

## FUNCTIONAL OUTCOME OF CLOSED REDUCTION AND CAST FIXATION TREATMENT OF DISLOCATED DISTAL METAPHYSEAL EPIPHYSEAL FOREARM FRACTURES

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### Abstract

*The purpose of this study is to evaluate the functional outcome of conservative treatment of fractures of the forearm, metaphyseal -epiphyseal distal region, on short and medium term, in order to assess the socio-professional reintegration as soon as possible. From 2009 to 2013 we followed and assessed, in terms of functional status, 120 patients who experienced a trauma which resulted in a fracture with displacement of the distal radius, with or without joint involvement (according to AO Classification) and received conservative treatment consisting of closed reduction of the fracture and immobilization in a cast and / or wrist immobilization brace, for a period of six weeks. Functional evaluation was done posttraumatic (immediately after reduction and immobilization in a cast or brace), at 3, 7, 21 days, 6 weeks, 3 months, 6 months and one year and took into account both objective assessment (ROM and tolerance to medium and large effort) and subjective (VAS scale).*

**Keywords:** metaphyseal-epiphyseal region distal forearm fracture, conservative treatment, functional outcome

### INTRODUCTION

The forearm is a complex anatomical structure with an important role in superior member biomechanics. So, any change in the anatomical geometry of forearm distal region alters congruence and range of motion at this level. (1, 2) Distal radius fractures represent approximately 15% of all fractures in adulthood. Because the incidence of these fractures is beginning to grow in young, active adult, no longer being attributed to older people, a thorough understanding of the physiopathology and specific treatment is required, in order to ensure a quick reintegration of these patients in daily activity, as it was prior to the traumatic event. (3, 4, 5)

The treatment of these fractures, as well as the post therapeutic management is still cause for debate in recent years and has undergone major changes with the development of the surgical techniques. (6)

The best approach is a multidisciplinary one, an approach which includes several specialties: hand surgery, orthopedics, plastic surgery, physiotherapy, medical recovery, balneology and even psycho therapy. (7, 8)

The therapeutic decision requires taking into consideration several factors such as the type of the fracture, the possibility to reduce and stabilize the fracture. Both conservative and the surgical approach have a number of advantages and disadvantages, optimal management should take into account, besides the features of fracture, bone quality and medical condition of the patient. (9, 10, 11)

## **MATERIAL AND METHODS**

From 2009 to 2013 we followed and assessed, in terms of functional status, 120 patients who experienced a trauma which resulted in a fracture with displacement of the distal radius (Fig.1), with or without joint involvement (according to AO Classification) and received conservative treatment consisting of closed reduction of the fracture and immobilization in a brahio-palmar cast, for a period of three weeks, with the hand in ulnar inclination and slight flexion or extension (depending on the type of fracture), followed by immobilization in antebrahio-palmar cast for 21 days /or wrist immobilization brace, with the arm in physiological position. Reduction of fractures was done urgently, at the moment of patient presentation in UPU service, and consisted in: positioning the patient supine on the table for orthopedic fracture reduction, disinfection and isolation of the traumatized hand and forearm, infiltration in the fracture focus up to 10ml of 1% lidocaine. Aprox.10 minutes after the anesthetic injection, it was performed the fixation of the affected limb with a strap extension, while, with the elbow at 90°, a help performed continuous, gradual traction, at the level of the traumatized upper member fingers. After ~ 2 minutes in this position, by manipulating the radiocarpal region (hyperflexion, hyperextension, medialisation or lateralization maneuvers, depending on the type of fracture and the degree of its displacement) we obtained the disengagement and reduction of the fracture. Fracture reduced so was stabilized with a brahiopalmar cast with the elbow flexed 90 °, hand in slight flexion (or extension) and ulnar inclination (Fig.2). After immobilization in a cast every patient had radiographic control of the traumatized region for certification fracture reduction.

In addition to immobilization in a cast, patients were recommended affected limb positioning with hand in proclimax position, active movement of the fingers throughout the immobilization and analgesics during the first 5-7 days. Clinical and paraclinical reassessment of the patients, during immobilization, was made at 3 days, 7 days, 21 days (at which date they underwent elbow immobilization suppression while preserving immobilization of the radio carpal region, Fig.3) and at 42-45 days

(suppression of gypsum device). After suppressing immobilization it was indicated physiokinethotherapy (minimum ten consecutive sessions) and reevaluations at 3 months, 6 months and one year. Unfortunately, for more or less objective reasons, not all patients follow medical recommendations "ad integrum" aspect which was shown by the results of our study.

