



EMG Case No. 69, July 2004

Presenting Symptom(s):

Intermittent left hand numbness

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Appropriate Audience: Residents and practicing physicians

Learning Objectives: After completing this educational activity, participant will be able to: (1) distinguish between ulnar mononeuropathies at the elbow and wrist electrodiagnostically, (2) identify the three types of ulnar nerve compression that occur at the wrist by their symptoms as well as electrodiagnostically, and (3) become familiar with causes and treatments of ulnar mononeuropathies at the wrist.

This case is no longer available for CME credit.

History

The patient is a 64-year-old gentleman with a six-month history of left hand numbness. The numbness is intermittent. It starts in the third through fifth digits and then spreads to encompass his entire hand. He reports no weakness of the left hand but occasionally drops things. He has no pain associated with the numbness.

- Prior to continuing, please develop a differential diagnosis and list each possible diagnosis in order of likelihood.
- Is there any additional information regarding the clinical history that might be helpful in clarifying your differential list or changing its order of priority?

Differential Diagnosis:

1. Ulnar mononeuropathy at the elbow
2. Ulnar mononeuropathy at the wrist
3. Carpal tunnel syndrome
4. C7 or C8 radiculopathy
5. Lower trunk plexopathy

Commentary I

The initial location of the numbness in the medial aspect of the hand would implicate a process affecting either the ulnar nerve, lower trunk plexus, or C8 nerve root. Since numbness is located only in the hand, a C8 radiculopathy is less likely as the sensory deficit would more likely also affect sensation along the medial aspect of the arm. The evolution of the numbness to vaguely include the entire hand may indicate carpal tunnel syndrome, which is a common cause of hand numbness.

It might be helpful to know if he has had any injury to his neck or a history of neck pain to evaluate risk for radiculopathy. Also, the examiner may wish to know if he has any risk



factors for nerve damage, such as resting his elbows on surfaces or work that requires excessive repetitive motions of the wrist or arms.

History, continued

The patient has no history of neck pain and no injury to the hand prior to the symptoms starting. He has a history of a right transfemoral amputation from an accident more than ten years ago. He has been using bilateral axillary crutches to ambulate for much of this time due to his inability to tolerate a prosthesis. He has no history of diabetes mellitus, thyroid dysfunction or heavy alcohol use.

- If necessary, revise your differential diagnosis based on the additional clinical history.
- On which details of the physical examination should you focus at this point?

Differential Diagnosis:

1. Ulnar mononeuropathy at the wrist
2. Ulnar mononeuropathy at the axilla
3. Carpal tunnel syndrome
4. Ulnar mononeuropathy at the elbow
5. C7 or C8 radiculopathy
6. Lower trunk plexopathy

Commentary II

The patient's history of using axillary crutches could increase the chances of developing pressure points in the axillae as well as at the hands. This increase in pressure may cause nerve injury, specifically to the ulnar nerve at the wrist and at the axilla. Carpal tunnel syndrome remains a possibility due to possible improper wrist position during crutch use. Ulnar mononeuropathy at the elbow would be less likely than these other diagnoses but is still very much a possibility due to location of symptoms.

On the physical examination, the examiner should focus on the distribution of any muscular weakness as well as sensory deficits. Provocative tests like Phalen's and Spurling's may be helpful in differentiating carpal tunnel syndrome and radiculopathy respectively.

Physical Examination

On physical examination, strength is normal in the upper extremities except for trace weakness of fifth finger abduction bilaterally. Reflexes were 2+ and symmetric at the biceps, triceps and brachioradialis bilaterally. Phalen's test was negative for symptoms in both hands. Spurling's maneuver caused no radiating symptoms into the arms or hands bilaterally.

- At this point, review your differential diagnosis and revise as appropriate.
- Are there additional observations on physical examination that might be helpful in narrowing your differential list?

Revised Differential Diagnosis:

1. Ulnar mononeuropathy at the wrist



2. Ulnar mononeuropathy at the elbow
3. Ulnar mononeuropathy at the axilla
4. Carpal tunnel syndrome
5. C7 or C8 radiculopathy
6. Lower trunk plexopathy

Commentary III

The normal strength found in all muscles except abductor digiti minimi would make a C8 radiculopathy and lower trunk plexopathy less likely as other C8 (and T1) muscles do not seem to be affected. Also, radiculopathy may be less likely due to the negative Spurling's test on the left. An ulnar mononeuropathy at the wrist or elbow is still probable, with increased likelihood of the lesion being at the wrist since no proximal ulnar innervated muscles are affected.

To further distinguish between the ulnar mononeuropathies, it would be helpful to check pinprick sensation to determine a location of sensory deficits, as well as to check for a positive Tinel's sign over the ulnar nerve at the elbow or the wrist.

Physical Examination, continued

Sensation was intact to pinprick over the palmar surface of all the fingertips as well as along the dorsal surface of the hand and the medial aspect of the forearm. There was a negative Tinel's sign over the ulnar nerve at the elbow as well as over the median and ulnar nerves at the wrist. Examination of the hands demonstrates thick callus formation over the proximal aspect of the hypothenar eminences at the base of the wrists bilaterally.

