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Isolated volar ulnar dislocation: case report and literature review

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Summary

Isolated ulnar head dislocation is a rare and frequently misdiagnosed clinical entity. To our knowledge, few cases of volar ulnar dislocation have been reported in literature and a well-defined treatment does not exist. This case report describes the management of an acute isolated volar ulna dislocation in a 64-year-old patient. We also performed a systematic review of the available English literature in order to evaluate management of volar ulna dislocation. Among 86 eligible articles, 13 were included and fully evaluated. Isolated distal radioulnar joint (DRUJ) dislocation with only ligamentous involvement are uncommon injuries. If diagnosis is uncertain and X-ray are not informative, further imaging with CT or MRI can be performed because it is mandatory to recognise these lesions and to manage them properly. The first step is to reduce the DRUJ dislocation. The second is to evaluate the stability of the joint. If multidirectional instability is noted, direct repair of the ligament or Triangular Fibrocartilaginous Complex (TFCC) is indicated. Management of the acute lesion initially consists of an attempt of closed reduction, but if closed reduction is impossible in our opinion the only option is to restore the normal anatomy of the DRUJ with operative treatment. Herein, we summarise the available evidence on this lesion, based on this case and after a systematic review of the literature. We propose operative management for this lesion, with open reduction and reconstruction of ligaments to allow a rapid functional recovery and to avoid secondary complications.

Key words: distal radioulnar joint, dislocation, ulnar, volar, isolated

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Conflict of interest
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Introduction

First described on cadaveric specimens in 1777 by Desault, acute isolated distal radio-ulnar joint dislocation is a rare entity and no consensus on its management has been established in literature [1]. Ulnar dislocation often occurs in a more complex context, for example in Galeazzi's injuries, forearm or distal ulna fracture, or in association with interosseous membrane laceration. The dislocation can be either volar or dorsal, although the latter is more common [2].

If not promptly recognised and treated, these injuries can lead to significant functional disability. Treatment can be conservative with closed reduction and immobilisation with an above-elbow plaster cast or surgical with open reduction and reconstruction of ligaments.

The aim of our study was to describe a case of successful operative management of an acute isolated volar ulna dislocation, comparing our data with the available evidence on this lesion by performing a systematic review of literature.

Description of the case report

A 64-year-old male, right hand dominant, presented to the Emergency Department following road accident polytrauma. He presented with multiple bruises, head trauma and right wrist pain. On examination, his right forearm was supinated with absence of the ulnar head prominence on the dorsum of the forearm, there were no neurological symptoms. He reported moderate swelling and tenderness in the right wrist and there was no active or passive rotation of the forearm. Patient related no significant pre-existing comorbidities. The patient had not had previous injuries to the wrists, forearm or hand. A cranial-CT and a total body CT were positive for hepatic injuries requiring surgical treatment. Wrist X-ray was taken and revealed a volar dislocation of the ulnar head with respect to the radius (Fig. 1). Closed reduction was attempted by rotating the forearm under slight sedation, without success. Since patient needed abdominal surgery treatment for a hepatic lesion, the forearm was temporarily immobilised in a cast.
After abdominal surgery, the patient was addressed to the Department of Hand Surgery for evaluation of the right wrist trauma.
Therefore, we asked for a CT scan of the right wrist in order to plan surgery. CT confirmed the isolated volar ulna dislocation and showed the empty fovea of the radius (Fig. 2).
We decided to operate on the patient to restore the normal anatomy of the wrist. The patient was positioned supine, under general anaesthesia and tourniquet. Through a distal ulnar approach we observed the absence of the ulnar head in the ulnar notch, a complete lesion of the DRUJ, interposition of the extensor carpi ulnaris and tear of the triangular fibrocartilage complex (TFCC). We proceeded to reduce the dislocation, repair the TFCC with suture anchor and performed anatomical reconstruction of the distal radioulnar ligaments. Evaluation of distal radioulnar joint stability was satisfying, and we therefore pursued capsule and retinaculum suture.

Figure 1. Right wrist lateral and anteroposterior x-ray at initial presentation.

