



EMG Case No. 44, April 2000

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Presenting Symptom: Leg Weakness

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Presenting Symptom: Leg weakness

Appropriate Audience: Residents as well as practicing physiatrists.

Learning Objectives: After completing this educational activity, participants will be able (1) to assess their ability to apply a systematic approach to the differential diagnosis of neuromuscular injuries and diseases and (2) to compare their diagnostic impressions with those of experts in the field of electrodiagnostic medicine.

History

JD is a 76-year-old African-American gentleman with non insulin dependent diabetes mellitus who presents to the Electrodiagnostic Laboratory with a chief complaint of weakness involving the right leg. This has been present for about 2 to 3 months. Prior to this he has not had any problems with walking or lower extremity weakness. There is no history of trauma to account for the onset of symptoms. He believes that the weakness occurred fairly rapidly and has not changed in the last several weeks. There has been numbness and tingling noticed in the dorsal and plantar surfaces of the right foot. He occasionally catches the toe while walking, but has not fallen. There have been no bowel or bladder abnormalities noted. He has minimal "soreness" at the junction of the buttock and proximal thigh.

- *Prior to continuing, develop a differential diagnosis and list each possible diagnosis in the order of likelihood.*

At this point the differential diagnosis may include:

1. Lumbosacral radiculopathy / Polyradiculopathy
 2. Lumbosacral plexopathy
 3. Sciatic neuropathy
 4. Diabetic neuropathy / Amyotrophy
 5. Multiple mononeuropathies at the knee
- *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

Given what is known it would appear that these symptoms are neuromuscular in nature. The diagnostic possibilities are multiple and range from compressive mononeuropathy to radiculopathy, and there is even possibility of a central etiology. In elderly individuals one must also consider the possibility of compressive neuropathy in the back or pelvis secondary to occult malignant disease.



History, continued

The patient has no previous history of neurologic symptoms or disease, but is known to have had non-insulin dependent diabetes mellitus for 5 to 10 years. He has not noted any back discomfort. He says there has been some aching at the junction of the right buttock and proximal thigh in the area of the sciatic notch. There is no family history of neuromuscular diseases. With exception of oral medication being taken for the diabetes, there is no additional significant medication history.

Social history reveals that the patient is retired from an automotive job many years ago. He spends most of his days working in the garden. Approximately 3 months ago he and his wife purchased a stationary exer-cycle which he has been riding for up to 2 hours per day.

- *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 I I

Non-insulin dependent diabetes mellitus may be associated with a polyneuropathy depending on the level of glucose control. The lack of back pain goes against a compressive disc lesion. However, the pain in the buttock and proximal thigh may be associated with lateral protrusion. The presence of the new onset of intensive physical activity raises the possibility that this might be a causative or an aggravating factor in producing the condition.

Physical Examination

The patient is a pleasant African-American gentleman who is alert, oriented, and in no acute distress. His cranial nerve examination is normal as is neuromuscular examination in the upper extremities. Examination of his back reveals that there is appropriate motion for someone his age. Motion of the back is not painful. There was mild tenderness in the area of the right sciatic notch. Seated straight leg raising is negative to 90 degrees bilaterally. Neuromuscular examination of the lower extremities reveals a very mild atrophy of the right anterior compartment musculature and a slight decrease in bulk of the right calf when compared to the left. Reflex testing was 1+ at both knees and absent at both ankles. Sensory examination demonstrates decreased pin and light touch sensation over the entire right foot including dorsal and plantar surfaces. The vibratory sense is decreased at both ankles. Manual muscle testing shows normal and symmetric strength at both hips. The knee extensors are equal bilaterally. There is mild (4/5) right knee flexor weakness. There is weakness of dorsiflexion and plantar flexion of the right ankle when compared to the left. Babinski signs are equivocal bilaterally. There is no ankle clonus. He demonstrates a mild steppage gait pattern on the right side.

- *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

Physical examination shows some neuromuscular dysfunction in both lower extremities but is asymmetric in nature. The minimal findings in the left lower extremity are compatible with a mild polyneuropathy. The sensory and motor changes in the right lower extremity are outside that seen with a single level radiculopathy. Multiple compressive mononeuropathies may produce such a picture as can a plexopathy. There does not appear to be any evidence of a central process based on this clinical examination.

