



EMG Case No. 46, August 2000

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Presenting Symptoms: Neck Pain, Elbow Pain, and Hand Numbness

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Presenting Symptoms: Neck pain, elbow pain, and hand numbness

Appropriate Audience: Residents and practicing physicians.

Learning Objectives: After completing this educational activity, participant will be able to (1) evaluate patients electrodiagnostically with complaints of neck and upper limb pain and numbness, (2) describe symptoms common to cervical radiculopathy, and ulnar neuropathy, and learn techniques to distinguish the two electrodiagnostically, and (3) identify atypical findings and anatomic variations.

History

A 57-year-old right hand dominant woman underwent anterior cervical discectomy and fusion (ACDF) at C5-6 and C6-7 3 years prior to presentation. She now reports a 3-month history of right medial elbow pain, forearm aching, and numbness in the 4th and 5th digits of the right hand. She denies traumatic injury.

- *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?*

Commentary I

The recent symptoms seem to be originating at the elbow. She denies any trauma, but further history must be obtained regarding any possible aggravating activities in the last 3 months. The cervical spine may also be the source of her symptoms. She may have hypermobility of the cervical segments adjacent to her fusion, which could cause radicular symptoms. Past medical history and diagnostic imaging may give information that could change the differential. The patient may also have a "double crush" phenomenon with both cervical root and ulnar nerve compression.

The differential diagnosis at this point would include at least:

1. Right lower cervical radiculopathy
2. Right ulnar neuropathy at the elbow
3. Right brachial plexopathy (lower trunk or medial cord)
4. Atypical presentation of diffuse polyneuropathy
5. Atypical presentation of carpal tunnel syndrome (less likely)



History, continued

She started a new job about four months prior, which required her to spend a good part of her day at a computer terminal. Her chronic neck pain had not worsened significantly over this time period. She had minimal upper arm pain, but did report nocturnal awakening with right hand numbness.

Her past medical history is significant for diabetes mellitus, diagnosed 3 years prior, and hypertension. In addition to her ACDF, she has had a hysterectomy and left carpal tunnel release. Her current medications include an anti-inflammatory agent, an oral hypoglycemic, and an anti-hypertensive medication. She denies medication allergies.

Flexion/extension X-rays of the cervical spine show solid fusion at C5-6 and C6-7, with no evidence of instability or spondylolisthesis at other levels. She has degenerative changes and disc space narrowing at C7-T1, with left greater than right-sided foraminal narrowing. MRI confirms this and shows no disc herniation or significant spinal canal stenosis.

- *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?*

Commentary I I

With the additional information noted above, we must expand our differential:

1. Right ulnar neuropathy
2. Diabetic radiculopathy
3. Compressive right lower cervical radiculopathy
4. Right brachial plexopathy
5. Atypical presentation of peripheral neuropathy related to DM
6. Atypical presentation of carpal tunnel syndrome

Physical Examination

On physical examination, she has limited cervical range of motion in all planes. Spurling's maneuver is negative bilaterally. She has full active range of motion of both upperlimbs. Motor strength is 5/5 in deltoid, biceps, triceps, wrist extension, and wrist flexion symmetrically. Right dorsal interosseus muscles were weaker than the left at 4+/5. There is no muscle atrophy. MSRs are 2+ and symmetric. Sensation is decreased to light touch and pin prick over the 4th and 5th digits of the right hand and over the mid to distal right ulnar forearm. Ulnar Tinel's sign is negative at the right elbow and at Guyon's canal.

- *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?*



Electrophysiologic Data

SENSORY NERVE CONDUCTION STUDIES							
NERVE	SIDE	STIM SITE	RECORD	cm	AMPL	LAT	CV
ulnar	R	wrist	5 th digit	14	10	4.7	--
ulnar	R	palm	5 th digit	6	absent	--	--
median	R	wrist	Index	14	53	3.5	--
median	R	palm	Index	6	72	1.6	--
median	R	wrist	Thumb	10	44	2.8	--
radial	R	wrist	Thumb	10	15	2.9	--

MOTOR NERVE CONDUCTION STUDIES							
NERVE	SIDE	STIM SITE	RECORD	cm	AMPL (mv)	LAT (ms)	CV (m/s)
ulnar	R	wrist	ADM	8	7.7	4.0	--
ulnar	R	below elbow	ADM	18	7.6	7.1	58
ulnar	R	above elbow	ADM	10	6.1	9.5	42
ulnar	R	axillary	ADM	11	6.4	11.6	52
median	R	wrist	APB	8	5.7	3.6	59

NEEDLE ELECTROMYOGRAPHY									
INSERTional activity: N, sust, unsust									
FIB: 0, 1+, 2+, 3+, 4+									
OTHer: 0 or fascic, myotonia, myokymia									
EFFort: N, decr									
RECruitment: N, inc or dec 1+, 2+, 3+, 4+									
AMPlititude: N, inc or dec 1+, 2+, 3+, 4+									
DURation: N, inc or dec 1+, 2+, 3+, 4+									
POLyphasia: N, inc or dec 1+, 2+, 3+, 4+									
R/L	MUSCLE	INSER	FIB	OTH	EFF	REC	AMP	DUR	POL
R	deltoid	N	0	0	N	N	N	N	N



