Conservative vs. surgical management of ulnar styloid fractures associated with distal radius fractures

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ABSTRACT

Objectives: To evaluate potential differences in clinical and radiological outcomes after surgical versus conservative management of ulnar styloid fractures associated with unstable distal radius fractures treated by locked volar plating. **Materials and Methods:** This was a multicenter, retrospective and descriptive study including surgical patients treated at four different institutions between 2009 and 2012 for ulnar styloid fractures associated with unstable distal radius fractures. Ulnar styloid fractures were treated conservatively in group I and surgically in group II. **Results:** The average follow-up was 56 months. The study included 57 patients divided into two groups (group I [29 cases] and group II [28 cases]). Patients in group II had 2.76 times (95% CI: 1.086; 8.80) more chances of achieving bone union than those in group I. DASH and pain scores, both at rest and during activity, did not show significant differences between the two groups (p = 0.276 and p = 0.877). Group I presented milder ulnar deviation and better strength (p = 0.0194 and p = 0.024). **Conclusions:** Although patients who underwent surgery for ulnar styloid fractures had 2.76 more chances of achieving bone union than those who received conservative management, there were no significant differences between both groups in subjective evaluations (DASH and pain scores) or when considering the degree of ulnar styloid involvement. However, the parameters of strength and ulnar deviation were better in the conservative management group.

Keywords: Ulnar styloid fracture; distal radius fracture; surgical management; conservative management.
Level of Evidence: III

Tratamiento conservador versus tratamiento quirúrgico de fracturas de estiloides cubital en el contexto de fracturas del radio distal

RESUMEN

Objetivo: Determinar si los resultados clínicos y radiográficos difieren después del tratamiento conservador y el tratamiento quirúrgico para las fracturas de la estiloides cubital asociadas a fracturas inestables del radio distal tratadas mediante placa volar bloqueada. **Materiales y Métodos:** Estudio multicéntrico, retrospectivo y descriptivo que incluye pacientes operados en cuatro instituciones, entre 2009 y 2012. Todos tenían fracturas de la estiloides cubital en el contexto de una fractura del radio distal. Las fracturas de la estiloides cubital fueron tratadas de forma conservadora (grupo I) o con cirugía (grupo II). **Resultados:** El seguimiento promedio fue de 56 meses. Se evaluó a 57 pacientes; grupo I (29 casos) y grupo II (28 casos). Los pacientes del grupo II tuvieron 2,76 veces (IC95% 1,086; 8,80) más posibilidades de lograr una consolidación que aquellos del grupo I. El puntaje DASH y el dolor, tanto en reposo como en actividad, no presentaron diferencias significativas (p = 0,276 y p = 0,877). La desviación cubital y la fuerza obtuvieron mejores resultados en el grupo I (p = 0,0194 y p = 0,024). **Conclusiones:** Aunque los pacientes con estabilización quirúrgica de la estiloides cubital tuvieron 2,76 más posibilidades de lograr la consolidación que aquellos del grupo I, no hubo diferencias significativas en la evaluación subjetiva (DASH y dolor) entre ambos grupos. Tampoco hubo diferencias significativas cuando se consideró el grado de compromiso de la estiloides cubital, pero la fuerza y la desviación cubital presentaron mejores resultados en el grupo sin fijación de la estiloides cubital.

Palabras clave: Fractura de estiloides cubital; fractura del radio distal; tratamiento quirúrgico; tratamiento conservador.
Nivel de Evidencia: III

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INTRODUCTION

Unstable distal radius fractures require an anatomical reduction and are commonly associated with ulnar styloid fractures.[1,2] The ulnar styloid plays a major role in the wrist biomechanics: the base of the ulnar styloid and the fovea constitute sites of insertion for the primary stabilizers of the distal radioulnar joint (DRUJ) and also play a role in the stabilization of posterior ulnar tendon and ulnar carpal ligaments.[3] Ulnar styloid fractures accompany 50% or more of distal radius fractures and approximately 25% of them do not heal properly; however, most are asymptomatic.[4] There is currently no general agreement on whether the ulnar styloid fractures influence on the normal function of the DRUJ after the open reduction internal fixation (ORIF) of distal radius fractures[5], and there are concerns that ulnar styloid fractures associated with distal radius fractures may be an indicator of associated soft-tissue injuries with increased risk of disability.[2,6-8] While some studies suggest that ulnar styloid fractures bare have little effect on radiographic or clinical outcomes, other studies showed that these fractures can contribute to poor patient-reported outcomes, including pain, stiffness, and weakness, and DRUJ instability.[3,9,10]

This study seeks to evaluate potential differences in clinical and radiological outcomes from surgical versus conservative management of ulnar styloid fractures associated with unstable distal radius fractures treated by ORIF using volar locking plates after a long follow-up period.

