

Research Article

Radiocarpal-Fracture Dislocations: A Report of 14 Consecutive Cases

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Abstract: Background: Radiocarpal fracture-dislocations (RCFD) constitute a rare and serious wrist injury with several classifications and proposed treatment modalities in literature. The present study seeks to identify common radiographic lesions, to determine popular treatment modalities and how these influence functional outcome and prognosis through a retrospective review of 14 consecutive cases. **Patients and Methods:** We retrospectively reviewed the records of 14 patients who underwent operative treatment for radiocarpal fracture dislocations at the Department of Trauma and Orthopedic Surgery A, CHU Hassan II, Fes between 2010 to 2017. 12 patients with dorsally displaced radiocarpal fracture dislocations and two cases involving volar displacement were managed using both closed and open reduction techniques. 12 cases underwent open reduction and internal fixation of bony fragments. **Results:** Functional outcome was assessed according to Grumillier criteria. Overall 10 patients had good functional outcome after treatment. 03 patients showed moderate outcome with wrist stiffness and occasional pain during weight bearing. One case with poor outcome was marked by wrist stiffness and complex regional syndrome. **Conclusion:** Radiocarpal fracture dislocations constitute a rare yet challenging injury that could potentially complicate high energy traumas in young adults. Management is emergent and entails closed or open reduction with internal fixation of severely displaced associated bony lesions. Prognosis and long term outcome depend on radiocarpal osteoarthritis hence the need for near anatomic reduction.

Keywords: Fracture; Radiocarpal; Dislocation; Wrist; Prognosis.

INTRODUCTION

Radiocarpal fracture dislocation represents a complex ligamentous injury of the wrist characterized by a dislocation of the radiocarpal joint associated with a volar or dorsal distal radius fragment. Fractures of the radial and ulnar styloid are common bony insults.

It is a rare lesion accounting for 0.2% of all dislocations usually caused by high-energy trauma (Tsuruta, T. *et al.*, 1981; Dunn A.W. 1972).

Several pathological entities have been previously described with posteriorly displaced radiocarpal fracture dislocations the most commonly reported group although other groups (notably pure radiocarpal dislocations and even anteriorly displaced subgroups) are seldom reported (Howard, R. F. *et al.*, 1997; Loubignac, F. *et al.*, 1999; Moore, D. P., &

McMahon, B. A. 1988; Thomsen, S., & Falstie, J. S. 1985).

Radio-carpal dislocations representing pure ligamentous injury are even more poorly documented having been the subject of isolated reports in literature.

Nonetheless radiocarpal joint congruity remains the main prerequisite of treatment that seeks to restore wrist anatomy as a principal indicator of good functional outcome according to several authors.

Thus, the present retrospective study seeks to highlight the pathophysiology and mechanism, morbidity as well popular treatment strategies for radiocarpal fracture dislocations.

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PATIENTS AND METHODS

Between 2010 to 2017, 14 patients were managed for RCFD. Upon admission at the emergency room, all patients underwent radiographic assessment entailing standard wrist x-rays, AP and lateral views. 12 patients with dorsally displaced RCFD and 02 cases with volar displacement were managed using closed and open reduction techniques. Open reduction internal fixation was carried out in 12 cases with severe displacement and or open wounds.

Two classification systems were used preoperatively. Dumontier *et al.*, previously described a system (Dumontier, C. *et al.*, 2001) which divides RCFDs into two groups: Group I comprising of pure radiocarpal dislocation or associated with bony avulsion

of the tip of the radial or ulnar styloid, while Group II was composed of RCFDs with radial fractures exceeding a third of the scaphoid fossa. The second system is that of Moneim *et al.*, (1985) that divides radiocarpal dislocation into two types depending on intercarpal involvement:

- Type I: without intra-carpal dislocation (which can be treated by simple closed reduction and plaster cast immobilization).
- Type II: with intra carpal involvement (thus requiring open reduction and intra carpal fixation) (Table I). We excluded cases with incomplete preoperative radiography as well as Barton (displaced marginal distal radius) fractures.

Table I: Classification of Radiocarpal Dislocations:

Classification according to Dumontier <i>et al.</i> , (2001)	Moneim <i>et al.</i> , (1985)
Group I: pure ligamentous injury or associated with avulsion fractures of radial styloid.	Type 1: Radiocarpal dislocations without intracarpal dislocation or subluxation
Group II: radiocarpal fracture dislocations with radial styloid fracture exceeding a third of the scaphoid fossa.	Type 2: Radiocarpal dislocation with intra-carpal involvement.

At the last follow up, functional outcome was assessed using the Grumillier scale (Table II),

measuring wrist ROM and grip strength, pain on weight bearing as well as any complex regional syndrome.

Table II: Outcome using Grumillier scale:

Subjective measures :	Objective measures :			
	F	E	PS	RI-UI
Very Good Normal wrist function	> 50°	> 50°	> 130°	> 30°
Good Occasional pain Moderate reduction in grip strength No limitation in wrist function	30–50°	30–50°	100–130°	10–30°
Average Pain on radial inclination Moderate stiffness Weak grip strength Complex regional pain syndrome	15–30°	10–30°	70–100°	< 10°
Poor Marked stiffness Severe Pain Complex regional pain syndrome	Elbow stiffness with limited ROM in all planes			

F: Flexion

E: Extension

PS: Prono-supination

RI-UI: Radial inclination, Ulna inclination

RESULTS

Mean age was 25 years old (20-35 years) and the right side mostly affected and the dominant side in all men patients involved. Mechanism of injury was a fall on an outstretched hyper-extended hand.

