

## CASE REPORTS / REPORTE DE CASO

## Common Peroneal Nerve Injury in a Patient with COVID-19 Infection

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**Abstract:** This report described a 46-year man with the characteristic Computerized Tomography (CT) scan findings of Corona Virus Disease Infection 19 (COVID-19) who presented to the hospital with right ankle weakness three weeks after the pneumonitis. He had been initially hospitalized, complaining of fever, myalgia, cough, and dyspnea. Electromyogram (EMG) revealed obvious evidence of increased insertional activity (IA) and significant denervation potentials, including positive sharp waves (PSW) and fibrillation potentials, particularly in ankle dorsiflexor muscles. Moreover, no voluntary motor unit action potential (MUAP) was observed. Eventually, the patient was diagnosed with severe axonal mononeuropathy of the right CPN, which could be considered a rare complication of COVID-19.

**Key words:** Nerve injury, Electromyography, Coronavirus, COVID-19.

## Introduction

A new beta coronavirus named COVID-19 was detected in December 2019 in Wuhan City, China, and shortly became a pandemic<sup>1</sup>. COVID-19 is fused with the angiotensin-converting enzyme II (ACE-II) receptor and enters the cells<sup>2</sup>. This new coronavirus can cause several systemic infections, among which respiratory complications are the most prevalent, quite similar to what earlier happened in severe acute respiratory syndrome coronavirus called SARS-CoV<sup>3</sup>.

It has been previously proved that around one-third of patients with COVID-19 had neurological symptoms. Although several specific neurological presentations such as anosmia, other non-specific ones, including reduced consciousness level, dizziness, and headache, have also been detected<sup>4</sup>. In one study, 214 patients with COVID-19 were evaluated in terms of neurological symptoms<sup>5</sup>. According to their findings, 36.4% of the hospitalized patients showed nervous system manifestations such as hyposmia, hypogeusia, headache, muscle injury, dizziness, ischemic, and hemorrhage stroke. However, it is still unknown whether the neurological symptoms are associated with the virus's direct damage, an abnormal immune response, or secondary mechanisms, including systemic inflammation or multi-organ dysfunction.

It has been hypothesized that SARS-CoV-2 can be considered as a new neuropathogen. However, it has not yet been proven by solid evidence<sup>6</sup>. Before COVID-19, it had been well-defined that infectious peripheral neuropathy could happen secondary to other viruses, including varicella-zoster, hepatitis C and human immunodeficiency virus (HIV)<sup>7</sup>. Similarly, during a viral infection, immune-mediated neuropathies such as chronic inflammatory demyelinating polyneuropathy (CIDP), as well as Guillain-Barre syndrome (GBS), might occur<sup>8</sup>. Also, an extended stay in the hospital can cause peripheral nerves.

Damage resulting from prolonged pressure effect or even critical illness polyneuropathy<sup>9</sup>. Recently, in some case reports, a potential relationship between peripheral nerve injury and the SARS-CoV-2 infection preceding the onset of damage by up to 4 weeks. Thus, the most probable reason would be a SARS-CoV2-triggered dysregulation of the immune sys-

tem<sup>10-12</sup>. This case report described a male patient infected with COVID-19 who showed a common peroneal nerve (CPN) injury as a rare complication.

## Case presentation

On 2 December, 2020, a 46-year-old man complained of inability to dorsiflex the right ankle from 3 weeks ago. The patient has referred to the emergency ward about 6 weeks ago under the probable diagnosis of COVID-19 and symptoms including fever, body aches, cough, and shortness of breath. During hospitalization, the polymerase chain reaction (PCR) and computerized chest tomography (CT) scan were performed and confirmed the diagnosis (Figure 1).

The patient had been admitted for 2 weeks resulting in 20 kg weight loss during this period. One week after the patient came back home, he noticed paresthesia on the right foot's dorsum and the sudden weakness of the right ankle dorsiflexion while walking and during the affected limb's swing phase.

He was referred to the clinic of physical medicine and rehabilitation (PM&R) to perform electromyography (EMG) and nerve conduction studies (NCS). As a result, sensory nerve action potential (SNAP) of the right superficial peroneal nerve (SPN) was not present, and the compound muscle action potential (CMAP) of the deep peroneal nerve (DPN) nerve was absent at the right side. In the EMG analysis, some evidence of increased insertional activity (IA) and denervation potentials, including PSW and fibrillation potentials, were detected in Tibialis Anterior (TA), Peroneus Longus (PL), Extensor Hallucis Longus (EHL), and Extensor Digitorum Brevis (EDB) muscles. Moreover, no voluntary motor unit action potential (MUAP) was observed in these muscles. Therefore, he was diagnosed with severe acute mono-neuropathy of the right CPN. Lumbosacral spine magnetic resonance imaging (MRI) was performed to assess discopathy, which was reported to be expected.

