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Original article

Clinical evaluation of patients with distal end of the radius fracture treated with percutaneous fixation

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ABSTRACT. The trend in distal radius fracture is towards open reduction and internal fixation; however, treatment with closed reduction and percutaneous nailing continues to provide good results, but physical therapy and appropriate early rehabilitation are needed. ***Material and methods:*** **We assessed patients with distal radius fractures treated with reduction with percutaneous maneuvers and nailing; we used clinical functional scales, like the DASH, the Mayo Clinic wrist scale, and the Visual Analog Scale (VAS) to assess pain. Patient results were compared at 12 and 24 weeks. We also compared patients with and without rehabilitation.** ***Results:*** **A total of 60 patients were assessed using the DASH scale; patients with rehabilitation had a score of 4.3, while those without rehabilitation had a score of 10.5 (p = 0.00001). In the Mayo Clinic scale, patients with rehabilitation had a score of 86.7, while those without rehabilitation had a score of 77.8 (p = 0.00001). The VAS was not significant.** ***Conclusion:*** **All patients showed improvement in their clinical assessment scales. However, when patients with and without rehabilitation are compared, the difference was greater in the Mayo Clinic scale and in the DASH scale.**

Key words: fracture, elbow, radius, fracture fixation, external fixation, evaluation.

RESUMEN. En fracturas del radio distal existe una tendencia hacia la reducción abierta y fijación interna, sin embargo, el tratamiento mediante reducción cerrada y enclavamiento percutáneo continúa ofreciendo buenos resultados pero es necesaria una terapia física y rehabilitación temprana y adecuada. ***Material y métodos:*** **Evaluamos a pacientes con fractura de radio distal tratados mediante reducción por maniobras y enclavamiento percutáneo, utilizamos escalas clínicas funcionales como la escala de DASH, la escala de muñeca de la Clínica Mayo y Escala Visual Análoga para valorar dolor. Los resultados de los pacientes fueron comparados a las 12 y 24 semanas. Así mismo comparamos a pacientes con o sin rehabilitación.** ***Resultados:*** **se evaluó a 60 pacientes con la escala DASH, en pacientes con rehabilitación obtuvieron 4.3 puntos, mientras que sin rehabilitación fue de 10.5 puntos (p = 0.00001), en la escala de la Clínica Mayo con rehabilitación tuvieron 86.7 puntos y sin rehabilitación tuvieron 77.8 puntos (p = 0.00001). El EVA no fue significativo.** ***Conclusión:*** **Todos los pacientes mostraron mejoría en sus escalas de evaluación clínica. Sin embargo, al comparar a pacientes con rehabilitación y sin rehabilitación la diferencia fue mayor en la escala de la Clínica Mayo y en la escala de DASH.**

Palabras clave: fractura, radio, codo, fijación de fractura, fijación externa, evaluación.

Level of evidence: IV (Act Ortop Mex, 2010)

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Introduction

The life risk of having a fracture of the distal end of the radius is 15% for women and 2% for men.[1] The Colles fracture is the most common one in people over 40. Several methods for the treatment of patients with distal end of radius fractures have been described such as the fracture reduction and application of short or long cast devices, closed reduction and placement of percutaneous nails, open reduction and application of plates, application of external fixation have proven to be effective throughout time.[2] Current reports show a trend toward a greater frequency of open fixation and use of plates; Koval et al[3] found that treating fractures of the distal end of the radius with open fixation has increased from 42% in 1999 to 81% in 2007. They found that patients treated with percutaneous fixation have more complications than with open fixation (14 *vs* 12.3%) as well as a greater rate of infection (5% *vs* 2.6%); however, patients treated with open fixation showed a greater rate of medial nerve injury (2% *vs* 1.2%).

We believe that treatment of this type of fractures with percutaneous fixation is still a good option, aside from a financial one, however this type of treatment has to be followed by appropriate physical therapy. The reason to prescribe physiotherapy after a distal end of radius fracture treated with percutaneous fixation is for early mobilization and it generally starts in week 7 or 8 after the injury.[4,5]

The objective of our work was to assess the radiographic and functional results of patients with distal end of radius fractures treated with reduction through external maneuvers and percutaneous nails and placement of a cast followed by physical therapy starting on the sixth week.

