

Radiocarpal Fracture-Dislocation: Retrospective Evaluation of a Case Series

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ABSTRACT

Introduction: Radiocarpal fracture-dislocations consist of the total loss of contact between the articular surfaces of the first row of the carpus and the radius. They are caused by high-energy trauma. The purpose of the work is to retrospectively evaluate a series of cases to compare the incidence of these lesions, their therapeutic management and functional outcomes with the literature published by reference centers in this pathology. **Materials and Methods:** Between February 2018 and June 2020 we retrospectively evaluated patients with radiocarpal fracture-dislocations, which were classified into groups I and II according to Dumontier. Inclusion criteria: males and females over 18 years of age with closed or open radiocarpal fracture-dislocations with a minimum follow-up of 3 months. A clinical/imaging follow-up was carried out using radiographs, the DASH questionnaire (Disabilities of the Arm, Shoulder and Hand), Modified Mayo Wrist Score, visual analog scale (VAS) and Patient Satisfaction Questionnaire Short Form (PSQ-18). **Results:** Eight patients with nine lesions with an average follow-up of 8 months were evaluated. Lesions were grouped into type 1 (4) and type II (5). All were surgically treated. According to the final values, outcomes were excellent in two cases, good/acceptable in six, and poor in one. **Conclusion:** We believe that the best method for definitive treatment is surgical. The correct classification and study of the pathology will play a fundamental role in making therapeutic decisions.

Keywords: Radiocarpal luxation; Dumontier; carpus; radiocarpal ligaments; radial styloid; fracture-dislocation.

Level of Evidence: IV

Luxofracturas radiocarpianas: evaluación retrospectiva de una serie de casos

RESUMEN

Introducción: Las luxofracturas radiocarpianas consisten en la pérdida total de contacto entre las superficies articulares de la primera fila del carpo y del radio. Se producen por traumatismos de alta energía. El objetivo de este estudio fue evaluar retrospectivamente una serie de casos para comparar la incidencia de estas lesiones, el manejo terapéutico y los resultados funcionales con la bibliografía publicada por centros de referencia en esta enfermedad. **Materiales y Métodos:** Entre febrero de 2018 y junio de 2020, se evaluó, en forma retrospectiva, a pacientes con luxofractura radiocarpiana, clasificada en tipos I y II según Dumontier. Criterios de inclusión: hombres y mujeres >18 años con luxofractura radiocarpiana cerrada o abierta y un seguimiento mínimo de 3 meses. Se llevó a cabo un seguimiento clínico/por imágenes mediante radiografías, el cuestionario DASH, la escala de la Clínica Mayor modificada para muñeca, la escala analógica visual para dolor y el PSQ-18. **Resultados:** Se evaluó a 8 pacientes con 9 lesiones, y un seguimiento promedio de 8 meses. Las luxaciones eran 4 tipo I y 5 tipo II. Todos fueron operados. Según valores finales, hubo 2 resultados excelentes, 6 buenos/aceptables y uno pobre. **Conclusión:** El mejor método para el tratamiento definitivo es quirúrgico. La correcta clasificación y el estudio de la enfermedad tienen un rol fundamental en la toma de decisiones terapéuticas.

Palabras clave: Luxación radiocarpiana; Dumontier; carpo; ligamentos radiocarpianos, estiloides radial; luxofractura.

Nivel de Evidencia: IV

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INTRODUCTION

Radiocarpal fracture-dislocations are defined as the total loss of contact between the articular surfaces of the first row of the carpus (scaphoid and lunate) and the radius, with mainly volar or dorsal displacements. In addition, associated injuries can be detected in the wrist area or the proximal joints.^{1,2}

They occur in the context of high-energy trauma. There is no consensus regarding the mechanism of the injury; it is estimated that it is due to a combination of hyperextension, pronation, and radial deviation of the wrist, although some authors associate it with flexion mechanisms. These are rare lesions, with a frequency of between 0.2% and 6% of all radiocarpal lesions.¹⁻³ The classification used is the one proposed by Dumontier, which divides these lesions into two groups.¹⁻⁴

There is agreement that the management of this condition in the acute stage is carried out in two stages: firstly, the reduction (closed or open, if necessary) and, secondly, the definitive surgery.¹⁻⁴ Regarding the surgical method used, the literature is contradictory.¹⁻³

The objective of this study was to retrospectively evaluate a series of cases from our Service to compare both the incidence of these lesions and the therapeutic management and functional outcomes with the literature published by centers of reference in this condition.

