Ganglion Cysts as a Cause of Ulnar Neuropathy at the Wrist

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ABSTRACT

Introduction: The diagnosis of ulnar neuropathy at the wrist traditionally has depended primarily on clinical and electrodiagnostic findings. Magnetic resonance imaging (MRI) and ultrasound have emerged as very important diagnostic tools in diagnosis of focal neuropathies.

Case Presentation: We present clinical, electrodiagnostic, and MRI findings in 2 patients with ulnar neuropathies at the wrist caused by ganglion cysts.

Discussion: Ulnar neuropathies at the wrist are common, may present with different patterns of motor and sensory deficits, and can be misdiagnosed. Nerve conduction studies and needle electromyography are essential to assist with anatomical localization of possible lesions. The structural lesions may be well characterized by MRI.

Conclusions: We conclude that MRI is a very useful and important diagnostic tool that may help with diagnosis and therapeutic decisions in patients with ulnar nerve lesions at the wrist. It complements the neurological exam and electrodiagnostic studies. High resolution ultrasound may be an adequate alternative to the MRI.

INTRODUCTION

Entrapment of the ulnar nerve at the wrist is far less common than at the elbow.[1] Entrapment in the Guyon's canal most frequently results from a ganglion cyst.[2] Clinical examination and carefully performed electrodiagnostic studies can lead to a quick diagnosis and effective treatment in most cases. Nerve conduction studies (NCS) and needle electromyography (EMG) are most helpful in localizing the site of nerve injury. Understanding the anatomy of the ulnar nerve at the wrist is essential to accurately localize the lesion to the Guyon's canal, based on the pattern of clinical and electrophysiologic findings.[3] However, not infrequently, the clinical symptoms and signs may not be straightforward for a reliable localization of the nerve lesion, and even the most diligent electrodiagnostic studies may not allow for confident confirmation of the site of the neuropathic process. Magnetic resonance imaging (MRI) or ultrasound may provide additional, clinically most useful information and help avoid diagnostic errors. By revealing a specific compressive lesion, such as a ganglion cyst, or other pathologies, it may help with selection of the appropriate treatment.[4] We present 2 cases of ulnar neuropathies with clinical and EMG findings consistent with nerve lesions at the region of the wrist. MRI in both cases revealed ganglion cysts originating from the pisotriquetral joint and compressing the ulnar nerves.

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CASE REPORTS

Case 1

A 54-year-old woman was referred for evaluation of progressive right hand weakness and atrophy for 5 months. She had tenderness to palpation over the medial palmar aspect of the right hand. She denied any history of trauma to her wrist or hand. Her past medical history included non-Hodgkin lymphoma treated by chemotherapy, which was in remission.

Motor examination showed prominent atrophy of the right hand interossei and hypothenar muscles. She had moderate degree of claw hand deformity on the right side. The thenar muscles were well preserved. There was no atrophy of her forearm muscles. The strength of the dorsal and palmar interossei muscles was 4/5 by

Table. Motor and Sensory Nerve Conduction Studies in Patients 1 and 2

	Normal		Patient 1		Patient 2	
	SNAP (μV)	LAT(ms)	SNAP(μV)	LAT(ms)	SNAP(mV)	LAT(ms)
R-Sensory						
Median	>15	<3.6	39	2.9	22	**4.7**
Ulnar	>10	<3.1	33	2.7	**9**	3.0
Radial	>19	<2.9	34	2.3	55	1.8
Median TC	>50	<2.3	61	2.2	**17**	**3.5**
Ulnar TC	>15	<2.3	18	2.0	**6**	**3.4**
DUC	>10	<2.8	17	2.1	12	2.6
	CMAP(mV)	**LAT(ms)**	**CMAP(mV)**	**LAT(ms)**	**CMAP(mV)**	**LAT(ms)**
R-Motor						
Median	>4	<4.5	5.8	3.7	5.7	7.7
Ulnar[a]	>6	<3.6	5.7	2.6	**4.0**	**4.2**
Ulnar[b]	>7	<4.5	.07	4.0	**0.5**	**6.5**
L-Motor						
Ulnar[a]	>6	<3.6	11.9	2.6	7.2	2.9
Ulnar[b]	>7	<4.5	14.0	4.0	5.8	4.0

Abbreviations: CMAP, compound muscle action potential (amplitude); DUC, dorsal ulnar cutaneous; SNAP: sensory nerve action potential (amplitude); LAT, latency; TC, transcarpal (mixed nerve action potential).
[a] Recording from abductor digiti minimi.
[b] Recording from first dorsal interosseous.
Abnormal values are in bold.