Material and methods

We carried out a case series study in the Orthopedics and Traumatology Department of our University Hospital supported by the ethics committee of the same institution. The inclusion criteria were: patients with skeletal maturity and a distal end of radius fracture with less than 12 hours of evolution diagnosed through imaging tests with an antero-posterior X-ray and a lateral wrist X-ray, with informed consent to participate in the study. Exclusion criteria were: patients initially treated in a different institution, exposed fractures of any degree, associated fractures, patients with chronic associated diseases; elimination criteria were: non compliance with treatment, patients with voluntary withdrawal from the study, incomplete follow up and an incomplete chart.

Reduction maneuver: All patients had a Bier block and under an aseptic technique,[6] the fracture was reduced through external reduction maneuvers which consisted of traction-contraction, radial and/or ulnar deviation according to initial displacement and then flexion of the distal fragment, we applied 0.062 Kirschner nails at the radial styloid process level and verified through X-rays its correct application, sterile bandaging was applied to cover up the entry of nails and an antibrachipalmar cast device was placed.

Follow-up: Weekly controls in weeks 1, 3, 6, 12 and 24 in the outpatient clinic. The Frykman classification was used for the initial staging.[7] On the sixth week of evolution, the cast and the percutaneous fixation were removed; the patient was then referred to rehabilitation. Patients were assessed clinically with the Mayo Clinic scale (MCS) for wrist,[8] Visual Analog Scale (VAS) for pain and the DASH scale[9] at 12 and 24 weeks. The MCS assesses four parameters (Pain, functional state, range of motion and grip strength), where an excellent result scores 90-100 and poor results score less than 60. The DASH scale shows excellent results when the score is from 0-25 and poor results from 75-100. It also has two additional modules, work and sports/art, which are assessed together with the evaluation parameters. We added the Visual Analog Scale to assess pain, with 0 points (no pain) to 10 (maximum pain).

Rehabilitation: Patients were referred to physical rehabilitation on the 6th week of fracture evolution where Kirschner nails and cast were removed. Therapy started with alternate heat-cold, as well as ranges of motion active to pain tolerance. From week seven to ten, passive wrist flex-extension movements were started, as well as pronation-supination and radial and ulnar deviation to tolerance, active movements were continued. After the tenth week, muscle strengthening exercises began and this therapy continued up to week 24 of evolution when the patient was discharged from rehabilitation.

Statistical analysis: Results were compared according to the distributions shown in the results data. For parametric distributions we used the student t test, while for non parametric distributions we used the chi square test. The program used for these assessments was the STATA-IC-10-2008.

Results

The total number of patients included in our study was 60, 41 females and 19 males. The average age was 51 (range 18-81). In 37 patients the fracture was in the dominant hand while in 23 patients it was in the non dominant hand. *(Table 1)*.

Frykman classification: Patients were divided according to the Frykman classification and are grouped according to the distribution of *table 2*.

Functional results: Results in the visual analog scale were an average of, 3.22 at 12 weeks, while at 24 weeks 2.35 ($p = 0.00001$). With regards to the MCS the average obtained at 12 weeks was 80 points while at 24 weeks it was 85,3 points ($p = 0.00004$). The results of the DASH were 8.9 at 12 weeks while at 24 weeks the results were 7,9 points where this difference was not significant *(Table 3)*.

Physical rehabilitation: All patients were referred to a Specialized Rehabilitation Center in the facilities of our medical area; however, only 17 patients attended (Group 1), while 43 patients had rehabilitation on their own (Group 2).

Table 1. Total number of patients divided by gender and condition in the dominant and non dominant side.

Gender	Male	Female	Dominance	Dominant side	Non dominant side
60	20	40		37	23

Table 2. Patients distributed according to the Frykman Classification.

Frykman	Type I	Type II	Type III	Type IV	Type V	Type VI	Type VII	Type VIII
Total	2	4	5	8	13	6	11	11

Due to this situation we were able to obtain a comparison between these groups with the following results in the VAS, MCS and the DASH scales.

Visual analog scale (VAS): In the results to evaluate pain, group 1 patients (rehabilitation) referred an average of 2,64 points at 12 weeks, while patients of group 2 (without rehabilitation) referred 3,44 points (p = 0.0103); while at 24 weeks, patients in group 1 referred an average of 1,94 points and those of group 2 presented an average of 2,51 (p: 0.0369) *(Chart 1)*.

Mayo clinic scale: Patients of group 1 after 12 weeks of evolution presented an average of 86,7 while those in group 2 showed an average of 77.8 (p = 0.00001); while at 24 weeks of evolution group 1 presented an average of 83,4 points and patients in group 2 shoed 82.2 (p: non significant) *(Chart 2)*.