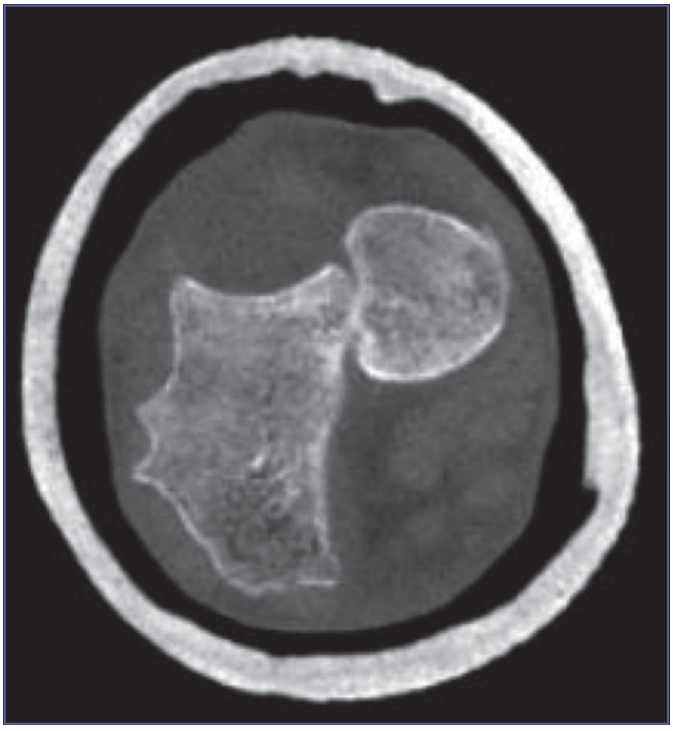

Figure 2. Absence of ulnar head in the ulnar notch: CT-scan examination.

At the end of surgery, distal radioulnar joint (DRUJ) stability was satisfying, and a sugar tong was applied.
On day 1 we performed X-ray which showed good reduction. We dismissed the patient with a sugar tong because we wanted to allow only flexion and extension of the elbow.
Four weeks later X-ray (Fig. 3) was performed. The sugar tong was removed and rehabilitation started at this time.
One year post surgery, X-ray showed a post-traumatic arthrosis but the patient was pain-free, with a full range of motion (Fig. 4). He resumed his normal activities with no limitations (Fig. 5).

Materials and methods

We performed a systematic review of the available English literature in order to evaluate the management of volar ulna dislocation.
The Pubmed, Embase, Medline, Medscape, Google Scholar and Cochrane library databases were screened for relevant studies. A systematic review of literature was performed with a primary search on Medline through PubMed using the following strategy: volar[All Fields] AND ("ulna"[MeSH Terms] OR "ulna"[All Fields]) AND ("joint dislocations"[MeSH Terms] OR ("joint"[All Fields] AND "dislocations"[All Fields]) OR "joint dislocations"[All Fields] OR "dislocation"[All Fields]). Non-pertinent manuscripts were excluded. Exclusion criteria were: in vitro studies, non-English manuscripts, instrumental evaluations and ab-

Figure 3. X-ray examinations 1 months post-surgery.

Figure 4. X-ray examinations 1 year post-surgery.

stract only available. References from the identified articles were checked in order not to miss any relevant articles.

Each title and abstract that was retrieved by our keywords was examined. The PRISMA 2009 flow diagram illustrates the review process.

A total of 86 articles were identified. Among 86 eligible articles, we selected only those matching our inclusion criteria. During the selection of papers, no cases of conflict between two authors were reported. We identified 5 studies from other references.

Thirteen manuscripts were finally included and fully evaluated (Table I,II, Fig. 6).

Discussion

The DRUJ is a complex joint because of its relationship with several structures: the concave sigmoid notch of the distal radius, the convex articular surface of the distal ulna and the supporting capsuloligamentous structures (the volar and dorsal radioulnar ligaments, ulnocarpal ligaments and triangular fibrocartilage). Extrinsic support to the DRUJ is provided by the pronator quadratus, the subsheath of the extensor carpi ulnaris and the distal oblique bundle of the interosseous ligament. Anatomy permits the rotational movement for the forearm because it allows pronation and supination which are essential for the function of the upper limb. During supination the head of the ulna translates volarly and during pronation dorsally, which happens because the radial notch is shallow and does not constrain the ulna during the rotational movement [3].