MATERIALS AND METHODS

We carried out a retrospective study of patients treated between February 2018 and June 2020. The inclusion criteria were: men and women >18 years of age with a closed or open radiocarpal fracture-dislocation diagnosed and classified by radiographs and with a minimum follow-up of three months. The exclusion criteria were: Barton fractures (they are the only wrist injuries that can be misinterpreted as Dumontier; however, they are differentiated by the absence of incongruity of the articular facet), not having radiographs upon admission that document the dislocation, lack of postoperative controls.

In the emergency department, anteroposterior and lateral radiographs of the wrist or forearm were taken (Figure 1). Age, sex, mechanism of injury, and associated injuries were recorded. One patient had a tibial pilon fracture; another, a femoral and tibial shaft fracture; and another, a Monteggia fracture-dislocation, a tear wound in the thigh, foot phalanx and second metacarpal fractures, and severe traumatic brain injury that required admission to the Intensive Care Unit for 14 days (Table 1).



Figure 1. Case 3. Anteroposterior and lateral wrist radiographs upon admission and after reduction.

Table 1. Patients' data

Case	Sex	Age	Dumontier	Exposed	Mechanism	Reduction / immobilization in acute stage	Associated injuries	Dominant limb
1	F	46	II	No	Does not remember (APP)	Closed / Long arm cast	No	Yes
2	M	33	I	No	Extension (APP)	Closed / Long arm cast	Scalp on knee	Yes
3	M	20	I	No	Does not remember (fall from height)	Closed / Long arm cast	No	Yes
4	F	47	II	GI	Does not remember (APP)	Closed + IV AB / Long arm cast	No	No
5	M	21	I	No	Extension (APP)	Closed / Long arm cast	Femur / tibia and fibula fractures	Yes
6	M	25	I	No	Extension (fall from height)	Closed / Long arm cast	Tibial pilon fracture	Yes
7	M	30	II	No	Does not remember (APP)	Closed / Long arm cast	Monteggia fracture-dislocation, 2° fracture. MTC, thigh scalp, severe TBI	No
8	M	29	II	No	Extension (APP)	Closed / Long arm cast	No	Yes
9	M	29	II	No	Extension (APP)	Closed / Long arm cast	No	No
Averages	M 75%	31.1	I 44.5%	No 88.9%	Does not remember 44.4%	Closed / Cast 88.9%	No 55.5%	Yes 66.6%
	F 25%		II 55.5%	GI 11.1%	Extension 55.6%	Closed + IV AB / Cast 11.1%	Ipsilateral lesion 11.1%	No 33.3%
					APP 77.7%		Other injuries 44.4%	
					Fall from height 22.3%			

M = male, F = female, GI = Gustilo-Anderson, APP = accident in a public place, IV AB = intravenous antibiotic, MTC = metacarpal, TBI = traumatic brain injury.

Each patient's injuries were analyzed and two different groups were formed according to the Dumontier classification (Table 2). A closed reduction was performed in the emergency department under local anesthesia with axial traction and dorsal/palmar deviation according to the dislocation and a long arm cast was placed for immobilization. Subsequently, a computed tomography (Figure 2) of thin axial, coronal, and sagittal sections with 3D reconstruction was requested for surgical planning. If the fractures were exposed, they were treated within three hours of their occurrence under the hospital infectious protocol according to the Gustilo-Anderson classification. Patients with type I exposure received cephalothin intravenously for 24 hours, and those with types II and III received clindamycin plus gentamicin for 72 hours, in addition to surgical debridement.

Table 2. Dumontier classification of radiocarpal fracture-dislocations (2001)

Classification	Injury	Treatment
Group I	Pure radiocarpal joint dislocation + cortical avulsion / radial styloid tip fracture	Palmar repair of radiosaphocapitate + long radiolunate ligaments Dorsal avulsion is not treated as it is considered a Bankart capsule-periosteal injury rather than a tear of the dorsal ligaments.
Group II	Radiocarpal joint dislocation + radial styloid fracture of at least one third of the scaphoid fossa	Dorsal osteosynthesis of the radial styloid fragment

**Figure 2.** Case 3. Computerized tomography of the wrist after reduction.

Regarding the surgical technique, this type of injury usually requires osteosynthesis of the radial styloid, re-anchoring of the joint capsule, and ligament suture (short radiolunate). The Henry approach was used for the distal radius (Figure 3). Dorsal approaches were not necessary due to the correct indirect reduction of the fracture fragments. Stability/reduction was controlled by dynamic fluoroscopy in the operating room (Figure 4).



