

Vertical Instability of the Carpus – Axial Dislocation and Fracture-Dislocation: Review of the Literature

J. Vogels, A.-P. Uzel, and O. Delattre

1 Definition, Epidemiology, Classification

Carpal axial dislocation with preservation of the radio-luno-capitate axis on a lateral view is extremely rare.

According to Herzberg [1], it is a combination of dislocation of the second carpal row and the second carpometacarpal joint (the intermetacarpal space).

Since Oberst [2] in 1901, about 70 cases have been reported in the literature. The largest series was reported by Garcia-Elias et al. [3] from the Mayo clinic and was conducted over 16 years as a retrospective analysis of nearing on 1,140 carpal trauma and fracture cases, among which 16 cases (1.4 %) were diagnosed as axial dislocation (Fig. 1).

Garcia-Elias et al. [3] describes three types of axial dislocation according to the affected column:

- Radial axial (RA) (Fig. 2) with instability and proximal radial displacement of the radial column (first and second metacarpals, trapezium, trapezoid, scaphoid), while the ulnar column maintains stable relations with radius and ulna.
- Ulnar axial (UA) (Fig. 3) where the ulnar column (fourth and fifth metacarpals, hamate, triquetrum) is displaced proximal and ulnar, while the radial column maintains stable relations with the radius and ulna.

J. Vogels (✉) • O. Delattre
Hand Surgery Unit and Hands Emergency Care Unit,
CHU et SOS mains de Fort-de-France,
BP 632, Fort-de-France Martinique 97200, France
e-mail: jerome.vogels@gmail.com; olivier.delattre@chu-fortdefrance.fr

A.-P. Uzel
MCU-PH Chirurgie, Orthopédique, CHU,
Guadeloupe, France

Fig. 1 Radial and ulnar columns with axial dislocation lines. *AU* axial ulnar, *AR* axial radial

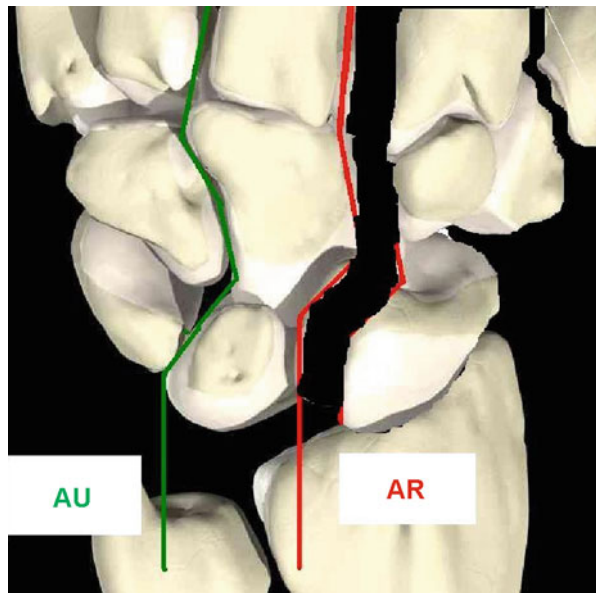
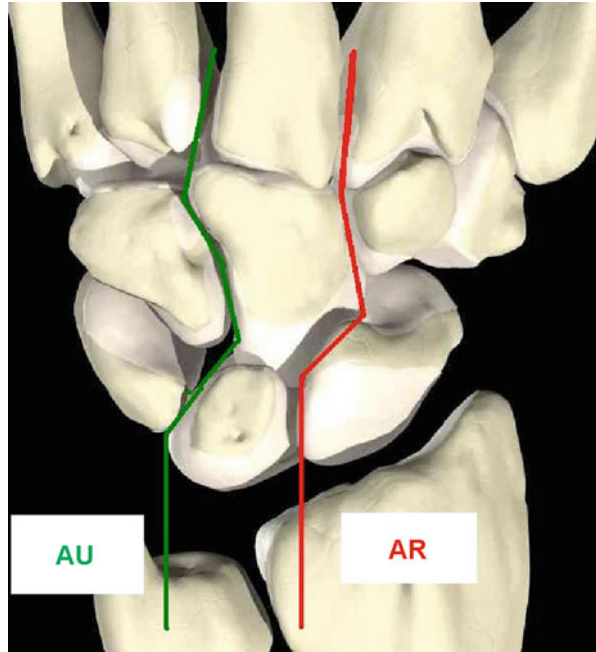