R	biceps	N	0	0	N	N	N	N	N
R	triceps	N	0	0	N	N	N	N	N
R	extensor carpi radialis	N	0	0	N	N	N	N	N
R	brachioradialis	N	0	0	N	N	N	N	N
R	flexor carpi radialis	N	0	0	N	N	N	N	N
R	flexor carpi ulnaris	unsust	0	0	N	N	N	N	N
R	flexor dig profundus (ulnar)	sust	2+	0	N	inc	N	N	inc
R	apb	N	1+	0	N	N	N	N	N
R	1 st dorsal interosseous	inc	2+	0	N	inc	N	N	inc
R	adm	inc	2+	0	N	inc	N	N	inc
R	extensor indicis	N	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.)*

Electrophysiologic Data, continued

There is prolongation of both the ulnar sensory and motor distal latencies as well as decreased amplitude of the ulnar SNAP. In addition, ulnar motor nerve conduction velocity and CMAP amplitude drop across the elbow. These changes meet the criteria for ulnar neuropathy at the elbow. There is a decrease of greater than 10 m/s in NCV and the NCV is less than 50 m/sec. Also, the CMAP amplitude drops nearly 20% across the elbow. There is evidence of denervation in the ulnar innervated muscles, as well as a neurogenic recruitment pattern.

There is one finding, fibrillations in the APB that complicates the diagnosis. This suggests that there may be a lesion in either the lower trunk or C8-T1 roots. This gives evidence to the possibility of "double crush" syndrome. The other possibility is that this is from an anatomical anomaly; specifically a Riche-Cannieu anastomosis. This is a common anomaly (approximately 77% of hands) of an anatomic connection between the deep ulnar nerve and the recurrent median motor nerve.

At this stage it is useful to attempt to document the presence of this anastomosis and rule out as much as possible the possibility of a lower trunk plexopathy or radiculopathy. Documenting the anastomosis can be very difficult. This can be done by comparing motor



evoked responses recorded with a needle electrode from the APB with stimulation of the ulnar nerve at the elbow. If this stimulation gives a sharp or serrated response from the APB, this strongly suggests that axons in the ulnar nerve at the elbow innervate the APB through a Riche-Cannieu anastomosis. Stimulation at the wrist may also help, however, simultaneous stimulation of both the median and ulnar nerves at the wrist is more likely than at the elbow. If both nerves are accidentally stimulated it will be impossible to differentiate if there is a Riche-Cannieu anastomosis.

Ruling out other abnormalities associated with plexopathy or radiculopathy is also critical to support the solitary lesion of the ulnar nerve at the elbow. Normal EMG of other muscles with C8-T1 and/or lower trunk innervation (extensor indicis, triceps and cervical paraspinals) is important. Normal SNAP of the medial antebrachial cutaneous can also speak against a lower trunk plexopathy.

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

Diagnostic Impression

1. Abnormal study.
 2. There is electrodiagnostic evidence for a right ulnar mononeuropathy at the elbow. This is characterized by mild focal demyelination, evidence of motor axon loss and conduction block.
 3. There is no electrodiagnostic evidence for
 - a. Right cervical radiculopathy.
 - b. Right brachial plexopathy.
 - c. Right median neuropathy at the wrist (carpal tunnel syndrome).
 4. Incidental note is made of Riche-Cannieu ulnar to median anastomosis in the hand.
- *What other diagnostic procedures (laboratory tests, etc.), if any, are needed?*
 - *What treatment would you recommend?*

Commentary III

Electrodiagnostic studies were helpful in this case to differentiate the site of pathology. The patient had some symptoms suggestive of cervical pathology, but the results of her electrodiagnostic studies strongly indicate that there is no myotomal axon loss. She may benefit from an exercise program involving stretching of the forearm musculature, as well as avoidance of compression and/or flexion of the elbow and stretch of the ulnar nerve. It may be helpful to modify her work station. However, due to the presence of ongoing denervation, surgical referral was made.

We cannot always precisely localize the site of entrapment in ulnar neuropathies, although inching studies can often differentiate retrocondylar compression from compression in Guyon's canal. Typically, surgery will involve releasing all potential sites of entrapment about the elbow. However some surgeons prefer not to transpose the ulnar nerve in every case. Compression at Guyon's canal would not explain the more proximal denervation, nor obviously the drop in NCV and CMAP amplitude across the elbow.

Electrodiagnostic technique is very important in evaluating suspected ulnar nerve pathology. The elbow should be flexed to between 90 and 135 degrees. Across elbow NCV may appear



falsely slowed if the study is done with the elbow fully extended. Additionally, care should be taken to ensure that one uses the lowest possible stimulus that yields a supramaximal response. An excessively high stimulus will depolarize the nerve more distally, resulting in an incorrectly increased distance measurement, and therefore in a falsely high NCV. This can in turn lead to a falsely low velocity reading in the next most proximal segment.

Bibliography

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