Physical Examination, continued

Plain films of the lumbar spine show only minimal degenerative change. The MRI shows a minimal spinal stenosis but no evidence of root level compromise. CAT Scan of the abdomen showed no occult malignancies. Serologic tests were all within normal limits with the exception of fasting blood sugar of 189. Electrodiagnostic testing was also performed.

- *If necessary, revise your differential diagnosis based on the additional physical examination results.*
- *Are there laboratory or other tests that could help you in your differential diagnosis?*

Commentary IV

The first notice that the sensory evoked responses are diffusely reduced, and the motor evoked response amplitudes are borderline. This may be appropriate given the patient's advanced age a patient with a history of NIDDM and age may explain the clinical findings of the decreased reflexes, decreased vibratory sense in the lower extremity. These findings are also consistent with the diagnosis of a mild superimposed diffuse polyneuropathy. The finding of significance is the asymmetry in the lower extremity motor evoked response amplitudes. The symptomatic limb shows motor evoked responses which are over 50 percent reduced from the uninvolved side. This suggests some additional superimposed process affecting multiple nerves in the symptomatic extremity. The right peroneal motor conduction velocity is normal in the segment crossing the fibular head which most likely rules out a focal mononeuropathy at this site. Superficial peroneal sensory conduction study was not done in this case, but may have been of some help had this been obtainable in the asymptomatic left lower extremity.

The needle findings are most helpful in localizing the pathology in this case. The first thing to note is that there is mild denervation in the foot intrinsic in the asymptomatic left lower extremity with no abnormalities seen in more proximal S1 innervated muscles. This is consistent with a mild chronic sensorimotor polyneuropathy. Some might argue that these findings could be in part due to age and or local trauma. On the symptomatic extremity, there are abnormalities both below and above the knee in the L5/S1 innervated muscles, but not in the paraspinal or gluteal muscles. Below the knee abnormalities appear in both the anterior and posterior compartment. There are also abnormalities in both the internal and external hamstring muscles. Another important finding is the lack of posterior myotome abnormalities as well as lack of findings in either the gluteus medius or gluteus maximus muscle in the symptomatic right lower extremity. The presence of normal findings in the paraspinal muscles as well as the proximal L-5, S1 muscles argues against the presence of a



right lumbo-sacral radiculopathy. The sparing of the right gluteus maximus and gluteus medius muscles goes against a lumbar plexopathy as being the source of the abnormalities although involvement of the distal portion of the plexus cannot be definitively ruled out. The findings taken as a whole seem consistent with two superimposed processes. The acute problem affecting the right lower extremity would appear to be consistent with a lesion to the proximal right sciatic nerve.

Electrophysiologic Data

SENSORY NERVE CONDUCTION									
nr = no response									
NERVE	LATENCY (ms)			AMPLITUDE (µV)			CONDUC VEL (m/s)		
	R	L	Norm	R	L	Norm	R	L	Norm
				(pos. to neg. peak)					
median sensory wrist	3.7	3.6	-	8.0	6.0	-	-	-	-
ulnar sensory wrist	3.4	-	-	6.0	-	-	-	-	-
sural sensory calf	-	-	-	nr	nr	-	-	-	-

MOTOR NERVE CONDUCTION										
nr = no response										
NERVE	LATENCY (ms)			AMPLITUDE (mv)			CONDUC VEL (m/s)			
	R	L	Norm	R	L	Norm	R	L	Norm	
				(baseline to peak)						
median motor wrist	3.1	-	-	6.0	-	-	-	-	-	
median motor elbow	8.1	-	-	6.0	-	-	50.0	-	-	
peroneal mtr ankle	6.1	6.0	-	0.8	2.0	-	-	-	-	



peroneal mtr b knee	12.1	-	-	0.8	-	-	37.0	-	-
tibial motor ankle	5.9	5.8	-	1.0	2.5	-	-	-	-