Figure 3. Case 3. Intraoperative images. Modified Henry approach.

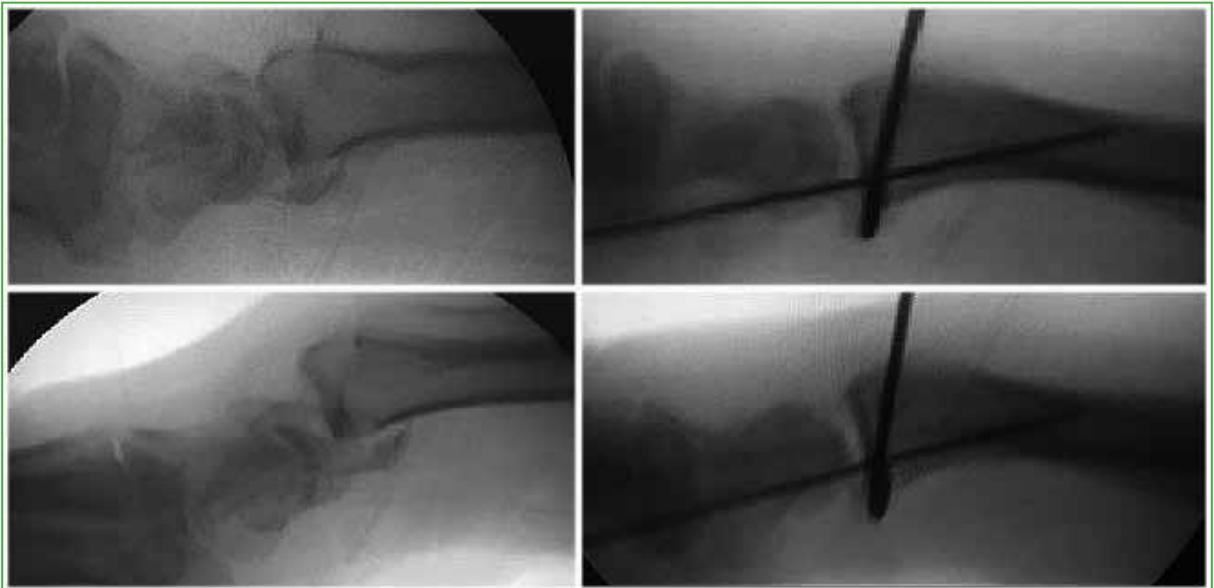


Figure 4. Case 9. Images obtained with the intensifier in the operating room.

By decision of the treating surgeon, two patients were immobilized after surgery with a short arm cast and seven, with a short arm splint for an average of 30 days (range 28-45). After 30 days, on average, the imaging studies were repeated, and the immobilization was removed to begin with passive and active movements guided by professionals. No differences were found regarding the immobilization method used. Osteodesis elements were removed at 4-6 weeks; two patients had local skin intolerance that disappeared when immobilization was removed.

Controls were performed at 15, 30, 90, 180, and 345 days with anteroposterior and lateral wrist radiographs (Figures 5 and 6). From the objective clinical/functional point of view, the ranges of motion in flexion, extension, pronosupination, and ulnar and radial deviation were evaluated, taking the healthy contralateral limb as the normal reference parameter on a scale from 0% to 100%.

As a complement to the subjective assessment, the DASH questionnaire and the modified Mayo Clinic wrist score were used. The degree of pain was determined with the visual analog scale (0 = no pain, 10 = maximum pain). The level of patient satisfaction was determined using the Patient Satisfaction Questionnaire Short Form (PSQ-18) as very satisfied, satisfied, not very satisfied, and dissatisfied. Signs of nonunion (delayed union/non-union), osteoarthritis, and associated alterations to the distal radioulnar joint were looked for.



Figure 5. Case 3. Anteroposterior and lateral wrist radiographs in the immediate postoperative period.