Isolated DRUJ dislocation with only ligamentous involvement is an uncommon injury. In most cases, they are associated with a concomitant fracture, usually in a complex fracture, like Galeazzi, Monteggia or Essex-Lopresti lesions, or fracture of the head of the ulna, but rarely of the distal radius.

Carlsen et al. affirmed that instability of the DRUJ due to injury of the TFCC occurs in as many as 60-84% of distal radius fractures [4]. Ulna styloid fractures usually do not result in DRUJ instability. This may happen if the fracture presents a displacement greater than 2 mm. Isolated, acute dislocation of the DRUJ without associated fracture is a less frequent entity [5,6].

Dorsal dislocation is more common than volar dislocation. Ulna isolated dislocations or subluxations are difficult to diagnose and are initially missed in up to 50% of cases [7]. Delay in diagnosis

Figure 5. Clinical examinations 1 year post-surgery.

Table I. Volar ulna dislocation review [6,8,9,13,16-24].

N°	References	Year	Study design	EBM Level	N° of patients	Trauma	Instrumental	Fracture association	Ligamentous injury
1	Duryea DM	2016	Case report	V	2	Acute D2	MRI	NO	-
						Acute D2	clinical + second look of radio-graphs	NO	-
2	Mittal R	2004	Case report	V	1	Acute D0	RX	NO	-
3	Wallwork N.A.	2001	Case report	V	1	Cronic D11 y	RX + CT	NO	-
4	Kumar A	1999	Case report	V	1	Acute D4	RX	NO	-
5	Newan KJH	1994	Case report	V	1	Acute D0	RX; MRI at week 6	NO	MRI: Tears of TFCC
6	Singletary E	1993	Case report	V	1	Acute D0	RX	NO	NO
7	Mulford SJ	2010	Case report	V	1	Acute D0	RX	Impaction fracture of the ulna head	-
						D6 weeks	RX		-
						D8 weeks	CT		-
8	Tarallo L.	2013	Case report	V	1	Acute	RX + CT; at 1 month MRI: no ligamen-tous injury	NO	-
9	Werthel J.-D.	2014	Case report + Literature review	II	1	Acute D0	RX / MRI a 8d: lesion of interosseus membrane and hyper-signal in the ulnar styloid process and tfcc	NO	-
10	Xianke L	2019	Case report	V	1	Acute D0	RX	NO	-
11	Starnoni M	2019	Case report	V	1	Acute D0	RX	NO	--
12	Spingardi O	2015	Case report	V	1	Acute D15	RX + MRI	NO	Complete disrup-tion of TFCC com-plex + pronator quadratus muscle interposition
13	Ellanti	2011	Case report	V	1	Acute D4	RX	NO	TFCC

Table II. Volar ulna dislocation review [6,8,9,13,16-24].

N°	Treatment	Anesthesia	Immobilization	Physical therapy	Average follow up	Clinical outcome
1	Close reduction	-	4 weeks	2 months	2 months	-
		-	4 weeks cast locked in supination	4 months	4 months	-
2	Close reduction, under image intensifier control in operating theatre	GA	Above elbow 4 weeks in pronation	5 weeks	9 weeks	No pain; Full motion
3	Open (osteotomies + bone graft + K-wire = osseous reconstruction of volar buttress	GA	Above elbow plaster 4 weeks; k-wire removal after 3 months	-	24 months	Pain that resolve after 2 y
4	Close	GA	Long arm splint in neutral position for 6 weeks	-	3 months	-
5	Close reduction after a secondary trauma into the ER	-	6 weeks splint in pronation	-	-	-
6	Close reduction	NO	6 weeks	-	-	-
7	No diagnosis - therapy	-	-	-	4 months	No pain
	Close reduction+PINNING	-	-	-	-	-
	Open reduction with 2 screws into ulna head	-	Wrist splint	-	-	-
8	Close reduction	Ascellary block	Cast for 3 weeks	-	1 month	No pain
9	Closed reduction	Sedation	Above-elbow plaster cast 6 weeks in neutral position	-	14 weeks	No pain- full range
10	Closed reduction because the patient refused open reduction for economic reason	Brachial plexus block	Above-elbow splint for 6 weeks	-	6 months	No pain- Full range
11	Close reduction under slight sedation --> failed; reduction was obtained under an axillary block and stabilized with 2 k-wire	Axillary Block	Forearm cast for 25 days	-	-	No pain- Full range
12	Surgical with anchor for the TFCC and 2 radioulnar k-wire	Axillary Block	K-wire for 6 weeks, an above elbow cast in pronation for 4 weeks, an under elbow cast for 2 weeks	-	12 months	-
13	Open, reduction and insertion TFCC with mini suture anchor	GA	Above elbow cast in pronation 4 weeks, below elbow cast 2 weeks	-	-	-

