



EMG CASE No. 62, June 2003

Presenting Symptom(s): Bilateral upper and lower limb numbness, tingling and pain.

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Appropriate Audience: Residents and practicing physicians

Learning Objectives: After completing this educational activity, participant will be able to:
1) Summarize the clinical findings in post-gastrectomy neuropathy, 2) identify electrodiagnostic findings consistent with post-gastrectomy neuropathy, and 3) employ this knowledge to manage patients with post-gastrectomy neuropathy.

This case is no longer available for CME credit.

History

R.W. is a 46 year old man with a 2-3 year history of bilateral upper and lower limb numbness, tingling, and pain which began insidiously and is slowly worsening. He describes constant numbness in a glove distribution extending to his elbows. It is worse at night and better when he shakes his hands vigorously. Lower limb symptoms are described as constant numbness around some old, proximal surgical scars and intermittent numbness, tingling, and shooting pain into the toes.

- 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

Carpal tunnel syndrome is suspected due to its prevalence and from the history of nocturnal worsening and "shaking out" of the hands. The distribution of paresthesias, though, including proximal and lower limb symptoms, suggests that a peripheral polyneuropathy may be the etiology. Diabetic and alcoholic peripheral polyneuropathy are the most common causes.

History, continued

The patient underwent a partial gastrectomy in 1996 for obesity. His weight dropped from 400lbs. to 200lbs over 3 years. He has had several operations by plastic surgeons for removal of skin folds in his inner thighs, abdomen, and beneath his scapulae as well as a ventral hernia repair. He does not have a history of diabetes, thyroid disease, arthritis, or local trauma. He drank a fifth of hard alcohol every 2 days until 1 1/2 years ago. He worked in construction previously, but is now receiving social assistance.

- 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

200 lb. weight loss from gastric surgery represents a form of iatrogenic starvation. Absorption of numerous nutrients can be affected by disturbing the physiology of the distal antrum and proximal small bowel. Deficiencies of Vitamins B1(thiamine), B2(niacin), B6(pyridoxine), B12 (cobalamin), folate, Vitamin E (tocopherol), magnesium, and calcium are all felt to cause peripheral polyneuropathy or paresthesias. All of these nutritional neuropathies cause a distal, symmetric, sensory>motor axon-loss peripheral polyneuropathy. Obesity and work in construction may have compromised his median nerve function across the wrists. His history of alcohol abuse may have damaged his nerves and may have been further associated with poor nutrition. Any presentation consistent with a peripheral polyneuropathy should raise the suspicion of diabetes.

At this point, the physical examination is very important to help narrow the differential diagnosis. Phalen's and Tinel's signs should be elicited. Large sensory fibers in the distal lower limbs should be evaluated by testing vibration sense and/or proprioception. Signs of weakness, muscle atrophy, or reflex loss should be sought. Predominantly sensory signs may be more suggestive of a nutritional neuropathy, while motor signs may point towards an alcoholic neuropathy. Central nervous system evaluation is relevant, particularly performing Romberg's test to evaluate for tabes dorsalis. This condition of demyelination in the posterior columns can be seen with vitamin B12 deficiency.

Physical Examination

6'0" 200lb male, BP 130/80, pulse 75. He is cooperative and pleasant; no abnormal pain behavior noted. Well-healed scars are noted bilaterally over his inner thighs, lower abdomen, and beneath his scapulae. Sensory testing reveals impaired pin/touch differentiation over the volar aspects of his hands on both the median and ulnar sides bilaterally, but normal testing over the dorsum of his hands. In the lower limbs, normal pin/touch differentiation is present, but proprioception and vibration sensation is absent below the ankles. Minimal symmetric weakness is suspected in the hand intrinsic muscles, although no atrophy is noted. Strength is normal in the lower limbs bilaterally. There is no atrophy of the thighs, calves, or extensors digitorum brevis bilaterally. Reflexes are normal bilaterally at the biceps, triceps, brachioradialis, quadriceps, and hamstrings. Bilateral gastrocnemius reflexes are absent. Romberg's test is negative.

- 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 patient appears to have motor and sensory involvement of his median and ulnar nerves bilaterally as well as sensory impairment in his lower limbs distally. These findings are more consistent with a peripheral polyneuropathy than with a mononeuropathy. The preponderance of sensory symptoms is more consistent with a diabetic neuropathy or nutritional neuropathy than an alcoholic neuropathy. A more detailed physical examination to evaluate nutritional status should be done. Folic acid, thiamine, nicotinic acid, and



cyanocobalamin can all cause cerebral deficits such as Wernicke-Korsakoff's encephalopathy and dementia. Deficiency of vitamins A and C can lead to ophthalmologic signs. Calcium and magnesium depletion may lead to tetany. Ecchymosis, pupura, glossitis, stomatitis, cheilosis, and edema can all be seen with malabsorption. Foot ulcers or an abnormal ophthalmoscopic examination can suggest diabetes mellitus.

Physical Examination, continued

Cranial nerve examination, cerebellar testing, and cognitive presentation are all normal. Tone is normal. Skin examination is normal except as mentioned previously.

- 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

Median nerves and ulnar nerves across the elbows should be examined to evaluate the clinical abnormalities. Electrodiagnostic evaluation should include motor and sensory nerve studies in three limbs to evaluate for peripheral polyneuropathy. F-waves should be performed to evaluate for a condition affecting proximal nerve function such as chronic idiopathic demyelinating polyradiculopathy. Electromyographic examination should include the hand muscles, which are the most involved clinically. A lower limb, including a foot muscle, should be studied to evaluate for a loss of motor innervation in a distal to proximal gradient.