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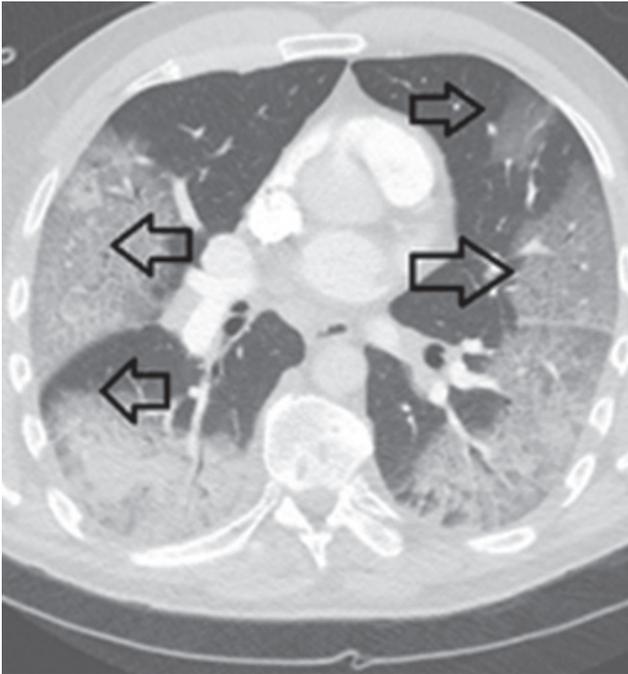
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**Figure 1.** Findings of the CT scan of COVID-19 patient. Bilateral peripheral ground-glass opacities in a patient with cough and dyspnea.

## Discussion

As we mentioned, as a post-infectious inflammatory response after SARS-CoV-2 infection, peripheral nerve injury can occur during the acute phase of resolution. This might be either the result of an abnormal hyper-immune response or treatment complications for COVID-19, such as nerve entrapment secondary to hematoma in the anticoagulation consumption setting or prolonged hospitalization that could be positional or critical illness-related polyneuropathy.

In the presented case, the patient was diagnosed with severe mononeuropathy of the right CPN after 3 weeks of developing symptoms such as fever, body aches, cough, and shortness of breath; compatible with COVID-19 pneumonia. The possibility of a direct neuropathic effect or an abnormal hyper-immune response in COVID-19 patients requires further research. There have been existed several case reports about GBS incidence among COVID-19 sufferers<sup>10,13,16</sup>.

This case has been reported even though all neurological manifestations in severe COVID-19 are not fully understood yet; then, the peripheral neuropathic damage cannot be positively attributed to COVID-19 due to the lack of nerve biopsy. However, the EMG findings, along with the clinical neural image, indicated peripheral neuropathy. There are two main probabilities in this regard: 1) direct involvement of nerve by the virus and the following inflammatory response; 2) nerve compression after severe weight loss has also been reported in bariatric surgery and so on<sup>17,18</sup>.

On the other hand, it has not clearly been understood how weight loss contributes to peroneal neuropathy. It is assumed that changes in metabolism followed by weight loss and mechanical compression of the peroneal nerve can play a significant role in this regard<sup>17,21</sup>. The adipose tissue depletion (inside and surrounding the nerve) results from weight loss; thus, the peroneal nerve's sensitivity to compression caused by the PL tendon on the lateral side and the adjacent fibular head medial side increases<sup>22</sup>.

The ACE-II receptor is where COVID-19 and SARS have

in common<sup>19</sup>. The receptor is found in the cell membrane of various organs in humans, such as the liver, kidney, lung, skeletal muscle, and nervous system<sup>5</sup>. However, the mechanisms involved in peripheral nerve injury incidence after COVID-19 infection have not yet been precisely studied. COVID-19 stimulates inflammatory cells, and different cytokines are generated, resulting in immune-mediated processes<sup>19</sup>. Therefore, peripheral nerve injury after SARS-CoV-2 infection is a theoretical consideration, and some COVID-19 patients have been reported to present with peripheral neuropathy and GBS<sup>13,20</sup>. Then, the cases of immune-mediated nerve injuries should be considered during this pandemic. According to the global pandemic of the SARS-COVID-1923-26, additional surveys should be conducted to find all epidemiological properties of disease<sup>27</sup>.

## Conclusions

To summarize, peripheral nerve injury should always be considered as a neurological complication that might occur in COVID-19. Probable post-infection peripheral nerve injury mechanisms include autoimmune response, direct neuro-invasion by the virus, and systemic disease complications. Further investigations are necessary to shed light on the exact pathophysiology of peripheral nerve involvement and high-risk patient determination. Given that, clinicians must be aware of these relationships to prevent delayed diagnosis from promoting treatment initiation at early stages and supportive care. This fact will be elucidated by further identified cases as well as longer time results.

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## Author contributions

FN designed the study and carried out the case identification. ZB, MS, and SRD carried out the CT-Scan and PCR. HSG and SM carried out the history taking and electromyography. FN wrote and drafted the manuscript. All authors read and confirm the final manuscript.

## Competing interests

The authors declared that they have no conflict of interest.

## Data and materials availability

All data are available in the main text or supplementary materials.

## Ethics statement

As noted on the journal's author guidelines page, the authors confirm that the journal's ethical policies have been adhered to. All identifying information of the patient presented in this study was kept secret.

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