Journal of Neurology & Experimental Neuroscience

https://doi.org/10.17756/jnen.2018-038

Short Communication

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Revisit: Neurophysiologic Features of Neuropathy in Patients with Sarcoidosis

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Received: May 30, 2018
Accepted: September 06, 2018
Published: September 10, 2018

Citation: Mehta AK, Luo JJ. 2018. Revisit: Neurophysiologic Features of Neuropathy in Patients with Sarcoidosis. *J Neurol Exp Neurosci* 4(1): 21-23.

Published by United Scientific Group

Abstract

We studied electrodiagnostic features in patients with sarcoidosis. Ten subjects (age: 54.0 ± 5.2 years, female/male: 8/2) were included. Data of conventional nerve conduction study (NCS) and needle electromyogram (EMG) were collected and analyzed. Our study showed electrodiagnostic evidence of large fiber involvement manifested as mononeuropathy and mononeuropathy multiplex in the majority (90%) of our patients, of which a small proportion (20%) of patients with secondary distally minimal active denervation, and normal electrodiagnostic findings were seen in only 10% of our patients. Findings of absence of active denervation in the majority of our patients with sarcoidosis may suggest a favorable outcome with appropriate treatments.

Keywords

Electrodiagnostic study, Neurosarcoidosis, Peripheral neuropathy, Sarcoidosis

Sarcoidosis is an idiopathic systemic inflammatory disorder characterized by the presentation of non-caseating granulomas in tissues. Sarcoid granulomas can involve any organ, but more than 90% of cases affect intrathoracic lymph node, lung, skin, eye or a combination [1]. The prevalence of sarcoidosis is approximately 40-50 per 100,000 population [2]. Diagnosis of sarcoidosis is established if the patient has a multisystem disease and confirmed by a histological study via biopsy showing non-caseating granulomas [3]. Neurological manifestations of sarcoidosis are relatively rare. It has been estimated 5% patients with systemic sarcoidosis may develop neurosarcoidosis with central nervous system (CNS) involvement, whereas peripheral nervous system involvement is extremely rare as only 15% of patients with neurosarcoidosis have peripheral neuropathy (PN) [4]. There is paucity in the understanding of the neurophysiologic properties of peripheral nervous system in sarcoidosis patients. In this report, we studied electrodiagnostic features in patients with sarcoidosis.

We retrospectively reviewed the database of the Neuromuscular Clinic and Neurophysiology Laboratory at the Temple University Hospital over a 10-year period to identify patients with sarcoidosis. Subjects with a clinically confirmed diagnosis of sarcoidosis, with or without CNS involvement, were initially selected. Subjects with a systemic disease other than sarcoidosis causing PN or without an electrodiagnostic study were subsequently excluded. Data of conventional nerve conduction study (NCS) and needle electromyogram (EMG) were collected and analyzed. NCS, including F-waves, was performed on sensory nerves of median, ulnar, radial and sural sensory nerves and motor nerves of median, ulnar, fibular (formerly called peroneal), tibial, and in the arm and the leg. EMG using a disposable concentric needle electrode was performed on muscles

of, at least, deltoid, biceps, triceps, first dorsal interosseous, and abductor pollicis brevis in the arm; and medial vastus, tibialis anterior, medial gastrocnemius, tibialis posterior and the first dorsal interosseous pedis in the leg. The skin temperature was monitored and maintained at 32 °C or above in the arm and 30 °C or above in the leg during the electrodiagnostic study. This study was approved by the Institutional Research Bureau of Temple University Hospital.

Fifty-two subjects with sarcoidosis were initially identified, of which 10 subjects (age: 54.0 ± 5.2 years, range: 47-66, female/male = 8/2) who met the inclusion criteria were included (Table 1). Abnormal recordings were seen in sensory NCS including sural (5/7, 71.4%), median (6/9, 66.7%), ulnar (2/9, 22.2%), and radial (1/9, 11.1%) sensory nerves; and in motor NCS including median (6/9, 66.7%), ulnar (3/9, 33%), fibular (4/7, 57.1%), and tibial (4/7, 57.1%) motor nerves (Table 1).

Table 1: NCS data.