DASH scale: In the assessment of this scale, patients in group 1 at 12 weeks of evolution presented an average of 4.3 while those of group 2 had an average of 10.51 (p = 0.00001); and at week 24 of evolution the average of group 1 was 3.11 while those in group 2 had an average of 9.81 (p = 0.00001) *(Chart 3)*.

Table 3. Patient results according to the DASH, MCS and VAS scales, results at 12 and 24 weeks and statistical significance.

	12 wks	24 wks	p
MCS	80 pts	85.3 pts	0.00004
DASH	8.9 pts	7.9 pts	N/S
VAS	3.22	2.35	0.00001

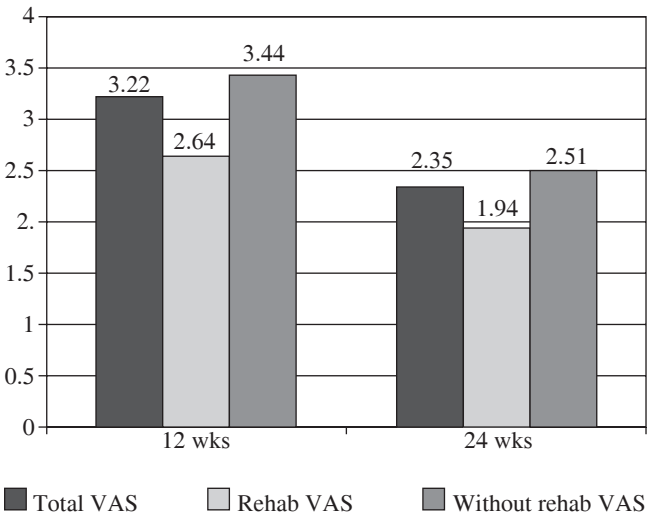

Chart 1. VAS Results. Total number of patients, those who received rehabilitation and those who did not. Values at 12 and 24 weeks.

Discussion

McAuliffe et al[10] performed a study where their hypothesis was that poor results in Colles fractures like wrist stiffness could be prevented by decreasing the wrist immobilization time. Two groups of patients were evaluated with 3 and 5 weeks of immobilization, they found improvement in mobility after one year in the 3 week group, but it was significant only in pronation, they also found an improvement in pain in patients who wore a cast for 3 weeks that was significant at 3 months and after 1 year. In an X-ray they also measured dorsal and radial angulation, deviation and radial shortening that were significant at 3 months and after one year.

While Fuji K et al[11] assessed 22 patients treated in a conservative fashion or through percutaneous fixation with an average age of 69.4 years, using the Saito demerit scale; they found excellent functional results in 10 patients, good in ten more patients and moderate in two patients.

Our results showed that percutaneous fixation and immobilization with an antibrachipalmar cast is a method that is still effective and patients had significant pain improvement after 12 to 24 weeks, there was improvement also in the MCS for wrist, scoring 80 points, while at 24 weeks it was 85,3 points, thus being significant, however, the DASH score was not significantly better after 24 weeks, these results were obtained when we assessed all our patients without comparing those who went to rehabilitation against patients who did not.

Kreder HJ et al,[12] assessed 179 patients, 88 of which had percutaneous fixation while 91 patients had internal fixation. Assessed through the Musculoskeletal Functional Evalua-

tion (MFE) and the SF-36 they found better function in the percutaneous group that was significant at 6 months but not at 1 to 2 years. Likewise for the evaluation of pain at 6 months which proved to be better in the percutaneous group.

Young C et al[13] evaluated 85 patients after 7 years of treatment with external fixation or immobilization with cast for Colles fractures, they found a rate of satisfaction that was similar in both groups of patients, although the external fixation group showed less radial shortening, they concluded that there is no significant difference between both treatments in the long term.

The reason physiotherapy is prescribed after a fracture of the distal end of the radius is that primary immobilization is performed, which is the most important principle to treat a fracture and it generally starts on week 7 or 8 after the injury.[4,5] Early reduction of edema is essential for the hand function.