Medical Research Council (MRC) scale. Her long finger flexors and thenar muscles strength were normal. Muscle stretch reflexes and sensory examination were normal.

The pattern of abnormalities on neurologic examination indicated ulnar neuropathy at the wrist that was confirmed by NCS and EMG (Table). Median, ulnar, and radial sensory nerve conduction studies were normal. The sensory action potentials (SNAP) had normal amplitudes and latencies. Median motor compound muscle action potential (CMAP) had normal amplitude and latency, and motor conduction velocity was normal. Right ulnar motor study, with recording from the abductor digiti minimi (ADM), revealed small CMAP amplitude with normal latency. The ulnar motor conduction velocity in the forearm was normal. Inching around elbow did not demonstrate any focal slowing or change in CMAP morphology. Stimulating the ulnar nerve at the wrist and recording from right first dorsal interosseous (FDI) revealed severely reduced CMAP amplitude without any significant prolongation of the latency. Dorsal ulnar cutaneous SNAP was normal. Needle EMG revealed spontaneous activity in the right FDI and ADM and motor unit potential changes indicative of a chronic neurogenic process. Remaining right upper limb muscles including abductor pollicis brevis, flexor carpi ulnaris, flexor digitorum profundus IV/V, pronator teres, triceps, deltoid, and cervical paraspinal muscles were normal on needle EMG. The electrodiagnostic studies indicated severe right distal ulnar motor neuropathy at the wrist, with severe axonal injury. The pattern of clinical and electrophysiologic abnormalities was consistent with a lesion affecting the deep branch of the ulnar nerve in the Guyon's canal, distal to the superficial sensory branch but proximal to the branch supplying the hypothenar muscles.

To confirm the suspected site of the ulnar nerve lesion and to identify possible structural abnormalities, MRI of the wrist and hand was requested. The MRI (Figure 1) revealed a 9 x 15 x 9 mm ganglion cyst arising from the pisotriquetral joint, extending into Guyon's canal and compressing the ulnar nerve in this region. Subsequently, the patient underwent surgical exploration with decompression of the right ulnar nerve at the Guyon's canal with removal of the large ganglion cyst. A follow-up neurological examination after 6 months showed complete recovery of her motor deficits, with normal muscle bulk and strength.

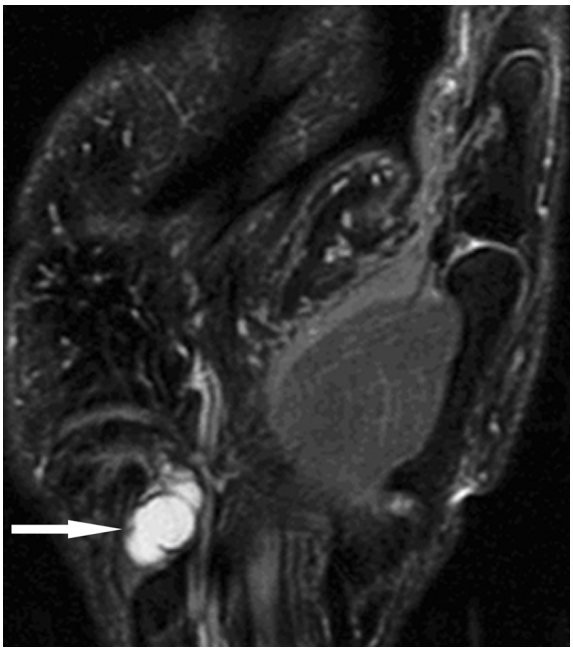
Case 2

A 54-year-old right-handed man was referred for evaluation of right hand weakness and atrophy. Onset of weakness was 6 months prior to our evaluation. He noted difficulty with activities such as pinching, grasping, and writing. Two months later he noticed muscle wasting in his right hand. For the last few years, he had intermittent tingling sensation in the distribution of the first 3 fingers of both hands. He had history of poliomyelitis as a child with residual weakness and atrophy of lower extremities and was using crutches to assist with ambulation.

Examination revealed atrophy and grade 4+/5 (MRC scale) weakness of the right hypothenar and interossei muscles. Other upper extremity muscles had normal muscle bulk and strength. Muscle stretch reflexes in both upper extremities were normal, as was the sensory examination.