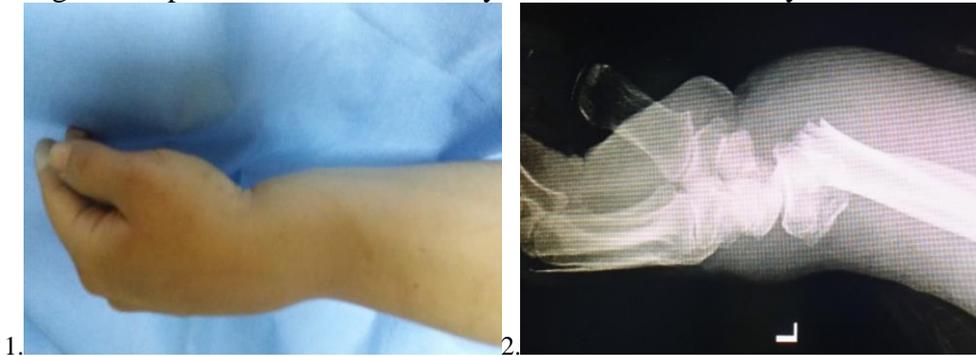


Fig. 1: Displaced distal radius fracture (1.clinical and 2. radiological LL view)



Fig.2: Braho - palmar cast after reduction of a radiocarpal fracture (1.) and through – cast radiological view (2.)



Fig.3: Antebrahiopalmar cast (1.)/brace (2.), three weeks after the radiocarpal fracture reduction

All patients were evaluated under the aspect of clinical and functional post therapeutic evolution. The assessment of reduction was made by several standardized posterior anterior and lateral radiographies took before and after closed fracture reduction and at 3 weeks, 6 weeks, 6 months and one year, analysing the radial height, radial inclination, articular congruity and the volar tilt.

Range of motion and grip strength were measured for each wrist and comparison was made with the unaffected side, the results being expressed in percentages related to that.

The assessment of pain was made using the Visual Analogue Scale for pain (VAS), which is an instrument that tries to quantify the amount of pain felt by the patient and it's scaled from none to extreme.

Functional outcome that included subjective and objective parameters was graded by two largely used scoring systems quick DASH and Gartland and Werley score. Quick DASH as a shortened version of the original DASH questionnaire consists in 11 items (instead of 30) that assesses physical function and symptoms of the patients. The lower the score, the better the outcome is. (12, 13, 14)

Gartland and Werley scoring system evaluates the treatment outcome by using various parameters among which are mobility, the grade of deformity, complications. 0-3 is considered an excellent score and 19 or more a poor score.

Last but not least we studied the number and type of the complications occurred after this kind of treatment and compared them to other types of therapy.

The results were statistically analysed using Student test, t-test and ANOVA variation test with Bonferroni or Tamhane correction.

## **RESULTS AND DISCUSSIONS**

From the 120 patients studied 25 were men and 95 were women, 38 of them being active persons. The mean age of the studied group was 59 years. Almost half of the patients were smokers. All of the fractures were closed and more than half (about 60%) of them had an associated ulna fractured. Only nine patients were found with associated pathology like osteoporosis, rheumatoid arthritis.

Table 1

## Demographic data of the 120 patients

Mean age	sex m/f	d.h.	a.p.	smoker	Associated ulna fr.	l-r .a.p	o.f.	Physio Kineto therapy	Radiologic Evaluation
59 (14)	25/95	48 40%	38 31,6%	52 43,3%	74 61,6%	9 7,5%	0 0%	98 81,6%	120 100%

Figures in brackets represent the standard deviation (SD)

d.h.: dominant hand

a.p.: active person (persons still employed)

l-r .a.p.: loco-regional associated pathology (rheumatoid arthritis, osteoporosis,...)

o.f.: open fracture

All of the patients were radiological evaluated. Radiological results before and after closed reduction, respectively at the times of the follow ups are listed in Table 2. Initial reduction improved radial length with an average of 4 mm, radial inclination with an average of 10°, and palmar inclination from -22,3° to 3°. As the fracture is consolidating, the radiological parameters are also changing, finally (at 1 year follow up) reaching the following values: radius length modified with 3 mm, radius inclination 19, 2°, palmar inclination 0°.

