



June 1998 EMG Case-of-the-Month

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HISTORY

A 34-year-old professional woman presents with the chief complaint of numbness and weakness of the right hand and forearm and intermittent pain in the extensor aspect of the forearm. Her family physician prescribed Relafen which has provided partial relief. She first noted her symptoms 4 weeks ago, and she believes they are gradually progressing. Her work as a health care executive has not been appreciably impeded, but lifting and carrying activities are limited by weakness and pain, and she fears dropping her three-year-old son who is large for his age and becoming increasingly difficult for her to hold.

- **Prior to continuing, please develop a differential diagnosis, and list each 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?**

COMMENTARY I

The pain could result from enthesitis (e.g. "tennis elbow") and the "weakness" might result from the pain rather than being true weakness. The numbness, however, increases the probability of nerve pathology. The differential diagnosis, therefore, must include focal involvement of the median, ulnar or radial nerve, the brachial plexus or a cervical nerve. A cervical cord lesion or a lesion more proximal in the central nervous system remains a lesser possibility.

Nerve injury in the hand or forearm due to repetitive motion must be considered in office workers, particularly those who are confronted by deadlines and overtime work. Cervical radiculopathy can present with symptoms similar to this patient though neck pain would add weight to this diagnosis. Gradually progressive nerve injury between the elbow and shoulder is uncommon, but must be considered. A brachial plexus lesion is unusual without acute trauma, but can occur in association with cancer or the use of crutches.

Additional history should probe for possible central nervous system symptoms and for symptoms of systemic disease such as vasculitic neuropathy that might cause focal nerve lesions. Possible causes of intermittent external compression should be explored. Activities that aggravate the patient's symptoms, especially repetitive motion, should be investigated.

HISTORY, continued

The patient denies fever and malaise, gait difficulties, dysarthria and visual changes. She has no history of neoplasm. She denies neck pain and states her symptoms are limited to her right upper limb. The only activity she clearly links to her symptoms is rocking her baby



stretched across her lap with his head resting in the crook of her elbow while she sits in a rocking chair. She relates one occasion when she fell asleep in this position and awoke with a "fallen-asleep" sensation in her right upper and lower limbs. These acute symptoms resolved within minutes.

- **If necessary, 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?**

COMMENTARY II

The presentation now leans heavily toward an extrinsic compression of a nerve in the region of the elbow caused by the baby's head resting on the patient's limb in a manner similar to "honeymoon palsy", which can affect either the median or radial nerve. Nerve entrapment in the forearm or arm remains possible. Radiculopathy and plexopathy must continue as part of the differential. Neuropathy as part of a systemic disease is unlikely as is a central nervous system lesion. Enthesitis as a separate condition could account for part of the pain if present in association with a nerve injury.

PHYSICAL EXAMINATION

There is no skin discoloration or obvious atrophy in the right upper limb, or elsewhere. Tenderness is present near the lateral epicondyle of the humerus and also just above the elbow. Extensor strength of the right wrist and fingers is graded 2/5 including the radial wrist extensors. There is normal strength of grasp, pronation, elbow flexion and extension, and shoulder abduction. Muscle stretch reflexes are elicited from the biceps and triceps muscles, but are difficult to observe in the brachioradialis bilaterally. Patchy areas of decreased light touch sensation are noted in the dorsal forearm and hand, but pinprick sensation is not impaired.

- **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 physical examination appears to have isolated an injury to the radial nerve with focal involvement distal to the branches to the triceps, but proximal to the branches to the extensor carpi radialis longus. However, in the examination of a person with wrist extensor weakness there is always difficulty in evaluating function of the intrinsic muscles of the hand because of lack of stabilization of the hand normally provided by the affected muscles. The examiner can stabilize the wrist manually or on a smooth surface to isolate the function of ulnar and median innervated muscles. However, the EMG is needed to detect subtle changes resulting from mild injury to these nerves or to the brachial plexus.

No attempt was made to elicit other physical findings.

- **Design your approach to the electrophysiologic examination based on the existing data.**



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 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	recr	amp	dur	poly	effort
R	paraspinals, C5-T1	N	N	N	N	N	N	N	N	N
R	deltoid	N	N	N	N	N	N	N	N	N
R	biceps brachii	N	N	N	N	N	N	N	N	N
R	pronator teres	N	N	N	N	N	N	N	N	N
R	flexor pollicus longus	N	N	N	N	N	N	N	N	N
R	triceps	N	N	N	N	N	N	N	N	N
R	anconeus	N	N	N	N	N	N	N	N	N
R	brachioradialis	incr	2+	1+	N	decr	N	N	N	N
R	extensor carpi radialis brevis	incr	1+	1+	N	decr	N	N	N	N
R	extensor carpi ulnaris	incr	3+	1+	N	decr	N	N	N	N
R	extensor indicis proprius	incr	1+	2+	N	decr	N	N	N	N
R	first dorsal interosseus	N	N	N	N	N	N	N	N	N