MATERIALS AND METHODS

We carried out a multicenter, retrospective and descriptive study including surgical patients treated at four different institutions between 2009 and 2012 for ulnar styloid fractures associated with unstable distal radius fractures. Inclusion criteria were both sex patients, >18-year-old patients who underwent an ORIF for unstable distal radius fractures with volar locking plates. Exclusion criteria were <18-year-old patients and patients with distal radius fractures and unsuccessful anatomical reduction. All patients had ulnar styloid fractures which were treated conservatively (Group I) and surgically (Group II), using Kirschner pins (seven/7), tension band systems (fourteen/14), microscrew internal fixation (two/2), and suture anchors (five/5) for the triangular fibrocartilage complex by arthroscopies. Distal radius fractures classified according to the Association for the Study of Internal Fixation (AO) classification and ulnar styloid fractures were classified according to Rotella's classification,[11] which divides fractures into tip, proximal and base fractures. The decision of whether to stabilize or not the ulnar styloid depended on the institution where the patient underwent surgery: in the first institution, no styloid fracture was stabilized; in the second institution, all styloid fractures were stabilized; in the third institution, the decision was taken by the surgeon during the procedure based on the DRUJ instability after stabilizing the radius fracture using the volar plate; and in the fourth institution, the ORIF of the distal radius fracture in all procedures was associated with wrist arthroscopy and the decision to stabilize was based on the extent of the lesion as shown by this method. Dynamic instability was defined as pathologic movement of the ulna relative to the radius during pronosupination and was tested using the clunk test, as described by Jupiter, in 2009. During the clunk test the distal ulna is compressed to the radius between thumb and index finger of the physician, with simultaneous passive pronosupination. The clunk test was considered positive if a 'clunk' was palpated or perceived by either the patient or examiner.[12]

All patients were assessed using the Disabilities of the Arm, Shoulder, and Hand (DASH) score for wrist function, and anteroposterior and lateral wrist radiographs were taken to establish whether the ulnar styloid fractures had healed. A Jammar® dynamometer was used to measure force, and a goniometer was used to assess the joint movement range, using the healthy joint to compare. It was also recorded patients' age, sex, follow-up period (months), immobilization period (months), and pain response (at rest and during activity) using the Visual Analog Scale (VAS), where 0 indicates no pain and 10 indicates the worst pain ever.

Scatter diagrams and bar charts and the usual statistics were used to describe the study. Hypothesis tests and confidence intervals were addressed using generalized models with multi-level structure (Rabe-Hesketh and Skrondal, 2012), for a two-level model, given that this study includes different health institutions. These models allow for the simultaneous analysis of two different subpopulations while preserving the original hierarchical structure and using it in the calculation of the components of variance and total variance Two-level multiple logistic regression was used to calculate the odds ratio as the parameter to assess the association between the binary outcome and the group classification, using as grouping variable the health institution.

RESULTS

The study included 57 patients divided into two groups (group I [29 cases] and group II [28 cases]). The overall average follow-up was 55.98 months. When adjusted by age and sex, the follow-up period comparison shows a difference between both groups (p = 0,001). Group II follow-up averaged 14.5 months less (standard deviation [SD] 4.5) than Group I follow-up. Sex distribution was different between both groups (p = 0,0435): Group II had more women. There was no significant difference regarding age (p = 0,525), with an average of 49.5 year old (SD 1.82; confidence interval 95% [95% CI]: 45.88-53.17) (Table 1).

From the 57 patients, 52 were right-handed, and 35% of them were operated on the right hand. Group distribution revealed differences (p = 0.0501): Group I 28%; and Group II 42%.

The distal radius AO classification for Group I resulted in the following fractures: nine 23A2, one 23A3, one 23B1, eleven 23C1, five 23C2, and two 23C3; and for Group II: three 23A2, four 23A3, four 23B1, one 23B3, nine 23C1, five 23C2, and two 23C3. Distribution of styloid fracture classification showed differences between both groups (p = 0.020). Figure 1 shows that Group I had a similar number of proximal and tip fractures, while Group II had more proximal fractures (only one case of tip fracture).

In terms of bone union, there were differences associated with sex (p = 0.245) and age (p = 0.134). Thus, patients that underwent surgery (Group II) had a 2.76 more chance to successfully achieve bone union than the patients with conservative management (Group II): fracture healed in 14 of the 29 cases from Group I, and in 19 of the 28 cases from Group II.

