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Adverse impact of COVID-19 on the nervous system

Impacto desfavorable de la COVID-19 sobre el sistema nervioso

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ADVERSE IMPACT OF COVID-19 ON THE NERVOUS SYSTEM

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Mr. Director,

On March 11th, 2020 the World Health Organization (WHO) declared the coronavirus outbreak a global pandemic due to the high number of people infected by COVID-19 worldwide.⁽¹⁾ With the progress in the study and research of the novel coronavirus, its impact on different organ systems has become evident. This contributes to its high lethality, which justifies and marks real challenges for the scientific community regarding the medical actions to be taken with these patients.

The clinical picture of COVID-19 is that of a mild flu-like syndrome, in most cases, but in 15% of these cases it is complicated by interstitial pneumonia and varying degrees of respiratory failure, with recent descriptions of nervous system involvement.^(2, 3, 4, 5)

Similar to SARS-CoV, SARS-CoV-2 uses the cellular receptor of angiotensin-converting enzyme 2 (ACE-2), which is expressed in the epithelium of the airway, lung parenchyma, vascular endothelium, brain, heart, and kidney, testicular and intestine tissues. However, some cells such as the hepatocyte may be infected with SARS-CoV, and these cells do not have expression of the ACE-2⁽¹⁾ cell receptor. Therefore, patients infected with COVID-19 may also have multisystem involvement.

SARS-CoV infection has been reported in the brains of experimental animals and infected patients. Its entry into the nervous system occurs through the olfactory nerves and subsequent spread to specific areas of the central nervous system (CNS). The transynaptic pathway through the route that connects the cardiorespiratory center from the mechanoreceptors and chemoreceptors in the lung and lower respiratory airways has been demonstrated in many coronaviruses, which may contribute to or have a large impact on the pathogenesis of respiratory failure in patients with COVID-19.⁽²⁾

On the other hand, coronaviruses are neurotrophies; the SARS-CoV-2 does not seem to be the exception and can infect both neurons and neuroglia cells. Neural cells express ACE-2 and direct infections of the CNS together with the systemic inflammatory process produced by COVID-19 compromise the blood-brain barrier and trigger a neuroinflammatory response with reactive astrogliosis and the activation of microglial cells. This could lead to various neurological processes that potentially induce respiratory disorders.⁽²⁾

It should be noted that the product of the respiratory failure developed by patients with COVID-19 is not the lung injury alone, but rather elements affecting the respiratory center in the brain stem, given the pathophysiology of the infection.

Mao et al.⁽³⁾ in their retrospectively study evaluated 214 patients with SARS-CoV-2. Out of them, 36,4% of the patients presented neurological manifestations, where CNS involvement predominated (24,8%), followed by damage to the skeletal muscle (10,7%) and the peripheral nervous system (8,9%). CNS

manifestations included dizziness, headache, impaired consciousness, acute cerebrovascular disease, ataxia and epilepsy. Muscle damage was reported to be present in 23 patients, and predominated in those with severe infection ($p < 0,001$). Disorders of taste, smell, vision and neuralgia characterized the peripheral nervous system involvement.(3)

Poyiadji col.(4) reported a case of acute necrotizing hemorrhagic encephalopathy in a patient with a history of cough, fever and acute impairment of mental functions, this patient tested positive for SARS-CoV-2. This may suggest a link between SARS-CoV-2 or an increased susceptibility to develop CNS-level complications.

The first case of Guillain-Barré syndrome associated with SARS-CoV-2 infection was reported in a 61-year-old woman, who initially presented with muscle weakness and osteotendinous areflexia in both lower limbs. On the eighth day of admission she began with typical respiratory symptoms and tested positive for SARS-CoV-2.(5) This case suggests a possible association between Guillain-Barré syndrome and SARS-CoV-2 infection, but more evidence is needed to attribute it to causality; this does not diminish its importance as a supportive element in the evidence of nervous system involvement by the novel coronavirus.

Neurological involvement by COVID-19 has raised several opinions at national and international levels, and the scientific community should be thoughtful to any neurological signs related to SARS-CoV-2 infection. The recent findings justify the relevance of this letter and mark the relevance of the topic under analysis.

CONFLICT OF INTEREST

The author states that there is no conflict of interest.

AUTHOR'S CONTRIBUTION

The author wrote, reviewed and approved the manuscript and its final version.

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