Electrophysiologic Data, continued

SENSORY NERVE CONDUCTION STUDIES							
NERVE	SIDE	STIM SITE	RECORD	cm	AMPL	LAT	CV
Radial	R	Forearm	Wrist	10	6.4	2.4	52.6
Sural	R	Calf	Ankle	14	NR		
	L	Calf	Ankle	14	1.2	3.7	45.2

MOTOR NERVE CONDUCTION STUDIES							
NERVE	SIDE	STIM SITE	RECORD	cm	AMPL	LAT	CV



Ulnar F-Response	R	Wrist	Hypothen			36.0	
	L	Wrist	Hypothen			36.3	
Peroneal		Ankle	EDB	8	3.7	6.1	
		B Knee	EDB	33	4.2	13.4	45.2

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+									
AMPliitude: 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
L	Biceps Brachii	N	0	0	N	N	N	N	N
	Extensor Indicis	N	0	0	N	N	N	N	N
	FDI (Hand)	N	0	0	N	N	N	N	N
	Opponens Pollicis	N	0	0	N	N	N	N	N
R	Anterior Tibialis	N	0	0	N	N	N	N	N
	Medial Gastroc	N	0	0	N	N	N	N	N
	FDI (Pedis)	N	0	0	N	N	N	N	N

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

The sural sensory and the radial sensory responses were either absent or significantly diminished, but latency was relatively spared. The ulnar F-responses were mildly prolonged bilaterally. The peroneal



motor latency was at the upper limit of normal. The needle examination was normal.

The findings cannot be explained solely by multiple entrapment mononeuropathies. The radial sensory and sural nerve abnormalities are suggestive of a diffuse, sensory, axonal peripheral polyneuropathy. Although the patient has a history of significant alcohol intake, his lack of motor abnormalities on EMG, normal peroneal nerve studies, and unimpressive F-wave latencies are not consistent with a primary alcoholic polyneuropathy. Of course, his alcohol consumption and accompanying health behaviors probably did not help the wellbeing of his nerves. He does not have a history of polydipsia and urinary frequency. The most notable aspect of his history is the iatrogenic starvation from his gastric bypass surgery. The nutritional deficits associated with this procedure typically produce a sensory>motor axonal neuropathy.

Diagnostic Impression

This is an abnormal examination. There is electrodiagnostic evidence of a diffuse, symmetric, distal, sensory>motor axonal peripheral polyneuropathy. Also seen are left greater than right, moderately severe median mononeuropathies at the wrists (carpal tunnel syndrome) and bilateral ulnar mononeuropathies at the elbows with conduction block on the left and conduction slowing on the right (cubital tunnel syndrome). This patient's electrodiagnostic findings can be explained by a diagnosis of post-gastrectomy polyneuropathy. Nutritional compromise and alcohol intake likely caused a systemic insult to his peripheral nerves. This combined with his history of obesity and manually intensive work probably led to bilateral sensorimotor entrapment neuropathies at the elbows and wrists.

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

General markers of nutritional status should be performed, including CBC, total protein, and albumin. Specific nutrients that are known to cause polyneuropathy when they are depleted should be sought, such as B12 (cyanocobalamin), folate, B1 (thiamine), B2 (nicotinic acid), B6 (pyridoxine), vitamin E (tocopherol), calcium, and magnesium. Vitamin D should also be measured and/or bone density, as these patients are at an increased risk of osteomalacia. Specific tests for malabsorption can be initiated if dumping syndrome is present.

Lab tests were obtained on this patient. They showed a microcytic, hypochromic anemia with a low iron and elevated RDW. Fasting glucose and 3 hour glucose-tolerance tests were normal. Na⁺, K⁺, Cl⁻ and CO₂ were all normal. BUN and creatinine were mildly low. AST, ALT, and alkaline phosphatase were normal. Vitamin B12 and folate serum levels were within normal limits. INR, PT, albumin, and total protein were normal. Ca⁺⁺ was at the lower limit of normal and Mg⁺⁺ was mildly reduced. Serum levels of vitamins B1, B2, B6, D, and E were never measured and a DEXA scan was not performed.

Following our consultation, his primary physician sent the patient to Orthopedic Surgery. He underwent bilateral carpal tunnel releases 3 months apart. 6 months later, the paresthesias in the right hand were improved, but severe, burning pain in the location of the scar and diffuse, achy pain throughout the right upper limb were present. On the left, the paresthesias were worse, and a burning pain affected the whole hand and wrist. Diffuse, achy pain was present through the left upper limb. Lower limb symptoms were unchanged.



The patient remained on oral B12 replacement.

In general, treatment should involve replacing any deficient nutrients, specifically magnesium and iron in this patient. Additional vitamin levels should be measured as discussed above. Intramuscular B12 and folate supplementation should be provided to all patients who undergo gastric bypass surgery. Folate replacement may correct hematologic abnormalities of megaloblastic anemia and thus mask an ongoing B12 deficiency. A trial of nonoperative treatment including exercises, bracing, and steroid injections is recommended for the carpal tunnel and cubital tunnel syndromes before progressing to surgery. Vitamin B6 is frequently used to treat the paresthesias associated with carpal tunnel syndrome if a B6 deficiency is found. These patients typically do better with frequent, small meals.

Commentary V

Nutritional neuropathies are probably underappreciated in clinical electrodiagnostic medicine. Electrodiagnostic findings are absent or very mild in all but the most severe cases. Many medical disorders, including chronic liver disease and alcoholism, are probably associated with mild nutritional compromise. An electrodiagnostic presentation of bilateral entrapment mononeuropathies in more than one nerve should raise suspicion for this, and other, systemic processes.

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