On the other hand, the evaluation of bone union in relation to DASH score, after sex and age adjustment, showed no differences between the mean DASH scores from patients who had a successful styloid consolidation from those who did not (p = 0,870).

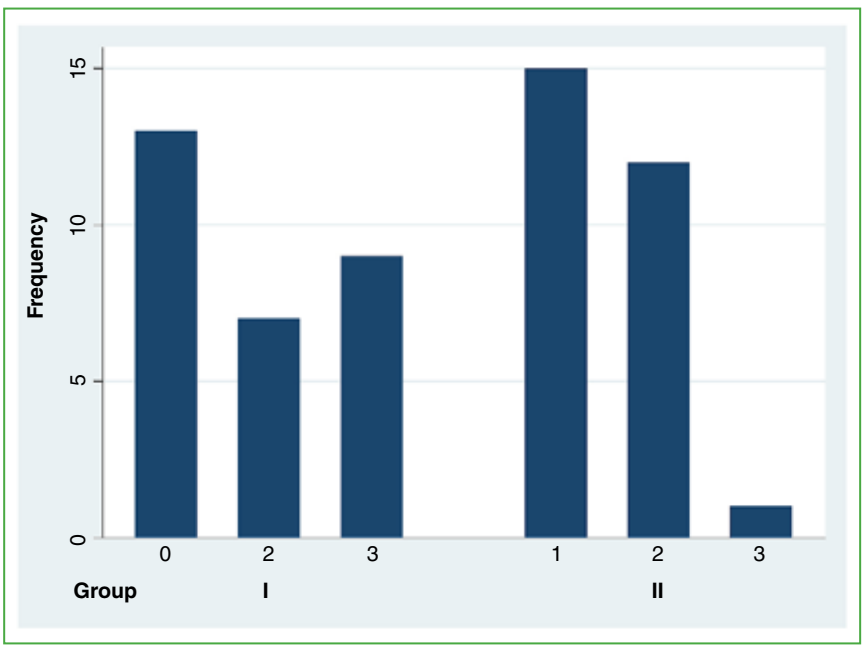

Figure 1. Distribution of the styloid fracture classification, in groups 1 = base, 2 = proximal, 3 = tip.

There were no significant differences in the mean DASH score, after sex and age adjustment, between both groups (p = 0.276) (Table 1): Group I mean DASH score was 4.10 (SD 0.57) and Group II mean DASH score was 3.67 (SD 0.42). DASH scores show a slight negative tendency associated with age: a 4% decrease as age increases (p = 0,082) (Figure 2). Nevertheless, it is worth mentioning that the study included patient groups of relatively homogeneous age ranges (Table 1).

The study of the DASH scores in relation to styloid fractures shows no differences between base and proximal fractures (p = 0.48), no differences between base and tip fractures (p = 0.811), and no differences between tip and proximal fractures (p = 0.194).

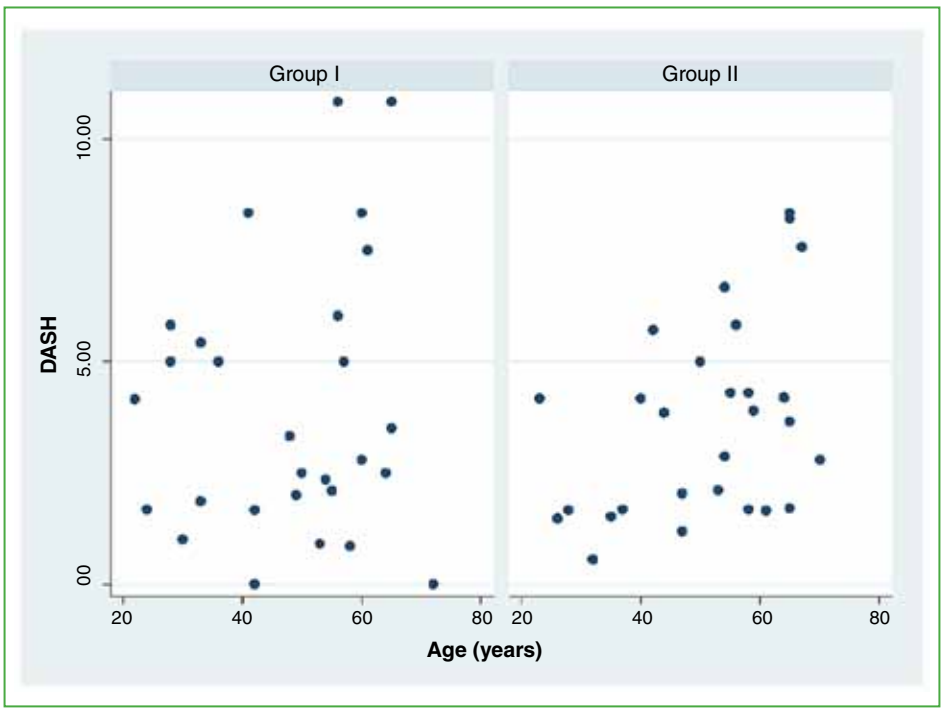

Figure 2. Scatter diagram of the correlation between the DASH score and patient's age.