	Median-motor					Ulnar-motor				
#/Sex/Age	**DL**	**Amp-d**	**Amp-p**	**CV**	**F-wave**	**DL**	**Amp-d**	**Amp-p**	**CV**	**F-wave**
1/F/51	3.3	10.8	10.5	53	24	2.7	10.4	10.4	49	24.8
2/F/58	5.1	9.1	8.9	55	27.3	2.7	10.2	9.9	56	29.3
3/M/54	3.9	3.7	3.4	46	ABS	3.7	6.8	6	41	34.9
4/F/47	4.3	10.5	8.2	50	26.8	3.7	7.7	7.6	54	28.5
5/F/51	5.4	9.9	9.3	56	29.3	2.5	8.7	8.9	53	28.3
6/F/55	5	6.8	5	51	28	3.1	7.8	7.3	56	27.9
7/F/54										
8/F/50	3.8	9.7	9.6	51	26.1	2.5	9.9	8.1	63	29.3
9/F/54	3.4	7.7	7.9	60	25.9	2.5	13	11.5	57	24.4
10/M/66	5.2	3.2	3	50	ABS	4.4	3.6	3.4	45	ABS
54 ± 5.2	4.4 ± 0.8	7.9 ± 2.8	7.3 ± 2.8	52.4 ± 4.1	26.8 ± 1.7	3.1 ± 0.7	8.7 ± 2.7	8.1 ± 2.5	52.7 ± 6.7	28.4 ± 3.2
	Peroneal-motor					**Tibial -motor**				
#	**DL**	**Amp-d**	**Amp-p**	**CV**	**F-wave**	**DL**	**Amp-d**	**Amp-p**	**CV**	**F-wave**
1	3.3	3.9	2.9	46	ABS	4.6	8.9	2	44	ABS
2										
3	5.1	2	2	39	55.8	8.6	3.9	3.5	37	63
4										
5	4	6.1	4.4	38	ABS	4.8	3.6	4.2	36	59.3
6										
7	4.5	3.4	3.6	49	ABS	4	8.7	3.8	40	51.9
8	3.9	4.9	5.2	47	45.6	4.9	7.6	5.9	48	55.8
9	4	6	4.2	47	44	4.1	10.6	7.5	42	46.1
10	6.6	1.2	0.9	40	ABS	ABS	ABS	ABS	ABS	ABS
Mean ± SD	4.5 ± 1.1	3.9 ± 1.9	3.3 ± 1.5	43.7 ± 4.5	48.5 ± 6.4	5.2 ± 1.7	7.2 ± 2.9	4.5 ± 1.9	41.2 ± 4.5	55.2 ± 6.6
	Median -sensory			**Ulnar -sensory**		**Radial -sensory**			**Sural -sensory**	
#	**Amp**	**CV**		**Amp**	**CV**	**Amp**	**CV**		**Amp**	**CV**
1	28	55		37	50	38	56		ABS	ABS
2	10	37		19	59	46	56			
3	15	37		23	42	17	52		ABS	ABS
4	40	43		18	51	19	51			
5	4	32		10	55	17	54		3	41
6	20	38		22	54	27	63			
7									5	36
8	13	46		19	54	31	57		15	47
9	21	61		28	62	44	65		20	48
10	13	40		2	41	18	48		ABS	ABS
Mean ± SD	18.2 ± 10.7	43.2 ± 9.4		19.8 ± 10	52 ± 7	28.6 ± 11.8	55.8 ± 5.5		10.8 ± 8.1	43 ± 5.6

DL: distal latency; Amp-d: distal amplitude; Amp-p: proximal amplitude; CV: conduction velocity; SD: standard deviation

Needle EMG demonstrated normal (5/10, 50%) findings, chronic neurogenic changes (3/10, 30%), distally minimal active degeneration (1/10, 10%), or distally minimal active degeneration with chronic neurogenic changes (1/10, 10%) (Table 2). Our study showed electrodiagnostic evidence of large fiber involvement manifested as mononeuropathy and mononeuropathy multiplex in the majority (90%) of our patients, of which a small proportion (20%) of patients with secondary distally minimal active denervation; and normal electrodiagnostic findings were seen in only 10% of our patients (Table 1 and 2). Notably, the active denervation in EMG was only observed in the muscle of first dorsal interosseous pedis in the lower extremity. This muscle was chosen because it is less likely subjected to a traumatic injury at its anatomical location and one of the most remote muscles in the body innervated by neurons from the spinal cord and more prone to early involvement in PN intuitively due to the dying back phenomenon. Sampling the muscle of first dorsal interosseous pedis improves the electrodiagnostic sensitivity for PN [5]. A previous pathology report from 11 sarcoidosis patients supports our findings [6]. Importantly, findings of electrodiagnostic evidence showing absence of active denervation in the majority of our sarcoidosis patients may suggest a favorable outcome with appropriate treatments.

Table 2: EMG data.

#	EMG	Findings
1	CNC	Multi-monoNP
2	NL	CTS
3	DAD, CNC	Multi-monoNP Multi-monoNP
4	CNC	Multi-monoNP
5	CNC	Multi-monoNP
6	NL	CTS
7	DAD	Multi-monoNP
8	NL	NL
9	NL	Multi-monoNP
10	NL	Multi-monoNP

CNC: chronic neurogenic changes; NL: normal; ADA: distally active denervation; Multi-monoNP: multiple mononeuropathy; CTS: carpal tunnel syndrome

Cranial nerves are predominantly involved in sarcoidosis and peripheral nerve involvement is extremely uncommon [7]. Early neurophysiologic study indicated that sensory fibers are most likely to be involved in sarcoid patients and no evidence of diffuse peripheral neuropathy [8]. Our current study confirmed this tendency, particularly in sural and median sensory nerves (Table 1). Subsequent clinical studies showed peripheral neuropathy occurs in 4-20% of patients with neurosarcoidosis, including mononeuritis, mononeuritis multiplex, or generalized sensory, motor or sensorimotor polyneuropathy [9]. Pathological studies revealed that the polyneuropathies can be predominantly demyelinating or axonal, or a mixture of both and patients with sarcoid neuropathy can be symptomatic or asymptomatic [6]. Treatment with corticosteroid can modify the clinical manifestations and pathological changes [6, 7].

Weakness of our study includes: 1) a small number of subjects with a range of severities of systemic sarcoidosis in which the CNS involvement were not specified; 2) whether small fiber involvement in sarcoidosis was not addressed as the conventional electrodiagnostic evaluations mainly evaluate large fibers; 3) electrodiagnostic studies on cranial nerves were not performed; and 4) no pathological confirmation was performed to correlate with the electrodiagnostic findings. However, peripheral nerve biopsy is not recommended for the diagnosis of sarcoid neuropathy in the contemporary practice. Nonetheless our finding shows that electrodiagnostic evidence of large fiber involvement manifested as mononeuropathy and mononeuropathy multiplex in our sarcoid patients may be noteworthy. The findings of absence of active denervation may suggest a favorable outcome if appropriately managed. A large scale study to validate our findings and characterize the features of PN in patients with sarcoidosis is warranted.

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