a prospective study carried out on 30 patients with fractures of the distal end radius, attending the outpatient and the emergency services of Meenakshi Medical College and Research Institute, Kanchipuram, who gave their consent to undergo the procedure. Thirty patients with fractures of the distal radius were included in the study.

Exclusion Criteria:

- Patients below 18 years of age
- Patient not willing /unfit for surgery
- Poor Skin Condition

Inclusion Criteria:

- Adults(aged over 18) both male and female with extra articular, unstable or comminuted intra articular distal end of radius fractures.
- Patient willing for treatment and given informed and written consent.

Investigations:

1. X ray of the distal radius - Anteroposterior view and lateral view
2. Screening chest X-ray
3. ECG /2DECHO
4. Blood: Hb%, Blood urea, FBS,PPBS,blood urea, Serum creatinine, Blood grouping
5. Urine for: Albumin, Sugar
6. BT/CT,TC,DC and ESR
7. Pus (if any) for culture and sensitivity
8. Follow up X ray

Pre Operative Treatment:

1. Above elbow slab
2. Analgesics
3. Antibiotics
4. Blood transfusion
5. Others

All the patients were subjected to clinical examination. Radiographic evaluation of the affected & the normal side was done at the time of injury with the antero-posterior and lateral views. The radiographs were assessed in terms of loss of palmar tilt or presence of dorsal tilt, radial shortening and loss of radial inclination. Fractures were classified as according to the AO Classification into type A (extra-articular), type B (partial articular) or type C (complete articular). After pre-anaesthetic evaluation patients were taken up for surgery.

SURGICAL TECHNIQUE

All procedures were performed under general or regional anaesthesia. Our standard practice was preoperative prophylactic intravenous cefoperazone and sulbactam and usage of tourniquet and diathermy for homeostasis. The standard volar approach was undertaken to fix the fragments. Dissection between the median nerve and flexor carpi radialis tendon was used. The distal and radial borders of pronator quadratus were lifted and retracted ulnarly. Open reduction was performed with the aid of intrafocal leverage, traction by an assistant, and provisional fixation by temporary Kirschner wires followed by definitive volar buttress or locking plate and screws. Image intensifier was used in theatre to assist the evaluation of fracture reduction and fixation

POSTOPERATIVE PROTOCOL:

Postoperatively radiographs were taken, the limb was kept elevated in above elbow plaster slab, active finger and shoulder exercises were started at the earliest possible. The plaster slab was removed after 10 days, sutures removed, crepe bandage applied and active exercises of wrist, elbow and shoulder were started.

EVALUATION OF OUTCOME:

The patients were followed up for minimum of 54 wks. Clinical, radiological and functional reviews were performed at periodic intervals.

Radiological Evaluation:

Radiological assessment was done in terms of residual dorsal angulation, radial shortening and loss of radial inclination and the results were graded according to the *Sarmiento's modification of Lind Strom Criteria*[42]. These parameters were assessed during the follow up of the patient to assess the quality of reduction and the ability of the technique to maintain the reduction

Clinical and Functional evaluation:

Functional evaluation of the patients was done at the last follow up according to the *demerit point system of Gartland and Werleywith*

Sarmiento et al's modification.

TABLE 1 : MODE OF TRAUMA & TYPE OF FRACTURE (AO Classification):

	TYPE A	TYPE B	TYPE C	TOTAL
FALL	6	0	12	18
RTA	2	4	6	12
TOTAL	8	4	18	30

The mode of injury was fall in 18 cases (60%), road traffic accident in 12 cases (40%). 8 fractures were classified as AO type A, 4 fractures as AO type B and 18 fractures as AO type C.

ULNAR STYLOID FRACTURE

Ulnar Styloid was fractured in 9 cases (30%) and intact in 21 cases (70%). The fracture was managed expectantly.

TIME LAPSE BETWEEN INJURY AND SURGERY

Most of the cases were operated on the same day or the next day of attending the OPD or the emergency.