In terms of pain intensity, no significant difference was found between the groups (nor at rest nor during activity) in the VAS scores (p = 0.877, p = 0.681, respectively) (Figure 3). A pianist (a Group I patient) experienced pain at rest which significantly increased while practicing his daily activities. Three Group II patients experienced mild pain at rest; however, the number of patients that experienced pain during their daily activities rose up to 11.

The joint movement range, measured with a goniometer and standardized by measuring the unoperated hand (the difference between both measures of each patient is studied and is evaluated as a dependent sample), shows different patterns within the groups; Group II shows smaller ulnar deviation mean values (p = 0.0194) (Table 1). Radial deviation and pronosupination values revealed no significant difference between both groups (p = 0.4369 y p = 0.356, respectively). In terms of force (Jammar®), parameter which was studied similarly to the previous parameters (as a dependent sample), there were significant differences (p = 0,024) after adjustments for sex (p <0.001) and age (p = 0.002). Group II mean force values were 4.5 kg smaller (SD 2.11) than those of Group I.

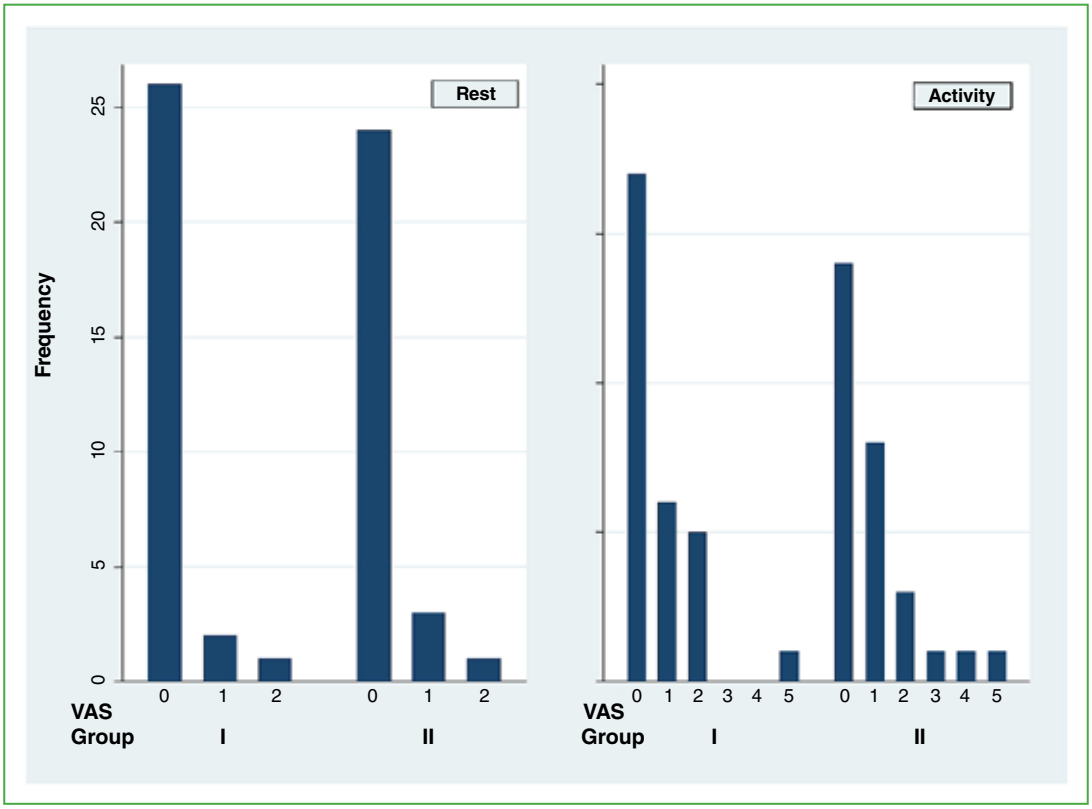

Figure 3. Distribution of pain VAS scores for both treatment groups.