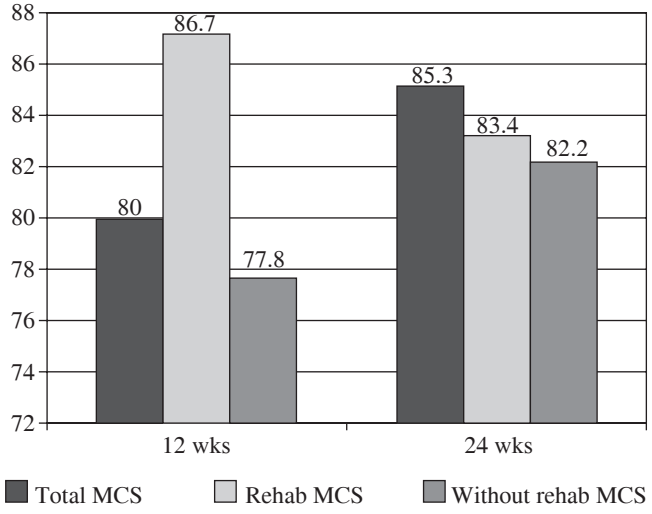

Chart 2. MCS Result. Total number of patients and divided into whether they received rehabilitation or not. Evaluation at 12 and 24 weeks.

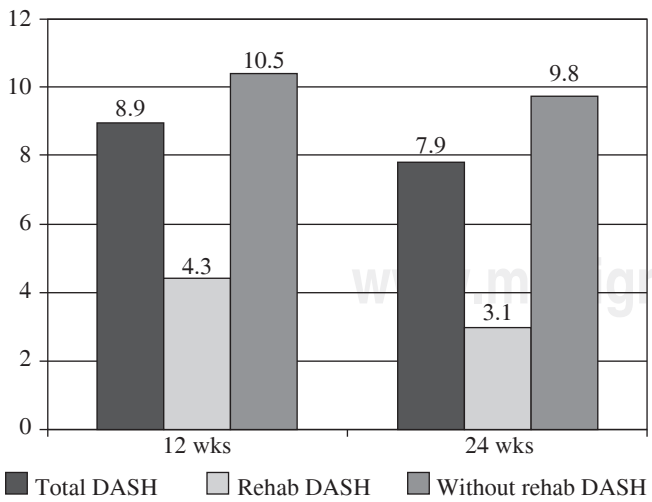

Chart 3. DASH Results. Evaluation at 12 and 24 weeks. The patient's total DASH result is shown and then it is divided into whether they received rehabilitation or not.

Thermal changes to increase venous return. Exercise programs consist of passive movements, massages for scars, progressive resistance exercises, massage and active movements. Physical therapy is followed by occupational therapy for 3 weeks.[14-16] Tai-Chi body balance exercise has not shown to decrease the rate of falls in patients with hip fractures; however, those patients with Colles fractures who show only a mild strength reduction are more prone to benefit from it.[17]

When we compared in our study the group of patients who went to rehabilitation with those who did not, we found a significant improvement both in the VAS as well as in the MCS at 12 and 24 weeks in those patients who went to rehabilitation. There was also significant improvement in the comparison of the DASH scale in these groups of patients unlike when the whole group of patients was evaluated.

For percutaneous nailing, multiple techniques have been described using Kirschner nails with the following diameters in inches: 0,045-0.062 (1.142 a 1.575 mm), placed throughout the styloid process or through the fracture site; in distal fragments to aid in the reduction and through the distal radio-ulnar joint for the treatment of instabilities. We recommend the use of fluoroscopy to evaluate and reduce the fracture.[18-24]

Koval et al[3] refer that pain during the follow up time was absent in 36% of patients with percutaneous fixation compared with 32% of open fixation. Also 17% of patients with percutaneous fixation referred normal function compared to 12% of those treated with open fixation. 30% of patients with percutaneous fixation were referred as without deformity, while those treated with open fixation were 32%.

The limitations of our study were the few patients who accepted to be in our study, and short term follow up which, although patients returned to the previous level of injury, it is necessary to perform an assessment at least after one year and three years of evolution to see if there is any degree of limitation developed by patients. There was little participation from patients when going to physical rehabilitation due to several factors such as: education, finances or simply because the patient was undecided.

However, the strong points of our study were that we were able to obtain a comparative group in those who went to rehabilitation and those who did not. In the significant results we obtained with specific disability scales of the upper limb and/or wrist, we demonstrated that in spite of having new treatment methods with less immobilization time and a faster incorporation to prior activities, percutaneous fixation and immobilization with a cast is still a valid option for certain patients when their conditions, whether financial or cultural, do not allow for the internal fixation treatment option.

In conclusion, we believe that percutaneous fixation is still an excellent fixation method for certain types of distal end of the radius, even though we obtained moderate results in patients with intra-articular traces. Early rehabilitation should always be recommended strongly in order to reach the condition prior to the injury. Improvement shown in the VAS, in the DASH and the MCS scales confirm it.

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