Out of the 30 cases, 24 cases (80%) were operated within a week of injury and 6 cases (20%) between 8-14 days. The delay, if any was on the part of the patients presenting late.

CLINICAL AND FUNCTIONAL EVALUATION RESIDUAL DEFORMITY

Prominent ulnar styloid – 3 patients (10%)
Residual dorsal tilt – 3 patients (10%)
Radial deviation of hand – 0 patients (0%)

Table 2 : SUBJECTIVE EVALUATION

SUBJECTIVE EVALUATION	NUMBER OF PATIENTS
EXCELLENT	21
GOOD	7
FAIR	2
POOR	0
TOTAL	30

Subjectively, out of 30 patients, 21 patients (70%) had excellent, 7 patients (23%) had good, and 2 patients had fair (7%) results.

Table 3

COMPLICATIONS	Number of patients
Reflex Sympathetic Dystrophy	Nil
Joint stiffness	3
Parasthesia in the distribution of radial nerve	1
Impingement of tendons	Nil
Median nerve complications	Nil

Table 4

OBJECTIVE EVALUATION	
Loss Of Dorsiflexion (<45 degrees)	0
Loss Of Palmar Flexion (<30 degrees)	3
Loss Of ulnar Deviation (< 15 degrees)	1
Loss Of Radial Deviation (< 15 degrees)	2
Loss Of Supination (< 50 degrees)	1
Loss Of Pronation (< 50 degrees)	1
Loss Of Circumduction	1
Pain at DRUJ	0
Grip Strength ≤ 60% of opp. Side	1

DISCUSSION

ANATOMICAL SCORE OF HEALED FRACTURE

The scoring was done according to the Sarmiento's modification of Lind Strom Criteria. Anatomically 24 patients (80%) had excellent restoration of anatomy, 4 patients (13%) had good restoration and 2 had fair (7%) restoration of anatomy. Thus 93% patients had excellent to good alignment of fragments and good reduction could not be achieved in 7% patients resulting in fair or poor results.

FUNCTIONAL END RESULT OF HEALED FRACTURE

The scoring of healed fracture was done as according to the demerit point system of Gartland and Werley with Sarmiento et al modification.

Functionally 22 patients (73%) had excellent, 5 good (17%) and 3 patients had fair (10%) restoration of functions. Poor function correlated with residual displacement and poor patient compliance.

SUMMARY

A total of 30 patients were taken up for study. The age of patients in the study ranged from 20 to 70 years with an mean age of 42.6 years. Out of the 30 patients 10 were male and 20 were female patients. With about 16 patients having a fracture on the right side and 14 patients a fracture on the left, both sides were almost equally involved. The mode of injury in 18 patients were due to fall on an outstretched hand while in 12 patients it was due to RTA. Out of the 30 patients taken up for study, 8 patients had AO type A fractures, 4 patients had AO type B and 18 patients had AO type C fractures.

Out of the 30 patients, 24 patients were operated within a week of injury and 6 patients were operated within 8-14 days. The residual dorsal tilt in post op patients was corrected in 25 patients. In the remaining 5 patients the residual dorsal tilt could not be achieved to a neutral degree. Out of these 5 patients 3 had an AO type C fractures were as 2 had AO type A fractures. In the final follow up, in 1 patient with AO type C fracture, the residual dorsal tilt could not be achieved to a neutral degree. The radial length could not be restored in 1 patient with AO type c fracture. The radial angle was restored post operatively in 29 patients, where as in 1 patient with AO type C fracture, the radial angle could not be restored.

A good to excellent anatomical results were obtained in 93% of cases and a fair anatomical result in 7% of cases. The functional results achieved were good to excellent in 90% of cases and fair result in 10% of cases. In both anatomical and functional result, the fair results were obtained in older patients and due to prolonged immobilisation respectively.