SENSORY NERVE CONDUCTION									
nr = no response									
NERVE	LATENCY (ms)			AMPLITUDE (µV)			CONduc VEL(m/s)		
	R	L	Norm	R	L	Norm	R	L	Norm
radial	-	-	-	-	-	-	-	-	-
10 cm wrist to thumb	2.4	-	<3.0	11	-	>5	-	-	-
median	-	-	-	-	-	-	-	-	-
10 cm wrist to thumb	2.5	-	<3.0	40	-	>20	-	-	-
median	-	-	-	-	-	-	-	-	-
14 cm wrist to long finger	3.2	-	<3.8	55	-	>40	-	-	-
median	-	-	-	-	-	-	-	-	-
7 cm palm to long finger	1.7	-	<2.0	72	-	>40	-	-	-



MOTOR NERVE CONDUCTION									
nr = no response									
NERVE	LATENCY (ms)			AMPLITUDE (mV)			CONDUCT VEL(m/s)		
	R	L	Norm	R	L	Norm	R	L	Norm
radial	-	-	-	-	-	-	-	-	-
below elbow to extensor indicis proprius	2.4	-	-	7.7	-	-	-	-	-
radial	-	-	-	-	-	-	-	-	-
above elbow to extensor indicis proprius	4.2	-	-	3.2	-	-	55	-	-
radial	-	-	-	-	-	-	-	-	-
spiral groove to extensor indicis proprius	5.6	-	-	2.7	-	-	69	-	-
radial*	-	-	-	-	-	-	-	-	-
axilla to extensor indicis proprius	6.3***	-	2.8**	-	-	-	207#	-	-

*Unable to isolate the stimulus to the radial nerve, ie. the median and/or ulnar nerve was also stimulated. The elicited wave form had a similar amplitude** but a strikingly different configuration than the compound muscle action potential evoked by radial stimulation at the spiral groove. The latency was unacceptably short*** resulting in a value for conduction velocity# that was unphysiologically fast.

COMMENTARY IV

Although the clinical evaluation pointed to a focal lesion of the radial nerve, lesser involvement of other nerves remained possible. Therefore, the needle electrode examination was used not only to evaluate the suspected pathology, but to screen for subtle changes in the distribution of other nerves, in this case, median nerve, ulnar nerve, brachial plexus, and spinal nerves. No abnormalities were found outside the distribution of the radial nerve.

The suspected site of radial nerve injury was in an unusual location. When faced with such a circumstance, standard nerve conduction techniques may need to be modified. Whenever possible, one should always stimulate the nerve both above and below the suspected injury location, and evaluate the velocity of the nerve segment as well as the wave forms elicited. This was accomplished by modified radial motor nerve conduction techniques. Radial sensory studies were done to further evaluate the condition of the radial nerve.

- **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

It would be of interest to compare left radial nerve conduction values with those on the right, but since the values on the right were well within normal limits, it was not deemed necessary to carry out these studies. No further electrodiagnostic studies were performed.

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

DIAGNOSTIC IMPRESSION

1. There is focal neuropathy of the right radial nerve above the elbow near the branch to the brachioradialis secondary to chronic repetitive compression. This has resulted primarily in neurapraxia, though some degree of axonal degeneration has occurred.
2. There is no evidence of other nerve pathology.
3. The possibility of enthesitis at the lateral epicondyle of the right humerus has not been excluded.

COMMENTARY

At this point the diagnosis is clear. The needle electrode abnormalities are confined to the radial nerve. Fibrillation potentials in this distribution strongly suggest some degree of axonal degeneration. The focal nature of the radial nerve lesion is documented by revealing a response to motor stimulation distal to the site of injury that is within normal limits and a 58% decrease in motor amplitude with stimulation proximal to the lesion across a distance of 10cm. This is clear evidence of conduction block, the clinical correlate of which is neurapraxia. This neurapraxic response predicts a good recovery with supportive care and a well planned rehabilitation program.

A static wrist splint was prescribed, holding the wrist in the neutral position while not limiting finger motion. Symptomatic use of minor analgesics such as Relafen or acetaminophen was encouraged. Instruction was given in performing stretching exercises of the affected muscles on a daily basis to avoid muscle shortening contractures and adhesions. The patient was asked to modify her method of rocking her baby to sleep by holding him in a more upright position on her lap with less of his weight born on her right upper limb.

FOLLOW-UP

At a follow-up visit four weeks later, wrist and finger extension strength was 4/5. The patient was advised to gradually increase her right hand activity while continuing to exercise for mobility. Isometric exercises were added to the stretching program. Continued use of the orthosis for any strenuous activity was recommended to prevent overuse injury during muscle reinnervation.

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