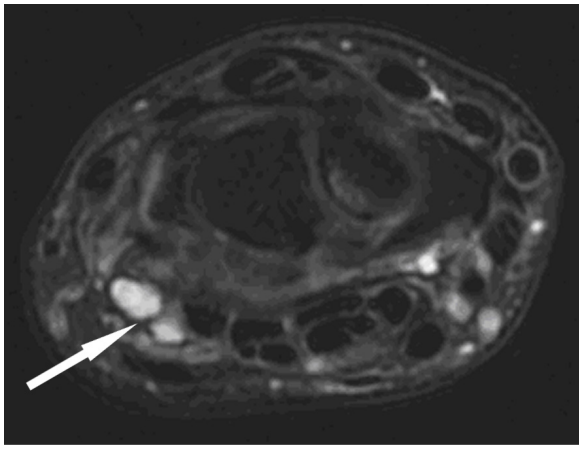
His NCS (Table) revealed decreased right ulnar SNAP (recording from the 5th digit) with normal latency. The right ulnar CMAP amplitudes (recording from the FDI and ADM) were reduced with prolonged latencies. Ulnar motor conduction velocities and inching around the elbow were normal. Ulnar transcarpal response had reduced amplitude and prolonged latency. Dorsal ulnar cutaneous SNAP was normal. Radial SNAP was also normal. He also had prolonged right median motor, sensory, and transcarpal latencies. The EMG study showed chronic and active neurogenic changes in the right FDI and ADM muscles. Flexor digitorum profundus IV/V, abductor pollicis brevis, pronator teres, triceps, deltoid, and cervical paraspinal muscles were normal. The NCS and EMG findings localized the ulnar neuropathy to the wrist, proximal to Guyon's canal affecting both motor and sensory branches. In addition, the patient had bilateral, relatively mild median neuropathies at the wrists, consistent with carpal tunnel syndrome. MRI of the right wrist (Figure 2) revealed 2 small ganglion cysts, 7.2 mm and 4.1 mm in diameters, respectively, in close approximation with the ulnar nerve, distal to the styloid process of the ulnar bone and adjacent to the proximal pisiform bone. The patient underwent surgical decompression of the right ulnar nerve at the wrist with removal of ganglion cysts. He did not return to the neuromuscular clinic for follow-up evaluation.

Figure 1. Patient 1, Magnetic Resonance Imaging of Right Wrist



Coronal fat-saturated T2 image showing a multiloculated, fluid containing cyst originating from the pisotriquetral joint extending into Guyon's canal, compatible with a ganglion cyst (arrow). It exerts mass-effect compressing the ulnar nerve in this region.

Figure 2. Patient 2, Magnetic Resonance Imaging of Right Wrist



Axial fat-saturated T2 image demonstrates 2 ganglion cysts in close proximity to the ulnar nerve along the medial and volar aspect of the wrist (arrow).

DISCUSSION

These 2 cases demonstrate the importance of careful correlation of clinical findings and electrodiagnostic studies for specific localization of possible ulnar nerve lesions. In both cases, the MRI provided further information about the structural abnormalities causing ulnar nerve compressions. In both patients, ulnar nerve compressions were caused by ganglion cysts arising from the pisotriquetral joint. In the first case, the cyst compressed the deep motor branch in the Guyon's canal and, in the second case, the site of compression was proximal to the bifurcation of the motor and sensory nerve branches just proximal to the Guyon's canal.

The ulnar nerve enters the hand through Guyon's canal at the wrist. Nerve injuries at this site are seen less frequently than at the elbow.[1] The ulnar nerve lesions at different sites along its course at the wrist and the hand may produce different patterns of symptoms and signs. Shea and McLain described 3 different types of ulnar neuropathy at the wrist, based on the anatomical course and clinical symptoms.[5] These correspond to the 3 anatomical zones described by Gross and Gelberman in their cadaveric study, with the proximal zone I containing both motor and sensory fibers before their bifurcation, zone II containing the deeper motor fibers, and zone III containing the more superficial predominantly sensory fibers.[6] Wu et al subsequently classified ulnar neuropathies at the wrist into 5 types: type I, a mixed sensory and motor neuropathy occurring within the proximal end of the Guyon's canal; type II, a pure sensory neuropathy caused by a lesion of the superficial branch at the wrist; type III, a pure motor neuropathy due to a lesion of the deep branch of the ulnar nerve just distal to the superficial branch but proximal to the branch innervating the hypothenar muscles; type IV, a pure motor neuropathy with sparing of hypothenar muscles; and type V, with a pure limited distal motor neuropathy of ulnar nerve, in which the lesion occurs just proximal to the deep motor branches going only to the first dorsal interosseous and adductor pollicis muscles.[2] According to Waugh and Pellegrini, the muscles most commonly affected in the ulnar tunnel syndrome (caused by compression of the ulnar nerve at the Guyon's canal) include the first palmar and dorsal interossei, the lumbricals to the ring and little fingers, and adductor pollicis.[3]

