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WisdomGale

CASE REPORT

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Unveiling the intersection: Post traumatic Guyon's canal syndrome

Zahra S. M. Husain, Abdullah Saad Al Driweesh
Department of Diagnostic Radiology, Dammam Medical Complex, Dammam, Saudi Arabia

ABSTRACT

Guyon's canal syndrome, also known as ulnar tunnel syndrome or handlebar palsy, is a relatively rare peripheral ulnar neuropathy. It involves compression of the distal ulnar nerve at the wrist as it passes through a space called Guyon's canal. This canal is a tight triangular fibroosseous tunnel approximately 1.5 cm long located at the carpus. The syndrome can result from various causes, including compression due to ganglion cysts, occupational traumatic neuritis, musculotendinous arch issues, and ulnar artery disease. Herein, we describe a case of post-traumatic Guyon's canal syndrome secondary to a ruptured ganglion cyst and triquetrum fracture.

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Guyon's canal; ulnar nerve; trauma; MRI; ganglion cyst

Introduction

Guyon's canal syndrome, a relatively uncommon condition, occurs due to compression of the ulnar nerve as it traverses Guyon's canal. The wrist represents the second most frequent site of ulnar nerve entrapment, following the elbow. Diagnosis typically relies on clinical examination. However, due to varying clinical presentations, identifying the syndrome can be challenging, especially when sensory symptoms are atypical or absent. Additionally, pinpointing the exact compression site along the nerve course remains difficult based solely on clinical examination or electrophysiology. The neurological symptoms including the sensory and motor deficits caused by ulnar nerve compression can significantly affect the quality of life in individuals who rely on their hands for daily activities or occupational tasks.

Case Presentation

A previously healthy 35-year-old woman visited the orthopedic clinic due to 3 weeks' history of pain and tingling in her right hand's fourth and fifth fingers, along with the medial palm area. She had a history of falling on an outstretched hand but did not seek medical advice. Despite taking oral analgesics, her symptoms worsened. Clinical examination revealed weak grip strength.

The patient underwent a hand MRI 2 weeks after her visit, which revealed denervation edema in the third and fourth lumbrical muscles (Fig. 1). Ulnar nerve neuropathy was considered, prompting a wrist MRI to assess Guyon's canal.

Wrist MRI revealed a ruptured pisotriquetral joint ganglion cyst with surrounding free fluid extending to the proximal Guyon's canal. The latter is compressing the proximal ulnar nerve (zone I). There is bone marrow edema involving triquetrum with a low signal intensity line suggesting fracture (Fig. 2).

While ganglion cysts and triquetrum fractures are established causes of ulnar nerve compression in Guyon's canal, our case involves dual etiologies resulting from a traumatic event. Unlike typical Guyon's canal syndrome where the ganglion cyst is the primary cause, in our patient, ulnar nerve compression was due to free fluid that leaked from the cyst and extended into Guyon's canal. Additionally, the triquetrum fracture compounded the trauma, leading to the patient's symptoms.

Discussion

Guyon's canal, also known as the ulnar-carpal canal, is anatomically defined by the pisiform bone proximally and medially, and the hook of the hamate laterally and distally. The canal's floor consists of the

Contact Zahra S. M. Husain Zahra.4@live.com Department of Diagnostic Radiology, Dammam Medical Complex, Dammam, Saudi Arabia.