Table 2

## Radiologic parameters

	before O.R.	after O.R.	after 3 weeks	after 6 weeks	After 6 months	after 1year
Radius lenght (mm)	1 (0,3)	5 (0,3)	5 (0,3)	4 (0,3)	3 (0,3)	3 (0,3)
Radius inclination (°)	11,1 (8,1)	21,3 (5,2)	20,2 (5,4)	20,2 (5,4)	19,8 (5,5)	19,2 (5,5)
Palmar inclination(°)	-22,3 (12,1)	3 (10,4)	1 (9,3)	1 (10,2)	0 (12,1)	0 (1,4)

O.R.: orthopedic reduction; numbers in the brackets represent standard deviation (SD)

We used VAS to have a subjective appreciation of the pain intensity and we observed a substantial improvement over the whole follow up period, with maximum of positive results between 6 weeks and 3 months interval, as shown in table 3.

Table 3

## VAS

Radio carpal pain (VAS)				
	6 w	3 m	6m	1y
None	10	56	65	80
Mild	39	37	35	21
Moderate	63	22	18	19
Severe	8	5	2	0

Assessment of range of motion was made in percentages of the normal values according to the American Society for Surgery of the Hand indications as normal range of motion of the wrist and forearm. The normal reference ROM values were considered: 70<sup>0</sup>/85<sup>0</sup> for pronation/supination of the forearm, 70<sup>0</sup>/75<sup>0</sup> for extension/flexion and 20<sup>0</sup>/35<sup>0</sup> for radial/ulnar movements of the wrist.

The recovery of movement in all planes was gradual, beginning with lower values, 55%-62% of the normal range, at 6 weeks follow up, growing to 73%- 83% at the final follow up (Table 4).

Table 4

Follow up	Range of motion			
	Flexion	Extension	Pronation	Supination
6s	58,3%	55%	61,7%	61,1%
3m	70,8%	66,4	74,5%	70,7%
6m	76,3%	70,1%	78,8%	75,5%
1y	79,3%	72,6%	82,7%	80,2%

Grip strength also registered a real improvement from 6w (20, 12%) to 1y (78,56%), a significant difference being recorded between 3m (42,37%) and 6m (69,90%).

Quick DASH scoring showed an improvement along the whole period of follow up, of almost 10 points at the 1 year (18 points) follow up compared to the assessment at 6 weeks (27,1 points). At 3 months follow up we have registered 24,7 DASH score points and 19,2 at 6 months follow up. Nevertheless, the outcome is inferior to those seen after surgical treatment.

According to the clinical scoring of system of Gartland and Werley scale at 1 year follow up excellent 31 results were graded as excellent and just 2 of them as poor. Most of the patients (87) were included in the good (47 patients) and fair (40 patients) category of results, divided in almost equal percentatge.

Regarding to the pain intensity and to the limitation of ROM, it seems that physical therapy is needed and improves the treatment results, therefore the costs and time to return to work will be decrease.

#### **Complications:**

Two factors that affect on the rate of complications of the cast immobilization are the duration of casting and the length of the cast. (15, 16).

Complications such as pain or limitation of ROM are important factors which influence on the patients satisfaction. Twenty five out 120 of

our patient registered complication after closed fracture reduction and cast immobilization, eight of them developing carpal tunnel syndrome and twelve encountered re-displacement. We think that it is important to mention that five patients out of those eight with carpal tunnel syndrome complication were out of those twelve patients with secondary displacement complication. (Table 5)

Also important to mention is that those five patients with tenosynovitis and tendon irritation were out of those nine patients with associated pathology (osteoporosis and rheumatoid arthritis), which leads us to supposition that the associated pathology had high level of influence in this complications appearance.

We concluded that the most frequent complications (more than half of the total number of complications) were secondary displacement and carpal tunnel syndrome. Most likely these complications have nothing to do with position of immobilization (pronation/supination) or with the time of casting (meaning long cast immobilization period and short cast immobilisation period). Linden at al and Edmunds at al, in their study, found similar results. (17.18) On the other hand, patient selection for closed reduction and cast immobilization treatment and the compliance of the patient may have a defining role in complication appearance.

*Table 5*

Complications	
Tenosynovitis	2
Tendon rupture	-
Tendon irritation	3
Carpal tunnel syndrome	8
Complex regional pain syndrome	5
Re-displacement	12

## CONCLUSIONS

The choice of conservative treatment in distal forearm fractures should be made by taking into consideration the characteristics of the fracture (whether the fracture is stable or not) as well as of the patient (low demanding old one).

It seems that the physical therapy plays an important role in improving the results of conservative distal forearm fracture treatment, increasing the patient comfort and decreasing the costs and time to return to prior activities.

Patient quality of life expectations can be reachable with conservative treatment in distal metaphyseal epiphyseal forearm fractures, if the patient selection is made by proper criteria and the follow up is made et the proper interval, using all clinical and para-clinical needed investigations methods.

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