Etiologies of ulnar neuropathy at the wrist include acute and chronic trauma as the most common cause.[7] Other causes of ulnar neuropathy at the wrist include ganglion cysts, tumors, anatomic abnormalities, hypothenar hammer syndrome, fractures or dislocations, direct trauma during arthroscopy including other iatrogenic causes, rheumatoid arthritis, osteoarthritis, and tenosynovitis; it also may be more common in patients with carpal tunnel syndrome.[3,8,9] Physical labor and biking are associated with increased risk for ulnar neuropathy at the wrist.[10]

Entrapment of the ulnar nerve in Guyon's canal most frequently results from a ganglion cyst.[2,11,12] They are widely recognized as a mucoid degeneration of the wrist joint capsule that occasionally protrude into the Guyon's canal and induce entrapment neuropathies.[13] Seddon described a series of patients with motor symptoms caused by the ganglia compressing the deep

branch of the ulnar nerve.[14] Brooks observed that ganglion cysts arising proximal to the pisohamate ligament present with both motor and sensory symptoms, whereas those arising distal to this ligament tended to spare sensation.[15]

Some patients with ganglion cysts at the Guyon's canal can present with a subacute onset of discomfort and pain at the wrist (as in case 1) with subsequent weakness with or without sensory symptoms, according to the anatomical location.[16] As in case 1, nearly 90% of all nontraumatic cases of pure motor weakness result from a ganglion cyst arising from the triquetrohamate joint.[3] Zone III lesions are most commonly caused by anomalous muscles or thrombosis of the ulnar artery.[6]

NCS and EMG are essential to differentiate ulnar neuropathy at the wrist from the more common ulnar neuropathy at the elbow or other neuropathic processes that may mimic ulnar neuropathy. It also helps with more specific localization of ulnar nerve lesions in the wrist. In the case of distal motor ulnar neuropathy, it is imperative to perform motor studies recording from the FDI muscle, in order not to miss involvement of the more distal deep motor branch after take-off of the hypothenar branch.[7]

Accurate anatomical localization and characterization of the lesion is crucial in planning the surgical approach. MRI has an important clinical utility in diagnosis of space occupying lesions causing ulnar neuropathies, such as ganglia, tumors, aneurysm or thrombosis, or congenital abnormalities. Its use has a particular importance value in patients presenting with subacute or chronic neurologic deficits of the hand without history of trauma when the NCS and EMG localize the lesion to the wrist. The ganglion cysts have signal intensity similar to that of water-bright on T2-weighted imaging or short tau inversion recovery and dark on T1-weighted imaging.[17] MRI images depict the ulnar tunnel in excellent detail.[18] High-resolution sonographic examination reveals ganglion cyst as a well-demarcated anechoic mass with posterior enhancement and without vascularity within the mass.[13] In some studies, MRI and ultrasound examinations were found to be equally effective in detecting ganglion cysts.[4] The ultrasound may be a cheaper and adequate alternative to the MRI. The resolution of ultrasound techniques has improved in recent years; however, the images frequently are not sufficiently anatomically precise, and many processes affecting peripheral nerves cannot be adequately assessed by the ultrasound. In addition to the aforementioned pathologies, the ulnar nerve lesions at the wrist are quite frequently associated with various systemic conditions affecting the bones, joints, ligaments, tendons, and soft tissues. In those instances, MRI provides markedly better and more complete information about specific pathologies and may be more helpful than ultrasound with planning of specific therapeutic interventions. Both imaging techniques have been used by physicians of different specialties for evaluation of focal neuropathies. Future research will help determine which technique should be used preferentially, depending on the observed clinical and electrodiagnostic abnormalities.

Ganglion cysts at the Guyon's canal causing motor deficits are subject to surgical interventions.[19] In a large series of patients with ganglion cysts causing peripheral nerve compression, only 58% had a good motor recovery; this was related to the severity of preoperative motor deficits,[20] which underscores importance of early diagnosis and therapeutic intervention.

All 3 elements of the assessment are very important to maximize the chances of successful management of ulnar nerve lesions at the wrist: (1) diligent clinical assessment, based on understanding of the ulnar nerve neuroanatomy and various patterns of the sensory and motor function abnormalities in ulnar nerve lesions at different locations; (2) additional confirmation of the neuropathic process and likely localization of the lesion by NCS and needle EMG; and (3) visualization and characterization of the possible structural lesion by MRI or ultrasound.

CONCLUSIONS

MRI is a very useful and important diagnostic tool that may help with diagnosis and therapeutic decisions in patients with ulnar nerve lesions at the wrist. It complements the neurological exam and electrodiagnostic studies. High resolution ultrasound may be an adequate alternative to the MRI.

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