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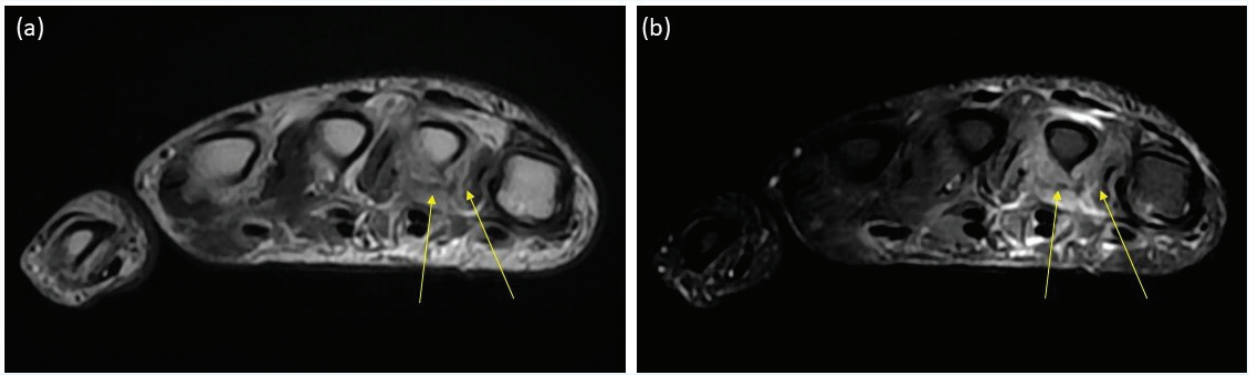


Figure 1. Hand MRI, axial T2 (a) and T2 fat saturation sequence (b) demonstrate atrophy and edematous signal in the third and fourth lumbrical muscles (arrows).