Table 1. Descriptive statistics of the quantitative variables

Variable	Group I (n = 29)		Group II (n = 28)	
	Mean	SD	Mean	SD
Age (years)	49.38	2.61	50.71	2.55
Follow-up period (years)	63.14	1.95	48.43	3.74
DASH score	4.10	0.57	3.67	0.42
Ulnar deviation (°)	49.31	1.84	46.07	1.52
Force (Jammar®) (kg)	33.83	2.22	29.32	2.20

DASH = Disabilities of the Arm, Shoulder, and Hand questionnaire.

DISCUSSION

There is currently a debate on which is the ideal initial treatment for ulnar styloid fractures associated with distal radius fractures.[3,7,9,13] The reported frequency of ulnar styloid nonunion associated with distal radius fracture varies between 14% and 26% of ulnar styloid fractures.[14] Recent studies have found that ulnar styloid nonunion in patients with distal radius fractures bear little adverse influence on the postoperative outcomes.[3,4,6,7,13] Also, arthroscopic evaluations have found that there may not be a correlation between ulnar styloid fractures and triangular fibrocartilage complex injuries, which suggests that the presence of ulnar styloid fractures should not be construed as predictors for ligament injuries.[15] In our study, the Group II patients (with surgical stabilization of the ulnar styloid) had a 2.76 (IC95%: 1.086-8.80) more likely to achieve bone union than the Group I patients; however, usually, nonunion of the ulnar styloid does not produce pain since the majority of ulnar styloid nonunion cases achieve stable fibrous union.[16] In our study, we found greater wrist persistent pain (both at rest as well as during the daily activities) in the patients that underwent surgical stabilization of the ulnar styloid—although this difference did not result to be statistically significant. Daneshvar *et al*.[13] had similar results: they found that patients that undergo surgical treatment for ulnar styloid fractures had greater pain and disability than those without styloid fracture; however, in their study, the differences also did not result to be statistically significant.

In our study, follow-up averaged 56 months. The analysis of the mean DASH score shows that the differences between both groups were not statistically significant ($p = 0.276$). Kim et al. found that ulnar styloid nonunion does not to affect functional outcomes, pain scale results or DRUJ stability.[13,16] Ozaka *et al*. also failed to find statistically significant differences in outcome between patients with untreated ulnar styloid fracture and those without ulnar styloid fracture.[17] Souer *et al*. compared the outcomes between patients with a distal radius fracture associated without an ulnar styloid fracture and patients without the latter, and found no significant differences were found that a fracture of the ulnar styloid base had no significant effect on the overall outcome; however, the patients with an untreated fracture of the ulnar styloid had less grip strength and ulnar deviation.[5] In our study, where all patients had ulnar styloid fractures, grip strength was greater in Group I (without fixation) than in Group II (with fixation). We found a statistically significant difference ($p = 0.024$) of 4.5 kg for the inferior mean values in favor of Group I. On the other hand, the average ulnar deviation was greater in Group I, with statistically significant differences ($p = 0.0194$).

Our study consisted of surgical patients treated between 2009 and 2012 and the decision of whether to stabilize or not the ulnar styloid depended on the institution were the patient underwent surgery: in the first institution, no styloid fracture was stabilized (the center surgeons considered that it was not required to stabilize ulnar styloid fractures associated with distal radius fractures); in the second institution, all styloid fractures were stabilized (at the time, the center surgeons considered it as first choice treatment); in the third institution, the decision was taken by the surgeon during the procedure based on the DRUJ instability after stabilizing the radius fracture using the volar plate; and in the fourth institution, the decision to stabilize was based on wrist arthroscopy (17 of the 57 patients were surgically treated, and styloid stabilization was performed in only 7 patients). We consider that this variability is a consequence of several studies assessing DRUJ instability associated with distal radius fractures through indirect methods (clunk test) while others used arthroscopy for the diagnosis.[12] Our study only included patients that had successfully undergone anatomical reduction of the distal radius fracture through an ORIF with volar locking plates, this anatomical reduction being one of the main factors in preventing DRUJ instability in these type of lesions.[3,17-20]

Notwithstanding the ongoing debate on conservative vs. surgical management of ulnar styloid fractures associated with distal radius fractures, our 55.98-mean follow-up study found that, although Group II patients (who underwent surgery for ulnar styloid fractures) had 2.76 more chances of achieving bone union than those from Group I, there were no significant differences between both groups in subjective evaluations (DASH and pain scores). There were also no significant differences in the outcomes related to the degree of ulnar styloid involvement (tip, proximal and base fractures had similar outcomes). However, the parameters of strength and ulnar deviation were better in the conservative management group with statistically significant differences ($p = 0.0194$ and $p = 0.024$, respectively).

Conflict of interest: Authors claim they do not have any conflict of interest.

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