



EMG Case No. 42, December 1999

Presenting Symptom: Arm Weakness and Clumsiness

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Presenting Symptom: Arm weakness and clumsiness

Appropriate Audience: Residents and practicing physicians

Learning Objectives: After completing this educational activity, participants will be able to (1) formulate an appropriate differential diagnosis for the presented arm weakness and clumsiness and (2) devise an appropriate treatment plan for the presented arm weakness and clumsiness.

History

A 54-year-old right-hand dominant woman who is employed as an operating room nurse has an 8-year history of progressive numbness, paresthesiae, pain, and weakness in the right upper limb. She complains of numbness and tingling, which intermittently affect all digits of the right hand. She denies any nocturnal paresthesiae. She also has a constant pain that begins in the proximal forearm and extends to the wrist. There are complaints of right hand weakness, and over the past year she has dropped instruments in the operating room several times. She has neck pain, but this does not extend into the 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 regarding the clinical history that might be helpful in clarifying your differential list or changing its order of priority?*

Commentary I

The differential diagnosis of hand numbness, paresthesiae, and pain must include carpal tunnel syndrome, as this is the most commonly recognized entrapment neuropathy. However, nocturnal paresthesiae are usually seen with CTS. Other considerations are cervical radiculopathy, involving either the C6, C7, or C8 root levels, brachial plexopathy, radial neuropathy, or proximal median neuropathy.

History, continued

Three years ago she underwent an endoscopic carpal tunnel release on the right. This resulted in transient improvement of the numbness and paresthesiae. Due to recurrent symptoms, one year later an open carpal tunnel release was performed on the right side with no significant improvement. Her medical history is negative and she is otherwise healthy. There is no relevant family history.

- *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 II

The recurrence of symptoms following an endoscopic carpal tunnel release suggests the possibility of an incomplete division of the transverse carpal ligament. The patient subsequently underwent an open carpal tunnel release. The lack of any improvement in her clinical condition warrants consideration of a lesion at a different site.

Physical Examination

Muscle stretch reflexes are symmetric at 2+ in the biceps, brachioradialis, and triceps. There is atrophy of the volar aspect of the proximal right forearm as well as of the thenar eminence. There is no active flexion present (0/5 strength) in either the distal phalanx of the right thumb or distal phalanx of the right index finger. There is marked weakness (3/5) in flexion of the proximal interphalangeal joint of the right long finger as well. There is normal strength in flexion of the distal interphalangeal and proximal interphalangeal joints of the ring and little fingers of the right hand. There is mild (4/5) weakness in wrist flexion with normal strength in elbow and wrist extension. All other major muscle groups are normal. Sensation is diminished to pinprick in the thumb, index, and long fingers of the right hand on the palmar aspect only. Sensation on the dorsum of the hand is intact.

- *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?*

Commentary III

The combination of forearm atrophy and wrist flexor and extrinsic digit flexor weakness eliminates carpal tunnel syndrome as a primary cause of this patient's clinical presentation. The weakness in wrist flexion suggests a lesion at or proximal to the flexor carpi radialis if the median nerve is the primary site of injury. The combination of wrist flexion weakness and sensory impairment in the median nerve distribution also excludes the possibility of an anterior interosseous neuropathy. Reflex symmetry in the face of forearm muscle atrophy, along with normal wrist extensor and elbow extensor strength, makes the possibility of a cervical radiculopathy less likely.

Physical Examination, continued

Phalen's test is negative at 60 seconds on the right side. There is some tenderness to palpation over the flexor/pronator mass on the right. The pronator compression test on the right is positive. There is full active cervical range of motion in all planes. A Spurling's sign is negative. There is tenderness to palpation in the right upper trapezius fibers.

- *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 presence or absence of Phalen’s sign in proximal median neuropathy is disputed and controversial. Reproduction of the symptoms following compression of the flexor/pronator mass has been described as a useful part of the physical examination. However, the specificity of this test is unknown. The absence of a Spurling’s sign combined with localized tenderness in the upper trapezius suggest the possibility of musculoskeletal pain as a cause of the patient’s neck pain.

Electrophysiologic Data

SENSORY NERVE CONDUCTION									
nr = no response									
NERVE	LATENCY			AMPLITUDE (µV)			CONDUc VEL(m/s)		
	R	L	Norm	R	L	Norm	R	L	Norm
Median	-	-	-	-	-	-	-	-	-
Wrist to Long Finger	3.3	3.2	<3.7	5	25	>15	-	-	-
Ulnar	-	-	-	-	-	-	-	-	-
Wrist to Little Finger	3.0	3.2	<3.7	23	25	>10	-	-	-
Median	-	-	-	-	-	-	-	-	-
Transcarpal @ 8cm	2.0	-	<2.3	22	-	>20	-	-	-
Ulnar	-	-	-	-	-	-	-	-	-
Transcarpal @ 8cm	1.9	-	<2.4	12	-	>5	-	-	-