Fig. 2 Radial axial dissociation. *AU* axial ulnar, *AR* axial radial

Fig. 3 Ulnar axial dissociation. *AU* axial ulnar, *AR* axial radial

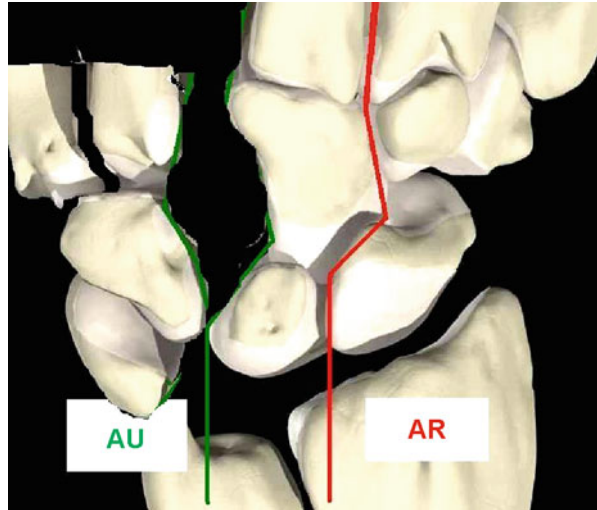
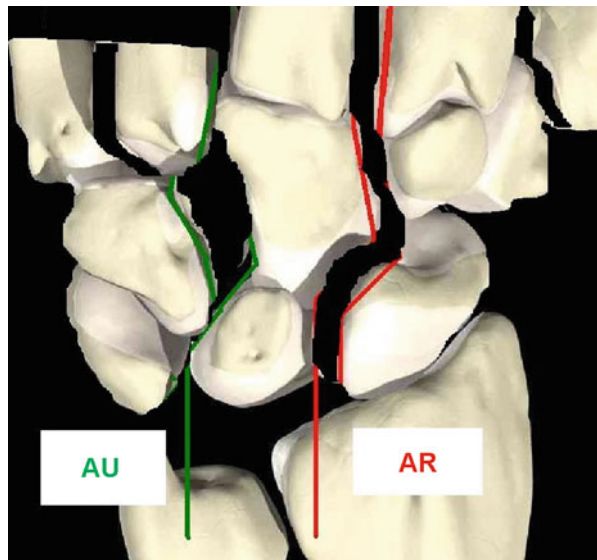


Fig. 4 Radioulnar axial dissociation. *AU* axial ulnar, *AR* axial radial



- Radioulnar axial (Fig. 4) with instability and displacement of both columns parting in opposite directions. Here, the third column (third metacarpal, lunate, capitate) is stable onto the radius and ulna, while the two other columns are displaced.

Garcia-Elias describes subgroups for the forms RA and UA:

- For RA, three subgroups: peritrapezial/peritrapezoid, peritrapezial, transtrapezial
- For UA, three subgroups: trans-hamatal/peri-pisiform, peri-hamatal/peri-pisiform, peri-hamatal/trans-triquetral

2 Mechanism

Several mechanisms have been suggested by different authors, but the common factor for this entity is the violence of the mechanism involved which has been reported throughout the literature.

According to Herzberg, axial dislocation is most often associated with blast injuries and open crush injuries. Garcia-Elias et al. [3] emphasizes the frequency of associated neurovascular and musculotendinous lesions: flexor/extensor injuries, thenar and hypothenar lacerations, median nerve, sensory and motor branches of ulnar nerve lesions, arterial injuries, fractures including metacarpal, hook of hamate, fracture avulsion of trapezium, pisiform, carpometacarpal dislocations and digital amputations.

Tabib [4] describes a case of radial axial dislocation and describes the mechanisms reported in the literature. These are most commonly manual work-related crush injuries or high kinetic energy accidents (motorcycle).