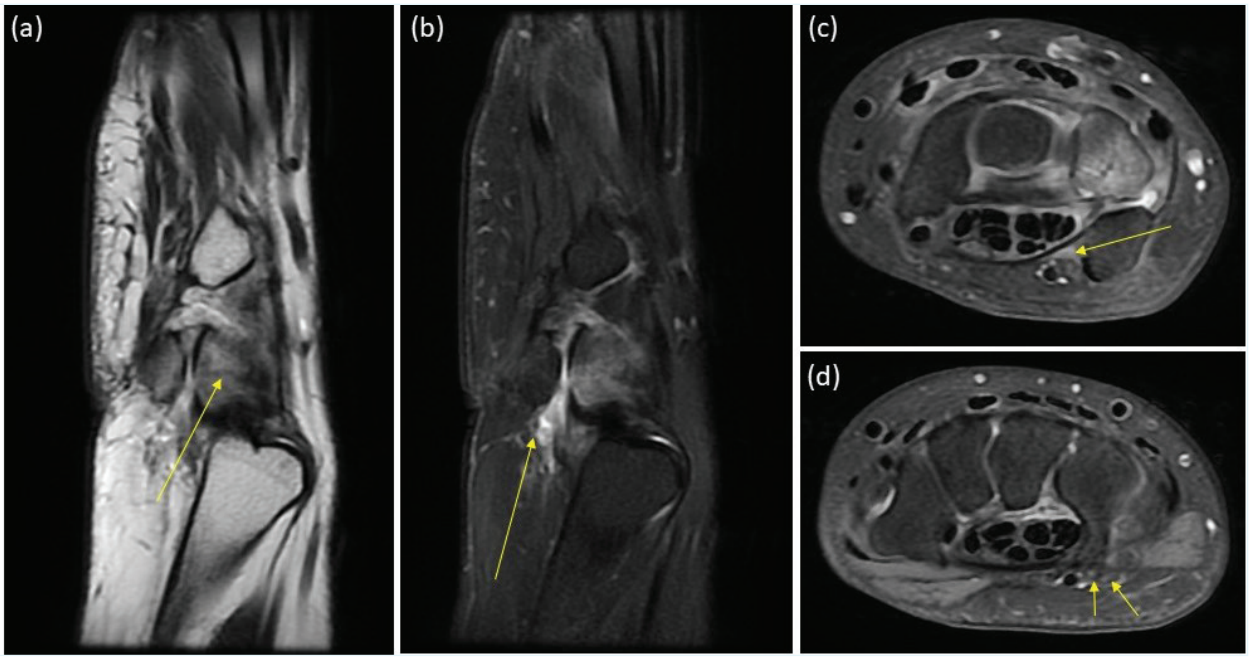


Figure 2. Wrist MRI, sagittal T1 (a), sagittal PD fat saturation (b), axial PD fat saturation sequences at the level of proximal (c) and distal (d) Guyon's canal. Triquetrum bone marrow edema with intramedullary low signal intensity line denoting fracture [arrow in (a)]. Pisotriquetral ganglion cyst with surrounding free fluid and edematous changes denoting rupture [arrow in (b)]. Free fluid noted in the proximal Guyon's canal (zone I) causing mass effect on the ulnar nerve [arrow in (c)]. The superficial and deep branches of the ulnar nerve demonstrate normal thickness and signal intensity [arrows in (d)].

transverse carpal ligament, while its roof is formed by the volar carpal ligament [1]. At the distal end of the canal's floor lies the pisohamate hiatus, bordered superiorly by a concave musculotendinous arch and inferiorly by the pisohamate ligament [1–2].

Within Guyon's canal, the ulnar artery and nerve are situated. The ulnar nerve divides into a superficial branch, responsible for sensory innervation to the palmar surface of the little finger and the ulnar side of the ring finger, as well as motor innervation to the palmaris brevis muscle. Additionally, a deep motor branch innervates the hypothenar muscles and then passes through the pisohamate hiatus to supply the third and fourth lumbricals, interossei, adductor pollicis, and the deep head of the flexor pollicis brevis muscles [3]. Notably, the ulnar nerve in Guyon's canal is more susceptible to direct external compression compared to the median nerve in the carpal tunnel due to its superficial location. Furthermore, the portion of the transverse carpal ligament covering Guyon's canal is thinner than

the corresponding segment covering the carpal tunnel [4].

Compression of the ulnar nerve within Guyon's canal can lead to sensorimotor, pure motor, or pure sensory abnormalities. Shea and McClain [5] classified ulnar nerve lesions in Guyon's canal into three types based on the anatomical site of compression at the wrist:

1. **Type I**: Involves the ulnar nerve proximal to or within Guyon's canal. It presents with both motor and sensory abnormalities, including weakness in intrinsic hand muscles innervated by the ulnar nerve. Sensory deficits occur in the hypothenar eminence and the ulnar half of the ring finger, specifically on the palmar surface (not dorsally, which is innervated by the dorsal cutaneous nerve).
2. **Type II**: Compression occurs along the deep branch of the ulnar nerve. This type manifests as weakness in muscles innervated by the deep branch. Depending on the location of compression, some hypothenar muscles may be spared.
3. **Type III**: Compression is distal within the end of Guyon's canal. Only sensory abnormalities are observed, affecting the palmar ulnar distribution. Notably, there is no motor deficit associated with this rare syndrome.

Shea and McClain [5] identified 19 distinct lesions responsible for ulnar nerve compression at the wrist and hand. The most common causes included ganglion cysts (28.7%), occupational neuritis (23.5%), lacerations (10.3%), ulnar artery disease (8.1%), and carpal bone fractures (5.9%). Among these lesions, 52% were classified as type II, 30% as type I, and 18% as type III. Congenital factors (such as anomalous muscles and accessory ossicles), trauma, rheumatoid arthritis, and mass lesions (both intrinsic and extrinsic) were implicated in ulnar nerve involvement near Guyon's canal [5]. Georgiev et al. [6] summarized various abductor digiti minimi variants associated with Guyon's canal syndrome, including absence, origins from forearm fascia, palmaris longus, flexor carpi radialis fascia, intermuscular fascia, three origins, and fusion with the flexor digiti minimi brevis.