- If necessary, revise your differential diagnosis based on the additional physical findings.
- Design your approach to the electrophysiologic examination based on the existing data.

Commentary IV

The normal pinprick sensation and negative Tinel's signs in the left upper extremity were not helpful in shaping the differential diagnosis in this case. These findings do not rule in or exclude any of the possibilities on the current list. The callus formation over the hypothenar eminences indicates this is an area of great pressure during crutch use. These calluses are located over Guyon's canal, where the ulnar nerve traverses the wrist and enters the hand. Due to this finding, an ulnar mononeuropathy at the wrist would remain at the top of the differential.

In evaluating for an ulnar mononeuropathy, to help determine whether the lesion is at the elbow or the wrist, ulnar sensory and motor nerve conductions should be performed. The first conduction would be the ulnar sensory conduction at the wrist. Prolongation of the distal latency at the wrist could indicate compression of the ulnar superficial sensory branch, but this could also occur in a compression of the ulnar nerve at the elbow. The second important conduction is the dorsal ulnar cutaneous sensory stimulation. An abnormality of this conduction can be helpful in distinguishing a lesion at the elbow from one at the wrist, since the dorsal ulnar cutaneous branch of the ulnar nerve occurs distal to the elbow and proximal to the wrist. An abnormal dorsal ulnar cutaneous would indicate the lesion is proximal to where it branches, and thus, likely at the elbow. A normal dorsal ulnar cutaneous stimulation might indicate that the lesion is distal to its take-off and so, likely to be at the wrist. An ulnar motor conduction performed across the elbow might demonstrate



slowing of the conduction velocity if the lesion is at the elbow. Also, prolongation of the distal latency at the wrist may indicate involvement of the deep motor branch if compression is found at the wrist.

The needle examination of the muscles will help to determine whether there is axonal loss associated with an ulnar lesion as well as evaluate for C8 radiculopathy. Hand intrinsic could demonstrate abnormalities in ulnar lesions both at the wrist and at the elbow. The ulnar-innervated muscles of the forearm could be useful to distinguish between the two, as they may be abnormal in an elbow lesion. Evaluation of C8 muscles outside the ulnar distribution (such as the extensor indicis, which is innervated by the radial nerve) may help rule in or out a C8 radiculopathy. A lower trunk plexopathy would be similar to the C8 radiculopathy in that muscles of the C8-T1 distribution will be affected, but can be distinguished because there will be a decreased amplitude of the sensory response of the ulnar nerve at the fifth digit (without affecting the conduction velocity) and a normal median sensory response.

Electrophysiologic Data

Nerve	Amplitude (mV or μ V)		Latency (ms)				Conduction Velocity (m/sec) Dist (mm)			
	R	L	R	L	R	L	R	L	R	L
Stimulate Record										
Median sensory										
Wrist Index		25.1		2.4		3.3		58.3		140
Ulnar Sensory										
Wrist 5 th digit	12.5	14.3	3.9	3.2	4.5	3.8	35.9	43.7	140	140
Median Sensory										
Palm Wrist		76.8		1.4		1.9		57.1		80
Ulnar Sensory										
Palm Wrist		27.9		1.6		2.2		50.0		80
Ulnar Sensory										
Wrist Dor hand	23.1	21.4	1.4	1.5	2.1	2.2	71.4	66.7	100	100
Ulnar Motor										
Wrist Hypothenar		10.3		3.4						70
B elbow hypothen		10.1		7.3				56.4		220
A elbow hypothen		10.1		9.0				58.8		100



Ulnar F-Response										
Wrist hypothenar				29.3						

Muscle	Insertional/Spontaneous					Voluntary motor unit potential				
	Ins	p wave	fib	fasc	oth	eff	rect	amp	dur	poly
L-FDIH (Hand)	N	0	0	0	0	N	N	I+	N	N
L-Abd Dig Quinti (h)	N	0	0	0	0	N	N	I+	N	N
L-Extensor Indices	N	0	0	0	0	N	N	N	N	N
L-Ext Digitorum Communis	N	0	0	0	0	N	N	N	N	N

- On the basis of both the clinical and electrophysiologic evaluations, formulate your diagnostic impression. List the most likely diagnosis first and follow in order with the other possibilities that are not excluded by the data. Eliminate those diagnoses not supported by the data.
- Are there additional electrophysiologic data that you feel would further delineate the diagnosis? (Remember, collecting data that are not needed for the diagnosis is costly and uncomfortable for the patient.)

The nerve conduction studies demonstrate prolonged distal latencies of bilateral ulnar sensory responses at the wrist. The left dorsal ulnar cutaneous sensory response is normal. The ulnar motor distal latency is within normal limits and there is no slowing of conduction velocity across the elbow. The needle examination of the left upper extremity is normal with the exception of mild amplitude changes of the left abductor digit minimi and first dorsal interosseous muscles.

- Make the final revisions of your diagnostic impression(s).