On admission, all patients had severe pain with functional impairment of the wrist. A Gustillo stage I wound was found in one patient whereas no vascular compromise was observed during the period.

Initial radiographic assessment included standard wrist x-rays AP and lateral views and elbow views to rule out associated injuries.

Management entailed emergent reduction usually carried out within the first six hours following injury. In all, 12 patients underwent closed reduction with percutaneous pinning whereas two cases underwent closed reduction only. All patients were immobilized in a plaster cast postoperatively for up to 6 weeks. Kirschner wires were removed after 6 weeks. Physical therapy was initiated after pin removal. No

procedures were undertaken for acute capsulo-ligamentous repair in all cases

Functional outcome was measured using the Grumillier scale.

At the last follow up, 10 patients had a good functional outcome with only slight occasional pain,

good ROM and return to work at an average of 16 months.

03 patients had fairly good outcome with moderate wrist stiffness and occasional pain on wrist loading. A single patient exhibited poor outcome with marked stiffness and complex regional syndrome. Patient had undergone closed reduction for an open RCFD with percutaneous pinning.



Figure 1: Wrist x-ray before and after closed reduction of RCD with a marginal volar distal radius fragment.



Figure 2: X-ray (preoperative et postoperative) of volar displaced RCFD with open reduction percutaneous pinning of radial styloid (note associated ulna styloid avulsion).



Figure 3: X-ray before and after open reduction internal fixation of RCFD with dorsal displacement and articular distal radius fracture.



Figure 4: wrist x-ray showing closed reduction screw fixation of RCFD with articular distal radius fracture.



Figure 5: Preoperative image showing an open dorsally displaced fracture with extensive soft tissue injury and major wound contamination requiring debridement

DISCUSSION

RCFD are rare injuries that complicate high energy trauma in young adults (Mourikis, A. *et al.*, 2008; Ilyas, A.M., & Mudgal, C.S. 2008), with serious potential wrist functional impairment due to complex capsulo-ligamentous insult with intra-carpal involvement (Girard, J. *et al.*, 2004) and even neurovascular compromise, median nerve palsy in particular according to literature.

Displacement is often dorsal (Lahtaoui, A. *et al.*, 2002) with frequent radial styloid fracture as associated lesion (Dahmani, O. *et al.*, 2013) thereby making pure forms exceptional (Fennell, C. W. *et al.*, 1992 ; Naranja, J. R. *et al.*, 1998).

Treatment is emergent and it entails reduction -internal fixation of bony lesions mostly with pins and screws (Fernandez, D.L., & Ghillani, R. 1996 ; Varodompun, N. *et al.*, 1985) followed by plaster cast immobilization for up to 6 weeks according to several authors.

Non conservative treatment involving proximal row carpectomy, wrist arthrodesis or even total joint replacement could be considered in neglected cases.

For type 1 lesions (Spiry, C., & Laulan, J. 2015):

Management requires near anatomical reduction that may be aided by a mini invasive posterior approach. Ideally it is recommended as a general rule of thumb to undertake:

- A temporary arthrodesis (arthroereisis) of the radio-scaphoid (RS) and radio-lunar (RL) joint to allow for capsulo-ligamentous healing or,
- Open or arthroscopic repair of the posterior capsulo-ligamentous complex.
- However, it is not mandatory to repair the posterior capsulo-ligamentous complex through a volar approach.

For type 2 lesions (Spiry, C., & Laulan, J. 2015):

It is paramount to achieve anatomic reduction of articular distal radius fracture

- With percutaneous pinning or screw fixation.

As For Marginal Distal Radius Fractures:

- Posterior marginal fracture: Reduction through a dorsal approach and osteosynthesis of fracture of radial styloid and marginal lesions despite frequent comminution.
- Strategy is similar for anterior marginal distal radius lesions fixed through an anterior approach
- If there is no concentric radiocarpal alignment consider intracarpal involvement: Correct ulnar deviation with radiocarpal pinning arthroereisis.

Poor Outcomes Have Been Attributed To:

- Initial radiocarpal cartilaginous injury which should be assessed preoperatively (either open or arthroscopically).
- Poor reduction with articular step-off leading to malunion and osteoarthritis or capsulo-ligamentous distension responsible for residual ulna deviation.

CONCLUSION

Radiocarpal dislocation is a rare ligamentous injury of the young active adult. Management is emergent involving reduction -internal fixation of associated lesions. Long term outcome is determined by radiocarpal osteoarthritis hence the need for near anatomic reduction and restoration carpal alignment.

DECLARATION

Ethics Approval and Consent to Participate

Local ethics committee approval was sought before the publication of this article.

Consent to Publish

Written informed consent was obtained from the patients involved in this case series for publication of this article and associated images.

Availability of data and materials

Not applicable.

Competing interests

The authors declare no potential conflicts of interest with respect to the authorship, and/or publication of this article.

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Author's Contributions:

All authors contributed either directly or indirectly in the writing and general format of the manuscript.

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