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## Case Report

## Nerve conduction study and electromyography findings in patients recovering from Covid-19 – Case report



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## ABSTRACT

• Three patients with recent sequelae after Corona Virus Disease (COVID)-19 such as fatigue and myalgia of both calves underwent electrophysiological examinations, nerve conduction studies (NCS) and electromyography (EMG). NCS shows, as common elements, the presence of a partial or complete conduction block on several nerves, slightly prolonged latency of the tibial nerve, and rare or absent F-waves, all suggesting a demyelinating polyneuropathy due to SARS–COV-2. The short duration and low amplitude of the motor unit action potential with early full recruitment on interference pattern on EMG, typical for myopathy, suggest a direct action of COVID-19 on muscular fibers, especially in the lower limbs.

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## Introduction

Living in the time of the SARS–COV-2 pandemic implies the risk of contracting the Corona Virus Disease (COVID)-19 and surviving it (Trias-Llimós and Bilal, 2020). Medical staff is not spared from this disease, and are actually more exposed to it (Bielicki et al., 2020). Medical personnel are an extremely valuable resource of the health care system, and their prompt return to work after sickness is necessary as they support the fight with this pandemic with all physical and psychological resources (Zhou and Panagioti, 2020). In this respect, we present three cases of medical personnel of “Bagdasar Arseni” Hospital who passed through this challenging disease and their related sequel symptoms.

## Case descriptions

**Case 1.** A 49 year old female suffering from type II diabetes mellitus and hypothyroidism presented a thoracic stab, sweating, and myalgia on the 17th August 2020 and was tested positive for SARS–COV-2 RNA by nasopharyngeal swab. The patient was admitted to an infectious diseases clinic (IDC) on August 21st and received Hydroxychloroquine, Azithromycin, anticoagulants, gastrointestinal protectants, and anti-inflammatory steroids, showing clinical improvement. The patient was discharged 8 days later following a negative result of the SARS–COV-2 RNA testing. On September 14th she returned to work, and 10 days later was submitted to a nerve conduction study (NCS) and a subsequent electromyography (EMG) investigation for residual symptoms: generalized myalgia (which was more pronounced in the calves, left more than right), fatigue and dizziness.

**Case 2.** A 44 year old hypertensive female reported a dry throat, stuffy nose, headache, and lack of taste and smell on August 22nd 2020. The SARS–COV-2 RNA test showed a positive result

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two days later and the patient was subsequently admitted to an IDC for a duration of 15 days. The patient received Hydroxychloroquine, Azithromycin, Ciprofloxacin, Lopinavir / Ritonavir, anticoagulants, gastrointestinal protectants, anti-inflammatory steroids, and Acetaminophen. On September 7th, the SARS–COV-2 RNA test turned out negative, and the patient was discharged. On September 22nd she returned to work with residual symptoms: bilateral calf myalgia and fatigue.

**Case 3.** A 52 year old female with type II diabetes mellitus and osteoarthritis showed the following symptoms on July 19th, 2020: fever, fatigue, sleepiness, sore throat, and headache, and was diagnosed with SARS–COV-2 infection by RNA testing and admitted to an IDC on July 21st. The patient was treated with Acetaminophen, anticoagulants, and Azithromycin, and was discharged based on a negative SARS–COV-2 RNA test on August 11th. Two weeks later, returning to work, the patient displayed residual bilateral calf myalgia, fatigue, and exhaustion under stress.

We underline that none of the three patients has been in a critical state or required admission to an intensive care unit.

Before returning to their medical activities, all employees were subjected to a battery of paraclinical tests including spirometry and plasmatic values of CK (and the CK-MM fraction) which were all within normal ranges. The occupational medicine physician recommended additional NCS and EMG tests due to the residual symptoms, especially myalgia, which impaired the patients' working capacity.

**Results**

*Nerve conduction studies (NCS)*

The NCS for Case 1 shows slight prolonged distal latency (DL) on the right median and left tibial nerves, partial conduction block (CB) on both ulnar nerves and tibial nerves, rare F-waves for the left median and right ulnar nerves. In case 2 the NCS emphasizes slightly prolonged DL on the right and left tibial nerves, total CB on

the left and right median, ulnar and tibial nerves, rare F-wave for the left ulnar and right tibial nerves. In the third case, the NCS shows slightly prolonged DL on the left tibial and right peroneal nerves, partial CB on the left tibial and right peroneal nerves, rare F-wave for the right ulnar and peroneal nerves, and absent F-wave for the left tibial nerve (Table 1).

*Electromyography*

The interference pattern (IP) in Case 1 shows difficult recruitment because of myalgia, short duration, and low amplitude of motor unit action potential (MUAP) with early full recruitment visible in the left biceps femoris muscle. In Case number 2, IP depicts short duration and low amplitude with early full recruitment in the left gastrocnemius muscle. Case 3 did not tolerate the intramuscular injection due to muscular pain, so an EMG could not be performed.