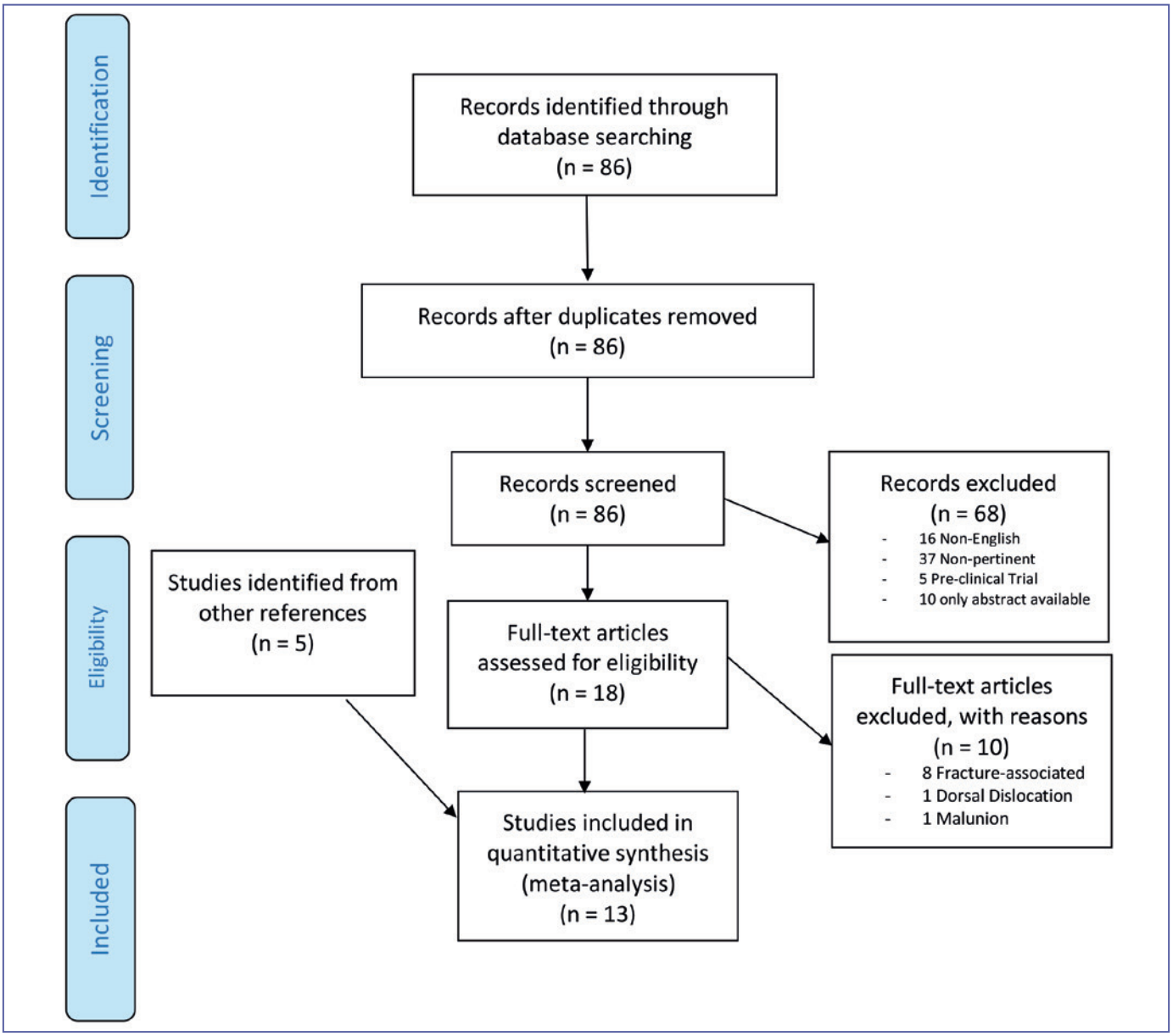

Figure 6. The PRISMA 2009 flow diagram illustrates the review process.

can lead to significant functional disability and increased healthcare costs [8]. In volar ulna dislocation, an associated TFCC lesion is more common, and requires further investigation. In case of chronic instability, a more complex treatment is often required: it needs open reduction and, in some cases, reconstruction of complex ligaments.

Volar dislocation of the ulna is usually caused by forced hypersupination, although a pronation injury to the hand with fixed forearm and a dorsally applied force to the distal ulna has been reported. Few isolated cases have been reported in literature. These cases had different causes for irreducibility and hence were treated in different ways (Tabs. I,II). At the moment, there is no standardised treatment.

The first problem of this type of lesion is diagnosis. A patient presenting with volar dislocation usually presents with the forearm fixed in supination and will be unable to pronate the wrist. However, pain and soft tissue oedema make clinical examination challenging. In these cases, X-ray may be difficult to interpret, especially if the displacement of the wrist is minimal.

It is important to perform an X-ray with the wrist in the correct position, both in the posteroanterior and lateral projections. Xianke et al. pointed out the importance of the standard lateral view and compar-

ison with the contralateral wrist [9]. If the diagnosis is uncertain and X-ray are not informative, further imaging like CT or MRI can be performed which will demonstrate any joint incongruence. Nowadays, CT is the gold standard for diagnosis. Amrami et al. suggested that the gold standard is bilateral CT for evaluation of DRUJ congruency because the degree of DRUJ translation varies from person to person. To confirm associated lesions, MRI can be helpful because it can evaluate conditions of ligament, TFCC and the interosseous membrane, which maintain the stability of the DRUJ [10-12].