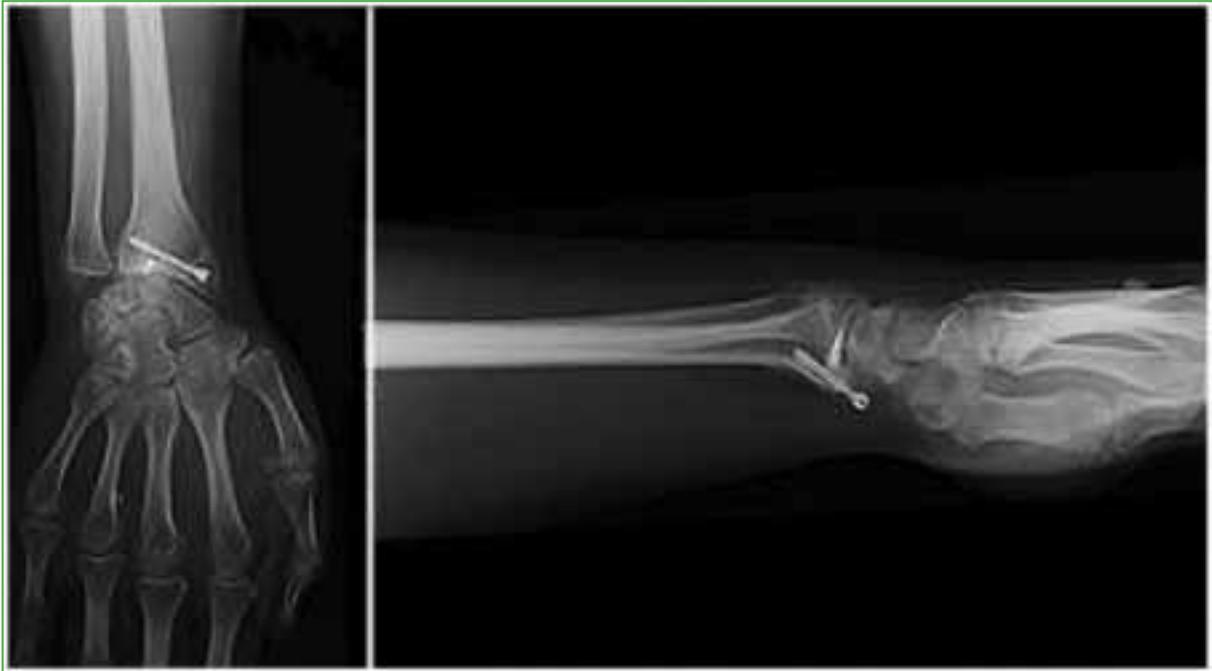


Figure 6. Case 5. Anteroposterior and lateral wrist radiographs 15 months after surgery.

RESULTS

We evaluated a retrospective series of eight patients with nine radiocarpal fracture-dislocations (one bilateral). There was a predominance of males (75%). The average age was 31.1 years (range 20-47).

The mechanism of injury involved falls from height (2 cases) or accidents in a public place (3 cases) with an extended wrist; the rest of the patients do not remember the mechanism, although the accidents were high-energy.

Four dislocations were Dumontier type I with volar displacement, while five were type II (4 with volar displacement and 1 with dorsal displacement; one patient had bilateral lesions, both in the volar direction).

The average time of evolution until surgery of the nine radiocarpal fracture-dislocations was 5.3 days (range 3-11). Given our experience with the modified Henry approach for the distal radius, we used in eight cases; a dorsal approach was not necessary. In one patient, closed reduction was acceptable and we decided to perform percutaneous fixation.

On six occasions, a palmar plate was used for reduction and support of the facet joint. In contrast, three patients required only osteodesis at the level of the radial styloid, and one required double fixation (using osteodesis and osteosynthesis) to achieve greater stability, in addition to an interfragmentary Herbert screw in order to simplify a comminuted line. It should be mentioned that, in three cases, harpoons were used as a method of repair of the joint capsule in combination with fixation of the radial styloid, without requiring a palmar plate. Additionally, in three cases, a repair was necessary by suturing the short radiolunate ligament.

One of the fracture-dislocations was exposed (Gustilo-Anderson type I) and was treated according to protocol. No patient had a sensory-motor deficit or associated vascular disease.

After an average follow-up of eight months (range 3-12), we evaluated the range of motion in flexion, extension, and pronosupination, and the ulnar and radial deviations in comparison to the contralateral limb (Figure 7) (except the patient with bilateral injury in whom each lesion was evaluated separately) and we determined that the range of motion was 75-99% in four patients; 50-74% in four patients, and 25-49% in one patient, respectively.

With the data collected, we can establish that the outcomes were excellent in two cases (91-100%), good/fair in six cases (65-90%), and poor in one case (<65%).