Yammine [5] reports an atypical case of scapholunate axial dislocation where the mechanism involved is an axial compression load acting as a major vector surpassing other associated forces in a longitudinal axis of the wrist associated with hyperextension.

Tanaka et al. [6] report a case of radioulnar axial dislocation where the mechanism is an anteroposterior compression dislocating both columns which part in opposite directions.

For Tanaka et al. [6], the force associated with the compression may result in a scaphoid fracture by the head of capitate.

The scaphoid may be dislocated by a high-energy force; Horton [7] describes a rare case of scaphoid dislocation associated with axial disjunction.

2.1 Management

Axial dislocation is most often due to a high-energy mechanism. When isolated, it is often clearly detectable by the associated soft tissue damage and clinical deformation. In a polytrauma setting and/or associated lesions, the diagnosis may be more difficult.

Standard x-rays remain key to diagnosis. The posteroanterior view shows the radial, ulnar ulnar radial inclination of the displacement, while the lateral view shows the radio-lunato-capito-3rd metacarpal axis and indicates the palmar or dorsal displacement of the affected columns.

Management is in emergency; however, an immediate diagnosis may be difficult due to the complexity of interpretation of PA and lateral views, and certain authors propose further investigations.

In a series of eight patients, Inoue and Miura [8] reports eight delayed diagnoses: 2 weeks in five patients and over 1 month in three patients. The worst outcomes are correlated with delayed diagnosis. In radiological abnormality associated with

clinical functional deficit or oedema, the diagnosis may require a CT scan which should not – nevertheless – delay management.

MRI may be useful but unavailable. It is of special interest in the diagnosis of ligament lesions and incomplete fractures. Horton [7] describes the use of MRI away from the trauma to diagnose ligamentous palmar, dorsal, intrinsic and extrinsic lesions. These lesions are confirmed by radiocarpal and midcarpal arthroscopy and unravel scapholunate and capitolhamatal instability.

2.2 Treatment and Results

The mechanism is often high-energy trauma, with skin laceration and severely displaced fractures. The associated ligamentous lesions are usually severe, causing great instability. Management is often surgical by closed reduction and fixation. A palmar or dorsal approach is recommended with reduction and pinning or screw fixation [9]. Some authors [3, 10] report closed reduction and immobilization in a cast. There is no evidence in the literature to favour surgical approach and fixation over closed fixation.

The mean immobilization is 4–6 weeks.

Functional prognosis is correlated to the severity of the initial trauma as well as associated neurovascular and other lesions. Good results reported in the literature are only around 60 %.

References

1. Herzberg G (2008) Perilunate and axial carpal dislocations and fracture – dislocations. *J Hand Surg* 33A:1659–1668
2. Oberst M (1901) Fracturen und luxationen der finger und des carpus, die fracturen des metacarpus und der vorderarmknochen. *Forstchr Geb Roentg* 5(suppl):1–21
3. Garcia-Elias M, Dobyns JH, Cooney WP, Linscheid RL (1989) Traumatic axial dislocations of the carpus. *J Hand Surg* 14A:446–457
4. Tabib W, Banalleg L, Banalleg Y, Lamelin JC (2001) Traumatic axial separation of the radial midcarpal joint. Case report and review of the literature. *Chir Main* 20(5):391–396
5. Yammine K (2000) Luxation axiale du carpe interscapulohunaire. *Rev Chir Orthop* 86:193–196
6. Tanaka Y, Ohshige T, Hanakawa S (2002) Traumatic axial dislocation of the carpus: a case report of transscaphoid pericapitate transhamate axial dislocation. *J Orthop Sci* 7:414–416
7. Horton T (2004) Isolated scaphoid dislocation associated with axial carpal dissociation: an unusual injury report. *J Hand Surg* 29A:1102–1108
8. Inoue G, Miura T (1991) Traumatic axial-ulnar disruption of the carpus. *Orthop Rev* 20:867–872
9. Freeland AE, Rojas SL (2001) Traumatic combined radial and ulnar axial wrist dislocation. *Orthopedics* 24:1161–1163
10. Irwin LR, Paul R, Kumaren R, Bagga TK (1995) Complex carpal dislocation. *J Hand Surg* 20B(6):746–749