The diagnosis of distal ulnar neuropathy relies on clinical criteria, but electromyography (EMG) and nerve conduction studies (NCSs) are essential for localizing the lesion and assessing nerve damage extent. A thorough patient history, including occupation, hobbies, and lifestyle details, is crucial. Generalized disorders such as rheumatoid arthritis, scleroderma, and diabetes mellitus should be considered. Additionally, cervical spine, shoulder, and elbow abnormalities must be ruled out [7–9]. Symptoms resemble those of ulnar nerve involvement at the elbow, except for the absence of sensory loss in the dorsum of the hand due to the dorsal cutaneous branch leaving the forearm 5–8 cm proximal to the wrist [10]. Pain, if present, may worsen with tapping over the pisiform (Tinel's sign) and can radiate up the forearm. The Palmaris brevis sign aids in diagnosis, distinguishing between ulnar nerve compression at the cubital tunnel versus the wrist. When the patient voluntarily abducts the little finger, simultaneous contraction of the Palmaris brevis occurs, absent in cubital tunnel entrapment but usually preserved when the ulnar nerve is compressed at the pisohamate hiatus [11–13].

Radiographs of the hand and wrist, including the carpal canal view, are essential to visualize possible fractures and bone displacement. MRI is recommended for patients with equivocal clinical findings, suspected mass lesions, or persistent symptoms after surgery. High-resolution ultrasound (HRUS) with ultrasound-guided ink marking reliably visualizes and assesses the deep branch of the ulnar nerve along its entire course. HRUS offers advantages over MRI, including cost-effectiveness, excellent resolution, tissue contrast, and suitability for ultrasound-guided therapy. However, MRI remains valuable for assessing structures (such as bone) not fully visible with HRUS and providing a broader field of view, which may be necessary for identifying pathologies and surgical planning. Therefore, HRUS should be the initial imaging method for suspected ulnar nerve lesions, with MRI reserved for further evaluation if initial findings are positive [14].

Electrophysiological studies play a pivotal role in their diagnosis of Guyon's canal syndrome. NCS assesses the nerve's conduction velocity and latency, aiding in identifying the site of compression. Sensory nerve action potentials and compound muscle action potentials provide valuable information about nerve function. Additionally, needle EMG evaluates muscle denervation and helps differentiate Guyon's canal syndrome from other ulnar neuropathies. These electrophysiological techniques contribute to accurate diagnosis, guide management decisions, and facilitate timely intervention to prevent irreversible nerve damage [15].

When the syndrome results from mechanical repetitive trauma (such as occupation, hobbies, or

lifestyle), the approach involves avoiding pressure on the hypothenar eminence. Initial conservative therapy includes immobilization, discontinuing traumatic habits, and local cortisone injections. Surgical decompression may be necessary in refractory cases [16–17].

Surgical intervention is recommended for mass lesions causing compression. Although small ganglia may not always be detectable through the skin, persistent signs of deep branch ulnar nerve impairment in Guyon's canal warrant exploration. During surgical exploration, the ulnar nerve and artery can be released within Guyon's canal. If a ganglion is present, it can be dissected and completely removed. In cases without an obvious mass lesion, constricting bands are divided, and the pisohamate hiatus is unroofed [16, 18–20]. Jengojanet al. [21] evaluated the efficacy and safety of ultrasound-guided thread release for transecting the palmar ligament in Guyon's canal using anatomic specimens. The technique demonstrated promising initial results, but further research is needed to ensure its safety. This approach may serve as a basis for refining the procedure and advancing its clinical application.

Conclusion

Guyon's canal syndrome is less common than carpal tunnel syndrome or cubital tunnel syndrome. Dual etiologies can coexist in Guyon's canal syndrome, necessitating thorough investigation and targeted treatment. Initial investigation of Guyon's canal syndrome can utilize more affordable imaging modalities such as ultrasonography. Subsequently, MRI can be employed to provide further details on the extent of pathology. Early diagnosis and timely treatment are essential to prevent irreversible damage. Promising results have been observed with emerging minimally invasive surgical techniques, which aim to minimize complications and alleviate symptoms in affected patients.

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