Diagnostic Impression

This is an abnormal examination. There is electrodiagnostic evidence consistent with a chronic, moderate ulnar mononeuropathy distal to the dorsal ulnar cutaneous branch, likely at the wrist. It is primarily sensory with minimal motor involvement. Callus formation over the palms is consistent with a history of chronic compression in this area. There is no electrodiagnostic evidence of a left C8 radiculopathy. The prolonged distal latency of the right ulnar sensory response is likely consistent with an ulnar mononeuropathy on the right but the patient does not have symptoms in the right hand at this time.

- What other diagnostic procedures (laboratory tests, etc.), if any, are needed?
- What treatment would you recommend?

Commentary V

The second most common site of ulnar nerve compression occurs at the wrist (the first being at the elbow). This occurs in or distal to Guyon's canal, which is also referred to as the ulnar tunnel. Due to the enclosed space of Guyon's canal, there is increased chance of damaging the ulnar nerve in this region. The ulnar nerve passes between the transverse carpal ligament and the volar carpal ligament. It is also bounded medially and laterally by the pisiform bone and the hook of the hamate respectively. The ulnar artery and vein also traverse Guyon's canal (figure 1 see below).

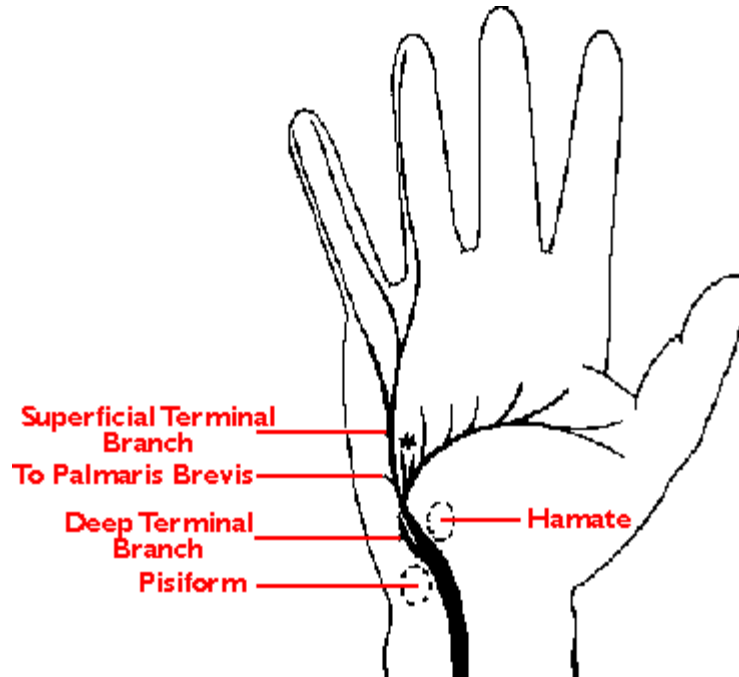
Review of anatomy at the wrist reveals that the ulnar tunnel is the location where the ulnar nerve divides into its terminal sensory and motor branches. The nerve separates just proximal or while within Guyon's canal. The motor branch to the hypothenar muscles arises from the deep motor branch rather quickly after exiting the canal. The deep motor branch then continues laterally to innervate the third and fourth lumbricals, as well as the interossei. The superficial sensory branch provides cutaneous sensation to the palmar aspect of the medial hand, including the fourth and fifth digits.

Due to the branching that occurs in this area, there are three types of lesions that can occur at Guyon's canal, depending on where the compression of the ulnar nerve occurs. A type I lesion occurs with compression of the ulnar nerve proximal to or within Guyon's canal. It affects both the superficial and deep branches of the ulnar nerve since they are in the process of separating while in the canal. In a type II lesion, only the deep motor branch is affected and compression occurs around the hook of the hamate. There is no sensory loss, only weakness of the ulnar innervated hand muscles. A subtype, called a IIa lesion, occurs distal to the innervation of the hypothenar muscles and so they are spared. The least common ulnar lesion at the wrist is the type III lesion. It also occurs at the hook of the hamate, but only affects the superficial sensory branch. There is no weakness, only sensory loss. In the case described above, with a prolonged ulnar sensory response latency, normal dorsal ulnar cutaneous response, normal ulnar motor response latency and minimal motor unit changes, the patient's lesion may be most consistent with a type III lesion.

Causes of ulnar nerve compression at the wrist include a ganglion, acute or chronic occupational trauma, ulnar artery thrombosis, and fracture of carpal bones, metacarpals or radius. There have been cases of ulnar tunnel classically described in cyclists from positioning of their hands on the handlebars and callus formation over the hypothenar eminences. Radiographs of the hand and wrist may be necessary to exclude fractures. An MRI may be performed to evaluate for masses in the area.

Mild ulnar neuropathies at the wrist due to chronic trauma can be treated by conservative methods initially. This can be accomplished through splinting and avoiding the trauma that causes pressure in the area of Guyon's canal. In the case of the gentleman described above, he might be willing to undergo good prosthetic fitting in order to ambulate with a prosthesis instead of axillary crutches. Otherwise, the patient may possibly be a surgical candidate for decompression of the ulnar nerve. Surgery may involve removal of ganglion cysts or resection of the pisiform or hamate bones.

Figure 1



Bibliography

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