



March 1997 EMG Case-of-the-Month

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HISTORY

The patient is a 48-year-old male who was washing his hair 6 days ago when he noticed that he was losing control of his right hand. The hand continues to be weak at present. He has no such symptoms in his other limbs or elsewhere. He has no history of injury to the neck or right upper limb.

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

The patient denies headache, dizziness, clumsiness or mental aberration. He has not experienced any systemic symptoms such as fever, skin rash or weight loss. He denies pain, numbness and tingling, and he states further that he feels perfectly well except for weakness of his hand.

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

PHYSICAL EXAMINATION

On physical examination, there is no Spurling sign. There is marked weakness and obvious atrophy of the ulnar-innervated intrinsic muscles of the right hand. No weakness is present proximal to the wrist including the flexor carpi ulnaris, and no weakness is apparent in the other limbs. All muscle stretch reflexes in the upper and lower limbs are present (2+) and symmetric bilaterally. No Babinski sign is present. There is no sensory deficit.

- **At this point, review your differential diagnosis and revise as appropriate. This will determine your working differential from which to design your electrodiagnostic study.**
- **Formulate your approach to the electrodiagnostic study.**



ELECTROPHYSIOLOGIC DATA

ELECTROMYOGRAPHY										
N = normal incr= increased decr = decreased 0 = absent 1+ = minimal 4+ = maximal crd = complex repetitive discharge fasc = fasciculation potential myk = myokymic discharge myt = myotonic discharge nmt = neuromyotonic discharge										
R/L	MUSCLE	INSERTION		SPONTAN		VOLUNTARY				
		activ	p wav	fib	other	rectr	amp	dur	poly	effort
R	paraspinals	N	0	0	0	N	N	N	N	
R	biceps	N	0	0	0	N	N	N	N	full
R	pronator teres	N	0	0	0	N	N	N	N	full
R	flexor carpi radialis	N	0	0	0	N	N	N	N	full
R	flexo carpi ulnaris	N	0	0	0	N	N	N	N	full
R	extensor carpi ulnaris	N	0	0	0	N	N	N	N	full
R	abductor digit quinti	N	0	0	0	4	N	N	N	full
R	4th dorsal interos	N	0	0	0	4	N	N	N	full
R	1st dorsal interos	N	0	0	0	4	N	N	N	full
R	opponens pollicis	N	0	0	0	N	N	N	N	full
L	flexo carpi ulnaris	N	0	0	0	N	N	N	N	full
L	extensor carpi ulnaris	N	0	0	0	N	N	N	N	full
L	abductor digit quinti	N	0	0	0	4	N	N	N	full
L	1st dorsal interos	N	0	0	0	4	N	N	N	full
L	opponens pollicis	N	0	0	0	N	N	N	N	full

MOTOR NERVE CONDUCTION									
nr = no response									
NERVE	LATENCY (ms)			AMPLITUDE (mV)			CONduc VEL (m/s)		
	R	L	Norm	R	L	Norm	R	L	Norm
ulnar									
wrist to hypothelar	4.1	-	<4.0	0.8	-	>5	-	-	-
ulnar									
wrist to 1" dors. Interos	5.2	-	-	0.4	-	-	-	-	-



MIXED NERVE CONDUCTION									
nr = no response									
NERVE	LATENCY (ms)			AMPLITUDE (V)			CONDUCT VEL (m/s)		
	R	L	Norm	R	L	Norm	R	L	Norm
(pos. to neg. peak)									
ulnar									
BE to wrist	3.9	-	-	54	-	-	62	-	>50
AE ro wrist	5.3	-	-	42	-	-	61	-	>58

SENSORY NERVE CONDUCTION									
nr = no response									
NERVE	LATENCY (ms)			AMPLITUDE (V)			CONDUCT VEL (m/s)		
	R	L	Norm	R	L	Norm	R	L	Norm
(pos. to neg. peak)									
ulnar									
wrist to digit 5	1.9	1.8	<2.9	43	39	>15	60	61	-

On needle electrode examination of the right upper limb and corresponding paraspinal muscles no positive waves or fibrillation potentials are detected, but a marked decrease in recruitment of motor unit potentials is noted in the abductor digiti quinti, 4th dorsal and 1st dorsal interosseus muscles. Recruitment was normal in all other muscles examined including the flexor carpi ulnaris and opponens pollicis.

Conduction in the motor fibers of the right ulnar nerve from the wrist to the hypothenar and first dorsal interosseus muscles was abnormal and the amplitudes of the compound muscle action potentials were markedly reduced. The difference in the motor conduction latencies to these two muscles was within normal limits.