The treatment generally depends on the mechanism of injury. Management for the acute lesion initially consists of an attempt at closed reduction. However, in the literature it is reported that there are factors that cause blocking of reduction in DRUJ dislocation such as the extensor carpi ulnaris tendon or subsheath that may preclude the reduction [13]. As for chronic dislocation, it is mandatory to attempt a closed reduction even if manual reduction of the ulnar head is difficult. In the case that closed reduction is not possible, the only option is to restore the normal anatomy of the DRUJ with operative treatment.

It is helpful to first try closed reduction with the patient under sedation or general anaesthesia, since as explained by Bouri et al. in volar DRUJ dislocations the prerogative for reduction is complete relaxation of the patient because the spasm of pronator quadratus muscle is an important blockade to reduction [14].

During surgery, the first step is to reduce the DRUJ dislocation. The second step to evaluate the stability of the joint. If multidirectional instability is noted, direct repair of the ligament or TFCC is indicated. When open reduction is chosen, Kirschner-wire fixation is usually effective.

However, Slattery et al. described a technique that has given good results without the need for temporary Kirschner wires [1]. Li et al. reported several options for treatment of chronic DRUJ dislocation: some form of resection arthroplasty, partial resection of ulnar head or total resection of ulna head [15]. Following open reduction, soft-tissue treatment includes simple repair of torn structures or ligaments reconstruction with use of local tissue, implants or grafts.

Conclusions

The correct recognition and management of these lesions is important because a missed diagnosis could result in a distal radioulnar joint instability, which can lead to pain and weakness. If closed reduction is not possible, operative treatment is mandatory, either immediate or delayed, with open reduction in order to investigate the injuries to ligaments and restore the normal stability of the distal radioulnar joint.

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