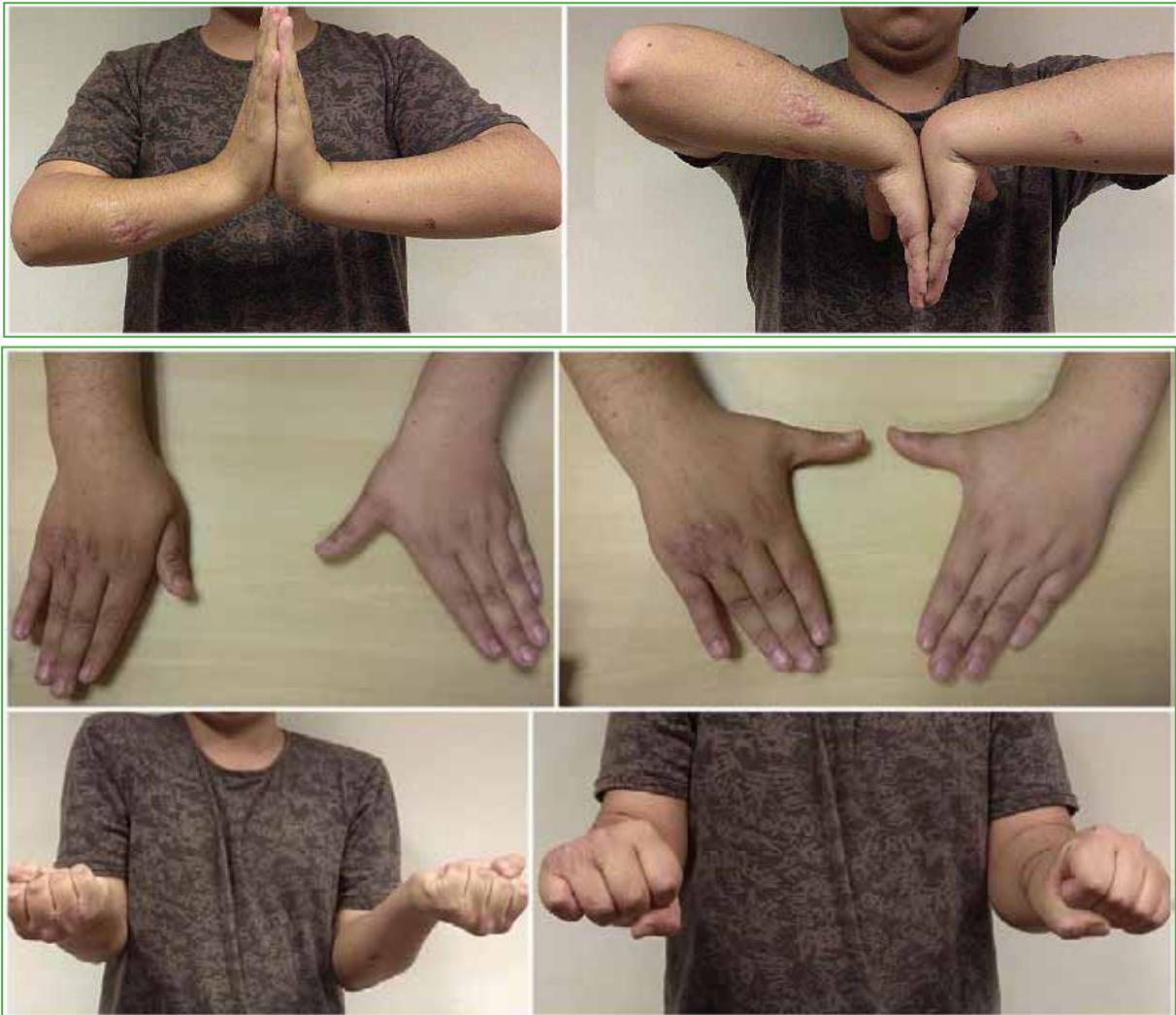


Figure 7. Case 3. Functional outcomes 12 months after surgery. Range of motion 75-99%, based on the Mayo Clinic Modified Wrist Score.

The subjective assessment regarding pain according to the visual analog scale yielded an average of 1.2 (range 0-3) at rest and 3.8 (range 0-8) in activity. The results, verified at the end of follow-up using the DASH questionnaire and the Modified Mayo Wrist Score, are shown in [Table 3](#). Finally, the levels of satisfaction according to the PSQ-18 were very satisfied (2 patients), satisfied (5 cases), and dissatisfied (the remaining cases), in spite of being able to perform basic/daily tasks.

