



# Multimodality Imaging Evaluation of a Unilateral Madelung Deformity

David Cyruz Jan<sup>1</sup>; Sydiongco-Inocencio Paula Marie<sup>2</sup>

<sup>1</sup>Resident, Department of Radiology, University of the Philippines -Philippine General Hospital.

<sup>2</sup>Attending, Department of Radiology, University of the Philippines -Philippine General Hospital.

**\*Corresponding Author(s): DAVID Cyruz Jan**

Resident, Department of Radiology, University of the Philippines – Philippine General Hospital.

Tel: +63-955-443-0517; Email: cyruzjandavid@gmail.com

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## Clinical History

A Filipino female teenager with gross deformity of her right wrist, came as an outpatient for radiographic evaluation non-specific pain and numbness after prolonged repetitive, active wrist movements like writing and clapping, are noted with no history of trauma, infection, or surgical intervention of the aforementioned wrist.

## Imaging Findings

Plain radiography of the right wrist showed a bayonet deformity characterized by increased radial inclination, proximal migration of the lunate, triangulation of the carpus, volar subluxation of the carpus, and subluxation of the distal ulna.



**Figure 1:** Postero-anterior Views of the Bilateral Wrists.

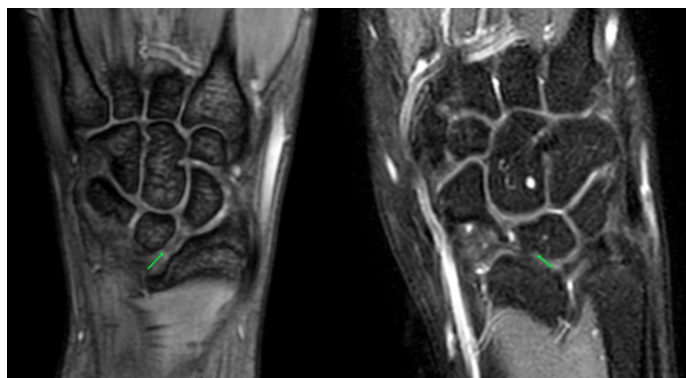


Multiple axial tomographic sections of the right wrist confirm the bayonet configuration. Moreover, there is a triangulation of the proximal carpus as the lunate subsides proximally with wedging in between the radius and ulna (Chevron carpus). There is no note of fractures or other potential causes of deformity.



**Figure 2:** 3D reconstruction of right wrist.

On magnetic resonance imaging of both wrists without contrast, a Vicker ligament on the right is noted as seen in Figure 5a, appearing as a prominent right radiolunate ligament. The triangular fibrocartilage appears thickened with heterogeneous intermediate signals on the proton-density weighted and T2-weighted sequences.



**Figure 3:** Magnetic resonance imaging of the bilateral wrist.

**Note:** Pointed by the green arrows are the radiolunate ligaments of the bilateral wrists.

### Discussion

**Background:** Madelung deformity is a rare abnormality of the wrists, exhibiting female predominance and approximately less than 2% prevalence among pediatric hand deformities [1].

**Clinical Perspective:** During adolescence and young adulthood, clinical manifestations such as gross deformity, pain, and fatigue, with associated limited dorsal extension, ulnar deviation, and supination are observed [2]. One of the most common considerations for the development of Madelung deformity is the presence of a Vicker ligament which is an abnormally short and thickened radiolunate ligament, which is postulated by previous studies to exerting a compressive effect on the epiphyseal plate, restricting medial and volar growth of the radius [3,4].

**Imaging Perspective:** Plain radiography of the wrists is the imaging of choice for diagnosing Madelung deformity. Four radiographic measurements are defined to recognize it, namely:

ulnar tilt, lunate fossa angle, lunate subsidence, and palmar carpal displacement [5,6].

Among these, ulnar tilt, lunate subsidence, and palmar carpal displacement are considered reliable and reproducible for quantifying the severity of the deformity on plain radiographs. Moreover, the lunate fossa angle has acceptable reliability and reproducibility for assisting in early diagnosis [5].

Magnetic resonance imaging and computed tomography are not routinely performed for radiographic assessment of Madelung deformity. However, the aforementioned Vicker ligament is only seen radiographically through MRI [7].

Plain computed tomography and 3D volume rendered imaging serves a purpose in surgical planning, as well as in excluding fractures and causes, especially in severely affected joints [4].

Madelung deformity presenting with mild pain and slight limitation of motion is managed conservatively by analgesics, activity restriction and volar splint. The aforementioned management shows reduction of intensity and number of episodes of pain [8].

Relative indications for surgical management of Madelung deformity include wrist pain, loss of wrist motion, and severe deformity of the wrist. Physiolysis of the Vicker ligament is hypothesized to prevent thinning of the radial physis, hence preventing further radial deformity [9].

**Teaching points:** Imaging evaluation is pivotal for diagnosing Madelung deformity, with plain radiography as its imaging of choice.

Ulnar tilt, lunate fossa angle, lunate subsidence, and palmar carpal displacement are reliable and reproducible radiographic measurements for objectively recognizing Madelung deformity.

MRI can reveal a Vicker ligament which may exert compressive effects on the epiphyseal growth plate of the affected radius, causing Madelung deformity.

CT offer better visualization of the osseous structures; hence it can be used to rule out other causes of deformity like fractures.

Written informed patient consent for publication has been obtained.

### Final Diagnosis

Madelung deformity, right

### Differential Diagnosis List

1. Deformity secondary to trauma and/or infection
2. Congenital as part of Leri-Weill dyschondrosteosis or Turner syndrome
3. Skeletal dysplasias, such as Ollier disease, diaphyseal aclasia, and mucopolysaccharidases

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