Conduction in the mixed motor and sensory fibers of the right ulnar nerve across the elbow and through the forearm was within normal limits and the amplitude of the compound nerve action potential was also within normal limits.

Conduction in the sensory fibers of the right ulnar nerve from the wrist to the 5th digit is within normal limits as is the amplitude of the sensory nerve action potential. Both values were quite comparable to those on the left side.

- **On the basis of the clinical and electrodiagnostic evaluation, formulate your final impression by determining the most likely diagnosis. List other possibilities that are not excluded by the data. Eliminate those diagnoses not supported by the data.**



DIAGNOSTIC IMPRESSION

There is an acute focal lesion of the deep motor branch of the right ulnar nerve in the hand within or in the region of Guyon's canal, probably the distal portion of the canal. (This would be a Type II lesion according to the classification of Shea and McClain.) The lesion includes the branch to the abductor digiti quinti muscle. The distal sensory branches are spared. In the absence of any history of trauma, the most likely causes are (a) abrupt impingement by a local structure such as a rapidly expanding ganglion cyst and (b) infarction of the nerve due to vasculitis or other cause.

FORMULATION OF A DIFFERENTIAL DIAGNOSIS

History - A rapid onset without any external compression or acute trauma narrows the etiologic possibilities to ischemia or local internal compression. A disease process such as a focal demyelinating neuropathy would not happen so abruptly. As for location of the lesion, the complete absence of sensory symptoms focuses ones attention on motor pathways, specifically those to the right hand. A discrete lesion within the central nervous system (CNS) is possible somewhere between the left cerebral cortex and the right anterior horn of the spinal cord at C8 or T1. In the peripheral nervous system (PNS), the ventral root and the deep motor branch of the ulnar nerve are the only two sites along the pathway where a lesion would not produce sensory symptoms. The absence of symptoms referable to the CNS diminishes the chances of a lesion in this region, and the absence of systemic symptoms reduces the likelihood of vasculitis. It is now probable that the lesion is in the PNS as a result of local internal compression.

Physical Examination - The absence of long-tract signs further supports a PNS lesion. A proximal PNS lesion is less likely without a Spurling sign, proximal weakness or asymmetry of the muscle stretch reflexes. The distribution of the weakness is confined to the deep motor branch of the ulnar nerve, making this the most likely site of the lesion. The cause of the nerve pathology remains obscure.

ELECTROPHYSIOLOGIC EVALUATION

Needle Examination - Reduced recruitment was found in all the muscles innervated by the deep motor branch of the right ulnar nerve and not elsewhere. Since the abductor digiti quinti is involved, the evidence that the lesion is at the proximal end of the nerve is very strong. The absence of positive waves is consistent with the 6-day duration of the problem.

Motor Conduction - Abnormal conduction from the wrist to the abductor digiti quinti places the lesion as proximal as the nerve to that muscle. No abnormality of conduction was found distal to this branch since a normal value was obtained when subtracting the latency to the 1st dorsal interosseus from the latency to the abductor digiti quinti. This confirms the site of the lesion.

Mixed Nerve Conduction - Normal conduction in the right ulnar nerve across the elbow confirms that the lesion is not there, and thus provides some additional support for localization of the lesion to the hand.



Sensory Conduction - Normal sensory conduction studies establish that the right ulnar sensory branches in the hand are not involved.

FORMULATION OF THE DIAGNOSTIC IMPRESSION

At this point, the lesion has been localized, but the cause of the lesion has not been determined, and cannot be via electrodiagnostic studies. Since conduction across the site of the lesion is slow, one might speculate that the etiology is internal compression rather than an infarction of the nerve since the latter does not typically cause slowing in the remaining viable fibers. If so, it is a highly unusual presentation.

FOLLOW-UP

Following the electrodiagnostic medicine consultation, an MRI of the patient's right hand revealed a ganglion cyst in the region of Guyon's canal. The ganglion was surgically removed, and within a month, the patient's strength had largely returned.

COMMENT

A usual rule of thumb is to wait three weeks following onset of symptoms before performing electrodiagnostic studies. This is to allow fibrillation potentials to develop if they are going to do so. The moment a nerve is damaged, recruitment decreases. Following this, a minimum of 7 or 8 days must pass before the earliest spontaneous activity can be detected. It may take as long as three weeks and sometimes more, particularly if there is a long distance between the site of injury and the muscle being evaluated, such as a distal limb muscle following acute compromise of a lumbosacral nerve root.

In this case, the diagnosis was reached before fibrillation developed, allowing imaging studies and surgical decompression to proceed. It would not have been appropriate to delay electrodiagnostic testing, and it would not have been helpful to have the patient return at a later date to document the presence of fibrillation. When to test is a matter of clinical judgment, and should not be determined by a hard and fast rule.

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