CONCLUSION

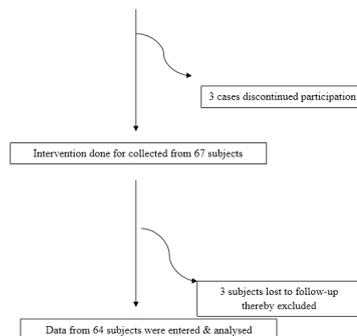
93% anatomical and 90% functional, excellent to good results, suggests that stabilizing the fracture fragments with volar plate and screws in the management of the fractures of distal radius, is an effective method to maintain the reduction till union and prevent collapse of the fracture fragments, even 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. 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.

RESULTS OBSERVATION AND RESULTS

The present study was conducted on adults aged >30 years who were attending the Orthopaedics OPD, Meenakshi Medical College, Kanchipuram. The study attempted to assess functional and radiological outcome of lumbar spondylolisthesis treated with posterolateral fusion and with pedicular screw fixation.

The flows of participants were described in the flow chart below:



The results have been summarized under the following headings:-

- Background characteristics of the study population
- Description of injury
- Description of outcome
- Analysis of spondylolisthesis between sexes pre-operatively and

- post-operatively
- Analysis of final outcome following the surgery- posterolateral fusion and pedicular screw fixation

1. DESCRIPTION OF INJURY

Table 1. Levels of slippage

Levels	No	%	p-value
L4-L5	46	71.9	0.001
L5-S1	18	28.1	
Non-parametric chi square = 12.25 , p-value <0.05 indicates significance			

Maximum of the slippage was found to be present at L4-L5 level (71.9%) while only 28.1% was present at L5-S1 level. Non-parametric chi-square test was used to find the difference and it was found to be statistically significant(p<.05).

Table 2. Distribution of final outcome

Complications	No	%	p-value
Excellent	51	79.7	<0.001
Good	5	7.8	
Eventful	8	12.5	
Non-parametric chi square = 62.09 p-value <0.05 indicates significance			

The excellent outcome was found in the majority of the cases (79.7%) which was followed by eventful outcomes (12.5%) and good (7.8%). Non-parametric chi-square test was used and it revealed significant difference in the distribution of outcomes (p<.05).

3. ANALYSIS OF SPONDYLOLISTHESIS BETWEEN SEXES

Table 3a. Gender wise pre-treatment assessment

Sex	Slip Score		Slip Angle		ODI	
	Mean	SD	Mean	SD	Mean	SD
Male	24.25	6.61	22.69	8.46	59.50	9.78
Female	23.69	7.79	23.63	9.81	49.83	12.92
	p-value = 0.820		p-value = 0.562		p-value= 0.003	
Independent t-test used p-value <0.05 indicates significance						

The pre-treatment assessment among males and females was shown in table4. The mean slip score and ODI were little higher in males than females, The females were having higher slip angle than males (23.63 vs. 22.69). The difference in ODI between the sexes were statistically significant (p<.05) as evaluated using Independent t-test

4. FUNCTIONAL AND C.T GUIDED FUSION ANALYSIS OUTCOME OF LUMBAR SPONDYLOLISTHESIS TREATED WITH POSTEROLATERAL FUSION AND PEDICULAR SCREW FIXATION

Table 4. Pre-treatment & post-treatment comparison

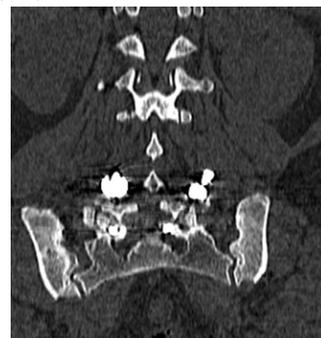
Variable	Slip Score		Slip Angle		ODI	
	Mean	SD	Mean	SD	Mean	SD
Pre-treatment	23.83	7.47	23.39	9.44	52.14	12.84
Post-treatment	15.56	7.97	15.28	8.51	16.00	8.85
	p-value <0.001		p-value <0.001		p-value <0.001	
Paired t-test used p-value <0.05 indicates significance						