F-WAVE								
# = number of stimuli P = persistence CD = chronodispersion F:M = ratio of average F-wave amplitude to M-wave amplitude								
R/L	NERVE	#	LATENCY (ms)			CD (ms)	P (%)	F:M (%)
			min	mean	max			
R	median wrist	-	31.0	-	-	-	-	-
R	peroneal ankle	-	nr	-	-	-	-	-
L	peroneal ankle	-	56.0	-	-	-	-	-
R	tibial ankle	-	57.0	-	-	-	-	-
L	tibial ankle	-	54.0	-	-	-	-	-

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	gluteus maximus	N	0	0	0	N	N	N	N	N



R	gluteus medius	N	0	0	0	N	N	N	N	N
R	vastus medialis	N	0	0	0	N	N	N	N	N
R	internal hamstring	N	0	0	0	N	N	N	N	N
R	external hamstring	sl incr	unsust	1+	0	N	1 incr	N	N	N
R	anterior tibialis	incr	sust	2+	0	1+ decr	N	N	N	N
R	ext hallucis longus	incr	sust	2+	0	2+ decr	N	N	N	N
R	peroneus longus	sl incr	unsust	1+	0	+/- decr	N	N	N	N
R	medial gastrocnemius	sl incr	unsust	+/-	0	N	N	N	N	N
R	fdi (pedis)	incr	sust	2+	0	2+ decr	2+ incr	+/- incr	2+ incr	N
L	fdi (pedis)	incr	sust	1+	0	1+ decr	1+ incr	+/- incr	1+ incr	N
L	gluteus medius	N	0	0	0	N	N	N	N	N
L	gluteus maximus	N	0	0	0	N	N	N	N	N
L	vastus medialis	N	0	0	0	N	N	N	N	N
L	anterior tibialis	N	0	0	0	N	N	N	N	N
L	ext hallucis longus	N	0	0	0	N	N	N	N	N
L	med gastrocnemius	N	0	0	0	N	N	N	N	N

- *On the basis of both the clinical and evaluation, formulate your final 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.*
- *What other diagnostic procedures are needed?*



Diagnostic Impression

1. Incomplete right sciatic mononeuropathy with minimal ongoing denervation of greater than 3 months duration.
2. Probable mild sensory motor polyneuropathy.

The electrodiagnostic examination was helpful in this case in quantifying and localizing areas of pathology. It is often difficult to differentiate two superimposed neurogenic processes. In this case, the asymmetry of the needle abnormalities as well as the proximal abnormalities, clearly point to a second superimposed process affecting the right lower extremity. This is supported by checking the asymmetry of the peroneal and tibial motor evoked amplitudes from right to left sides.

The sciatic nerve is composed of independent tibial (medial popliteal and common peroneal {lateral popliteal}) divisions commonly united into a single nerve as far as the lower part of the thigh. After emerging from the piriformis, the nerve lies below the gluteus maximus. As the nerve appears from the beneath the gluteus maximus, it is relatively superficial for a short distance. Many individuals have experienced a transient conduction block of the sciatic nerve in which the effected extremity "goes to sleep." When seated, the sciatic nerve is initially stretched by flexion of the hip and may then be compressed against a firm edge of a seat to produce an ischemic conduction block. Because of its relative lateral placement, the peroneal division is more frequently involved in compression and traction injuries.

Sciatic neuropathies have been reported to be produced from multiple types of stretching and compression injuries. These include post-anesthetic cause of nerve palsies, obstetrical and birth injury lesions. The nerve may be often injured in the gluteal region due to improperly placed injections or secondarily with injuries involving the hip joint. It is not infrequently seen in total hip arthroplasty. Common sites include the sciatic nerve in the thigh, as seen in drug induced coma.

Commentary V

Treatment includes relative rest and avoidance of further compression. With involvement of the peroneal division a rigid AFO may be necessary to avoid further injury.

The prognosis is variable depending on the extent of axonal loss and related in part to how proximal the site of traction and or compression occurs. In those responding to conservative treatment, recovery periods ranging from 7 to 102 weeks have been reported. Injection paralysis patients tend to do less well and may have residual pain syndromes requiring long term management.

In this case, JD was advised to stop using the exer-cycle and at 6 months follow up had improved considerably. There was still minimal residual paresthesia involving the dorsum of the foot and he required an AFO when ambulating outside of the home for longer distances.



Bibliography

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