MOTOR NERVE CONDUCTION									
nr = no response									
NERVE	LATENCY (ms)			AMPLITUDE (mV)			CONDUCT VEL (m/s)		
	R	L	Norm	R	L	Norm	R	L	Norm
Median	-	-	-	-	-	-	-	-	-
Wrist to Thenar	4.8	4.0	<4.3	2.5	7.1	>5.0	-	-	-
AE to Thenar	9.7	8.2	-	2.4	6.1	-	49	57	>50
Ulnar	-	-	-	-	-	-	-	-	-
Wrist to Hypothenar	2.6	-	<4.0	9.5	-	>5.0	-	-	-
BE to Hypothenar	5.9	-	-	8.9	-	-	62	-	>50
AE to BE	8.0	-	-	8.7	-	-	68	-	-

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 p wave = positive sharp waves fib = fibrillation potentials recr = recruitment amp = amplitude dur = duration poly = polyphasic potential										
R/L	MUSCLE	INSERTION			SPONTAN		VOLUNTARY			
		activ	p wave	fib	other	recrt	amp	dur	poly	effort
R	Deltoid	N	O	O	-	N	N	N	N	-
R	Biceps	N	O	O	-	N	N	N	N	-
R	Brachioradialis	N	O	O	-	N	N	N	N	-
R	Extensor Carpi Radialis	N	O	O	-	N	N	N	N	-
R	Pronator Teres	N	O	O	-	N	N	N	N	-
R	Flexor Carpi	Incr	O	O	-	1+	2+	2+	N	-



	Radialis					Decr	Incr	Incr		
R	Flexor Digitorum Superficialis	Incr	1+	O	CRDs	2+ Decr	4+ Incr	4+ Incr	1+	-
R	Extensor Digitorum Communis	N	O	O	-	N	N	N	N	-
R	Extensor Carpi Ulnaris	N	O	O	-	N	N	N	N	-
R	Flexor Pollicis Longus	Incr	1+	O	-	1+ Decr	2+ Incr	2+ Incr	1+	-
R	Flexor Carpi Ulnaris	N	O	O	-	N	N	N	N	-
R	Abductor Pollicis Brevis	Incr	O	O	-	1+ Decr	2+ Incr	2+ Incr	N	-
R	1 st Dorsal Interosseous	N	O	O	-	N	N	N	N	-
R	Cervical Paraspinals	N	O	O	-	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.)*
- *Make the final revisions of your diagnostic impression(s).*

Diagnostic Impression

The patient has a chronic compression neuropathy of the proximal median nerve on the right side, at or distal to the branch to the pronator teres. There are findings of partial axon loss seen on needle examination. This is manifested by evidence of ongoing denervation as well as chronic reinnervation changes throughout the median nerve distribution distal to the lesion site.

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

Commentary V

Previous electrical data were lacking at the time of evaluation. Although the patient’s history and physical examination findings point to the likelihood of other causes for her symptoms,



the frequency of carpal tunnel syndrome warrants thorough evaluation for its possible presence. Therefore, two separate assessments were performed to compare the median nerve latency with a different nerve across the right wrist. There is no significant relative delay of the median response on either of the two tests. Additionally, the absolute values of the median sensory peak latency on both the standard digital recording as well as the transcarpal recording with palmar stimulation were well within normal range.

Both the median sensory and motor responses are of small amplitude. The median motor amplitude is < 10% of the lower limit of normal, and is only slightly more than 5% of the amplitude observed from the contralateral response. This markedly reduced amplitude indicates severe motor axon loss, consistent with an injury either to the proximal median nerve or to the cervical root. However, the possibility of a C8 root level injury is unlikely due to the well-preserved amplitude of the ulnar motor conduction to the hypothenar muscles.

Delineation of the lesion site is clarified on needle examination by the distribution of abnormalities. All muscles sampled in the median nerve distribution distal to the pronator teres displayed numerous abnormalities indicating denervation and reinnervation. The presence of complex repetitive discharges in the flexor digitorum superficialis as well as abnormalities seen in the motor unit appearance reflect the chronicity of the process. The increased amplitude and duration of motor unit potentials observed are due to reinnervation, while the decrease in recruitment is a result of axon loss.

It is important in the presence of these findings to document a normal needle examination of C6-7-8 innervated muscles outside of the median nerve distribution. This, combined with a normal needle examination of the cervical paraspinal musculature, effectively rules out a cervical radiculopathy as the primary impairment.

Proximal median neuropathies are frequently confused with carpal tunnel syndrome or a cervical root level injury. Isolating an injury to the proximal median nerve is often very challenging as fewer than 50% of patients in most previously published series have any abnormalities on median conduction studies. It is also well recognized that either mild compression of the proximal median nerve or chronic, slowly progressive injuries can result in little to no abnormalities on the needle examination.

It is important to note that the data from this patient's electrical testing allowed for three important points to be made:

1. We demonstrated there was no significant demyelinating lesion involving the distal median nerve (i.e. carpal tunnel syndrome.)
2. Abnormalities were isolated to the median nerve after the branch to the pronator teres.

We eliminated the possibility of a cervical radiculopathy by documenting no abnormalities outside of the median nerve distribution as well as the normality of the cervical paraspinal muscles on needle examination.

Following electrodiagnostic evaluation, the patient underwent exploration of the proximal median nerve on the right side and was found to have fibrous bands encircling the nerve within the bulk of the pronator teres muscle. The median nerve was decompressed and postoperatively the patient had a significant reduction of her pain, numbness, and paresthesiae.



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