The table4 shows the pre-treatment and post-treatment comparison of subjects. The improvement in slip score, slip angle and ODI was significantly good in the post-treatment group as compared to the pre-treatment group (p<.05). Paired-t-test was used to find the difference

PRE-OP MRI



POST OPERATIVE CT IMAGE SHOWING PEDICLE SCREWS INSITU



DISCUSSION

In this study, the overall outcome following pedicle screw fixation with decompression and posterolateral fusion in patients with spondylolisthesis was successful with very significant reduction in the outcome variables like slip score, slip angle and ODI. The strengths and limitations were also discussed.

With better understanding of the natural history and biomechanics, the treatment options have evolved over the time. Most patient respond well to conservative treatment and only a small percentage of individuals require surgery. Surgical treatment has been shown to produce good results once patients fail a 6-week trial of standardized nonsurgical treatment that includes physical therapy, medications, and spinal injections⁴⁹

The main aim of surgery is to provide stable fusion across the unstable segment and to relieve pain and neurological deficit. Restoration of the segmental stability by adequate neural decompression, fusion, and stabilization helps to improve clinical symptoms and achieve normal spinal anatomy.

OUTCOME

The results from our study showed that, the chances of getting excellent results following posterolateral fusion and pedicle screw fixation with decompression will be seen in four fifth the observations.

The findings from this study are superior to that found from Kho VKS et al, where they got only good results in 94.5% of their patients treated with posterior decompression laminectomy with foraminotomy and PLF using laminectomy bone chips as bone graft, with reduction of the slipped vertebra with transpedicle screws. In negation to these results Ekman P et al., proclaimed in his study that no significant improvement of outcome were observed in surgical group compared to conservative group in their long term follow-up as there was significant difference found in the short term follow-up.

SUMMARY

- The study subjects were adults with age >30 years and the mean age of the total study population was 50.45 ± 9.53 years.
- The study population is unequally distributed according to the gender with male to female ratio being 1:3
- L4-L5 level of slippage was found in the majority (71.9%) against 21.1% of cases having L5-S1 levels.
- Post-operatively, most of the cases had no complications (87.5%) and implant failure was seen in only 3.1% of subjects.
- The final outcome was excellent in 79.7% of cases while 12.5% had an eventful outcome for whom re-surgery required.
- Pre-operatively the severity of the disease condition as assessed by slip score and ODI showed higher values in males while slip angle in females had wide variation abnormally.
- Post-operatively the improvement in outcomes like slip score and slip angle was better with regard to female subjects and this improvement varied significantly among them against males.
- As a whole, following the postero-lateral fusion with pedicle screw fixation, the significant advancement of all the outcomes considered in our study were well appreciated.
- On comparison of the outcomes following surgery among the genders, the progress was well noticed in female subjects as they showed significant difference in all entities against the male group which showed a significant difference in having improved their ODI.

CONCLUSION

For individuals who do not respond to conservative management, fusion in situ remains the gold standard procedure and is known to produce long lasting good results. Of the various techniques available, the Posterolateral Fusion (PLF) with pedicular screw fixation offers better fusion rates with which the aforementioned surgical procedure started gaining popularity.

Patients included in the study showed good clinical response and significant pain reduction with no significant complication. Postoperatively, all patients achieved a pain free status to carry on with a comfortable functional daily living.

In conclusion, lumbar posterolateral fusion with pedicular screw fixation is an effective treatment option for spondylolisthesis with high fusion rates and minimal postoperative morbidity. However, the long-term effects of the procedure cannot be assessed within the study period and needs further investigation. Further studies has to be carried over in acquaintance of incidence of long term after effects and factors ascertaining the comfort zone of the subjects with which we can able to form a concrete platform to start with surgery and even new techniques added to it.

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