**Discussion**

Polyneuropathy induced by corticosteroids or other drugs was previously reported in the literature, as was myopathy in critical illness treated in the ICU before the pandemic (Zink et al., 2009; Yang et al., 2018). Some data was published on COVID-19 patients who required admission to the ICU and developed polyneuropathy (McClafferty et al., 2020) and myopathy (Bagnato et al., 2020) associated with the disease. We are already aware of anosmia (Han et al., 2020) and ageusia resulting from direct damage due to the characteristic viral lysis of the neuronal tracts (Lozada-Nur et al., 2020) in COVID-19 patients. The significant difference in our paper is that our studied cases did not require intensive care. Moreover, cases 1 and 3 had a history of diabetes mellitus which could generate a diabetic polyneuropathy, but case 2 was free of any known neural pathology. Taking that into account and carefully observing all three NCSs, we underline the presence of a partial or complete conduction block on several nerves, in all studied patients. Also, the tibial nerves showed slightly prolonged latencies while F-waves were absent or rare, in all analyzed cases. Summarizing these NCS findings, we draw attention to a possible demyelinating neuropathy due to COVID-19. In general, the nerve

**Table 1**

**Nerve conduction study results for the studied cases.** DL = distal latency, CMAP = compound muscle action potential, MCV = Motor conduction velocity, CB = conduction block, SNAP = sensory nerve active potential, SCV = Sensory conduction velocity. Note: Abnormal values are marked with bold characters.

Nerve unit	DL (ms)	CMAP amplitude (mV)	MCV (m/s)	CB	F-wave (ms)	DL (ms)	SNAP amplitude (µV)	SCV (m/s)
<b>Case 1</b>								
Left median	2.3	5.9	38.1	–	<b>Rare</b> (3 waves mean 29.6)	–	–	–
Right median	<b>5</b>	3.6	39.3	–	–	3.8	8.4	<b>36.7</b>
Left ulnar	2.4	7.7	61.1	<b>Partial</b> 49%	27.3	–	–	–
Right ulnar	2.8	6.3	83.8	<b>Partial</b> 36%	<b>Rare</b> (few waves mean 26.6)	–	–	–
Left tibial	<b>5.1</b>	7.2	54.9	<b>Partial</b> 31%	50.3	–	–	–
Left sural	–	–	–	–	–	4.3	6.2	41.9
Right sural	–	–	–	–	–	3.9	7.1	44.4
<b>Case 2</b>								
Left median	2.7	6.8	59	<b>Total</b> 90%	21.6	–	–	–
Right median	3.5	4.2	61.1	<b>Total</b> 90%	–	2.6	1.8	59.1
Left ulnar	2.3	8	53.5	<b>Total</b> 61%	<b>Rare</b> (few waves, 27.3)	–	–	–
Right ulnar	2.4	8	54.9	<b>Total</b> 71%	27.8	–	–	–
Left tibial	<b>5.5</b>	<b>1.9</b>	63.9	<b>Total</b> 79%	–	–	–	–
Right tibial	<b>5.4</b>	5.3	40	<b>Total</b> 58%	<b>Rare</b> (few waves, 51.8)	–	–	–
Left peroneal	3.7	3.0	51.4	– (25%)	–	–	–	–
<b>Case 3</b>								
Left median	3.8	9.9	<b>41.3</b>	–	21.3	1.54	4	70
Right median	3.2	10	<b>41.7</b>	–	22.4	–	–	–
Left ulnar	–	–	–	–	–	–	–	–
Right ulnar	2.4	6.3	72.1	–	<b>Rare</b> (few waves, 26.1)	–	–	–
Left tibial	<b>5.6</b>	4.0	39.1	<b>Partial</b> 44%	<b>Absent</b>	–	–	–
Left peroneal	–	–	–	–	–	–	–	–
Right peroneal	<b>6.8</b>	<b>1.7</b>	41.7	<b>Partial</b> 42%	<b>Rare</b> (few waves, 38)	–	–	–

amplitude of CMAP or SNAP was adequate, which seems to exclude any axonal involvement. On the other hand, we cannot rule out a direct demyelinating action on nerves produced by COVID-19.

Regarding EMG, the presence of an intramuscular needle was poorly tolerated. The recruitment was difficult; in fact, Case 3 did not tolerate the investigation. For Cases 1 and 2, the EMG profile seems to be myopathic. The direct effect of SARS–COV-2 in generating myopathy for critical COVID-19 patients was previously observed (Vanhorebeek et al., 2020) but, as already mentioned, none of our patients were in a critical state nor did they show elevated CK values on the battery of tests they were submitted to when returning to work. The short duration and low amplitude of MUAP with early full recruitment on IP suggest a direct action of COVID-19 on all muscle fibers, especially in the lower limbs. This myopathic action may be temporary, without persistently elevated enzymes, but sufficient to affect the patients' ability to work at previous parameters, because of myalgia (Pinzon et al., 2020).

### Conclusion

NCS and EMG findings suggest a direct action of COVID-19 on nerves and muscles. SARS–COV-2 demyelinating polyneuropathy and elements of myopathy could be new pathological entities to be considered in the COVID-19 management. More studies are required for confirming these electrophysiological findings.

### Study finding

None declared.

### Conflict of interest

None declared.

### Ethical statement

This case presentation has been approved by the Ethics Commission of the "Bagdasar Arseni" Clinical Emergency Hospital, Bucharest, Romania

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