DISCUSSION

A retrospective study was conducted in which a series of patients with radiocarpal fracture-dislocations was evaluated. In line with the literature, these types of injuries are infrequent; in our Service, they have an incidence of 4.5 cases per year.⁵ According to the literature, these injuries are predominantly produced by high-energy mechanisms, affect mainly the male sex, and take place mostly during the third decade of life; this is consistent with the findings in this study.^{1,2,3,5}

Unlike most studies that report a predominance of dorsal displacement, our cases presented a volar predominance.^{1,2} The systematic classification and staging of this condition allow guiding and facilitating treatment planning.¹⁻³

Table 3. Clinical-functional outcomes

Case	Rehabilitation (postoperative days)	Motion (%)	Mayo Clinic Score	DASH	VAS (pain)	VAS (pain in activity)
1	30	90%	Good (85)	11.6%	1	2
2	28	95%	Excellent (92)	7.5 %	0	1
3	33	85%	Good (80)	15%	1	3
4	40	70%	Poor (75)	23.3%	2	7
5	30	60%	Poor (70)	20.8%	2	7
6	35	99%	Excellent (95)	9.9%	0	0
7	35	35%	Poor (60)	65.8%	3	8
8	42	70%	Good (80)	16.6%	1	4
9	28	70%	Good (85)	15.8%	1	3
Averages	Yes 100%	Low 66.6%	Excellent 22.2%	20.7%	.2	3.8
	33.4 days	Moderate 22.2%	Good 44.4%			
		High 11.1%	Poor 22.2%			
			Poor 11%			

VAS = visual analog scale.

In the studies presented by Dumontier, repair of the radiocarpal ligaments (by direct suture or harpoons) is important to avoid ulnar displacement of the carpus, as well as residual instability.¹⁻³ He proposes a palmar approach to type I injuries, placing Kirschner wires on the radial styloid to increase stability, in contrast to type II injuries in which a dorsal approach is recommended, guaranteeing anatomical reduction.

As Cornu pointed out, stabilization with Kirschner pins and immobilization for 4 to 6 weeks are sufficient measures to achieve ligament healing.⁶ In our center, we used a modified Henry palmar approach, with no associated complications. The fixation of the radial styloid was given primary importance for the stability of the long radiolunate and short radiolunate ligaments.

Potter et al. propose the placement of a radiocarpal bridge plate complemented with ligamentoplasty through a dorsal approach. The authors obtained good results, although without a follow-up that allows us to draw final conclusions about this technique.⁷

Spiry's reports established the need to complement the selected fixation method with Kirschner pins for comminuted fractures. In addition, he reports that six patients required radiocarpal arthrodesis.⁴ In our study, it was not necessary to reoperate on any patient.

No signs of osteoarthritis were found. Several authors state that it is a frequent complication in patients with associated intracarpal lesions without repair and that they appear approximately 24 months after surgery.¹⁻³ To diagnose them, Spiry and Girard propose using intraoperative dynamic fluoroscopy, the arthroscope, or postoperative computed tomography.^{4,5}

The limitations of our study are the retrospective design and the limited number of the sample, together with the heterogeneous treatment used due to the low incidence of this condition. Moreover, the follow-up was short, especially in some patients, but it reached the minimum required to achieve the proposed objectives. However, a longer follow-up would help to continue documenting clinical and imaging findings (especially those of a chronic nature). It should be mentioned, however, that this is mainly conditioned by the difficulty our population has in contacting and accessing the center. We consider that having addressed a rare traumatic condition is the main strength of our study. We propose the possibility of carrying out a prospective, randomized and multicenter study with more cases and a longer follow-up in order to document the evolution of this complex condition and its complications.

CONCLUSIONS

Radiocarpal fracture-dislocations are rare injuries associated with high-energy trauma; initial management requires a precise and early diagnosis, followed by reduction and computed tomography to better evaluate the lesion. Treatment is surgical, and correct classification and study are essential to determine an ideal therapeutic approach.

We have found two main lines of treatment. In spite of their differences, the functional outcomes have been similar and comparable, without ulnar displacement of the carpus or residual instability. The importance of fixation of the radial styloid is a common point to guarantee ligament stability.

Conflict of interest: The authors declare they do not have any conflict of interest.

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