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## Abstract

With the SARS-CoV-2 pandemic and the increased number of cases reported in the literature of post-Covid syndromes, and clinical conditions of rheumatic and cardiovascular diseases, neurological disorders have also been reported, with the description of cases of reduced memory and cerebrovascular complications post-Covid-19 virus infection. Thus, in addition to these conditions, neuropathic pain secondary to cases of novel coronavirus infection have been seen in the literature and have raised questions about the pathophysiology arising from this situation, prognostic factors, and best indications for treatment. Among the neuropathic pain reported, occipital neuralgia is one of the complications faced, characterized by a burning and paroxysmal pain of variable duration. One of the possible treatments for this condition is the use of pulsed radiofrequency on the affected nerves in cases refractory to optimized clinical treatment, being an effective measure for reducing symptoms and improving quality of life.

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## Introduction

According to the World Health Organization (WHO), with the widespread of Covid-19 disease around the world, until February 25, 2022, there were a total of more than 430 million confirmed cases since the beginning of the pandemic. Late complications gain greater impact by an increase in the absolute number of cases and its study becomes necessary in the face of new circumstances in the world after its evolution.<sup>1</sup>

In addition to the already commonly known respiratory and gastrointestinal symptoms caused by the SARS-Cov-2 virus, there are reports of chronic neurological involvements that can lead to brain impacts and serious neurological diseases, such as stroke, Guillain Barré syndrome, viral encephalitis, necrotizing encephalopathy, meningitis, smell and taste disorders, deserving emphasis on the described cases of chronic pain, such as occipital neuralgia, as a chronic manifestation of the post-Covid-19 syndrome.<sup>2</sup>

Thus, neurostimulator or neuromodulation implants by pulsed radiofrequency are recent techniques, minimally invasive and of rapid execution, which has been highlighted because they are procedures that aim at the pain solution in a prolonged or even definitive way for different forms of neuralgia with excellent results, being an option for treating patient refractory to optimized clinical treatment.

## Case Report

A 45-year-old male patient with a history of Covid-19 infection, presenting mild headache, fever, anosmia, and cough. After 2 months of clinical recovery, he developed with pain in the occipital and cervical region, of high intensity, paroxysmal, type in burning and with paresthesia, more pronounced on the right. On examination, positive Tinel sign on the right. Major and minor occipital nerve test block with anesthetic solution showed improvement of the condition for 4 days. From the diagnosis of post-Covid Occipital Neuralgia, he underwent neuromodulation therapy with pulsed radiofrequency in the dorsal root ganglion of C2, at a temperature of 42°C, for 3 minutes, with repetition after an interval of 3 minutes. Procedure without complications, with complete resolution of pain and hospital discharge on the same day.

## Discussion

SARS-CoV-2 is a viral infection of variable clinical presentations with distinct prognostic repercussions,

with potential chronicity of the symptoms presented and the emergence of new diseases secondary to infection. Pain, besides being one of its common symptoms, can also be accompanied by peripheral or central neurological complications, and neuropathic pain is one of the clinical repercussions after infection, being part of the post-COVID-19 syndrome. The neurological manifestations observed resulting from the immunological response to the virus influenced several studies to find the neuropathological relationship of the parasite with the central nervous system. Thus, neural virulence would likely be linked to violations of the blood brain barrier, either by endothelial invasion by binding the spike protein of the virus to the angiotensin-2-converter enzyme, or trans-synaptic route through invasion of the olfactory nerves - from which it can reach the brain stem, basal ganglia and thalamus - or even, increased permeability of the barrier caused by the release of cytokines resulting from the systemic inflammatory process as a reaction response.<sup>3,5</sup>

Regarding neuropathic pain, there are reports of being triggered from psychological stressors of viral infection or being due to hospitalization in the intensive care unit. There are post viral immunological reactions capable of fostering an environment conducive to the establishment of neurological complications, such as stroke, polyneuropathy, Guillain-Barré syndrome, thus enabling the emergence of neuropathic pain. In addition, it is noticed that some patients with neuropathic pain diagnosed prior to infection (diabetic painful neuropathy, painful radiculopathy), may develop neurological symptoms of greater severity, or even worsen the intensity of pain. In severe cases requiring hospitalization, possible etiologies of neuropathic pain may be related to the prone position with peripheral nerve compression, use of neuromuscular blocking agents and complications of traumatic procedures. Another mechanism for neuropathic pain after Covid-19 would be involvement of nociceptive fibers due to the systemic inflammatory process, which may occur early or months after the injury of the nervous system.<sup>4,6</sup>

Although neuralgia is not usual in the natural history of the pathology caused by SARS-Cov-2, due to the large number of cases of the disease, it acquires greater clinical relevance, and may affect different territories, depending on the nerves involved. Occipital neuralgia, specifically, is defined as pain of the type of shock or burning, paroxysmal and of variable duration, and may have a lancinate character, being distributed in the uni or bilateral region of the skull, in the occipital/cervical territory, in the



distributions of the major occipital nerve, minor occipital nerve and third occipital nerve, in addition to and possible irradiation scans for the auricular pavilion, mastoid process and eyeball region.<sup>7,8</sup>

Neuralgia originating from the major occipital nerve may be the effect of compression of the C2 nerve root, the inferior oblique muscle of the head, and the supraspinatus muscle of the head. Hypertrophy, tension or muscle spasms are believed to be factors that may contribute to compression. The positive Tinel sign may be present, especially where the major occipital nerve emerges at the base of the skull over the major occipital notities. Pain tends to begin unilaterally and may extend to a bilateral distribution in one third of cases. In the case of the minor occipital nerve, it arises from the ventral branch of C2 and is divided into three branches: the auricular, mastoid and occipital. The third occipital nerve is part of the dorsal branch of C3 and, as it sends many branches to the other two previously detailed nerves, it becomes difficult to separate the symptoms resulting only from their compression.<sup>7,10</sup>

It is noted that the low availability of data on this condition and targeted treatments makes the management of these patients challenging. Among the conservative therapeutic forms, which include the use of the cervical collar, physiotherapy, and cryotherapy, it was concluded that there was no superiority to placebo. Non-steroidal, antidepressant, and anticonvulsant anti-inflammatory drugs may help relieve symptoms. In cases refractory to conservative therapy, it is possible to opt for neurosurgical intervention, through decompression of the major occipital nerve and nerve blocks by analgesics.<sup>8,10</sup>

New neurosurgical techniques are being implemented to supplement the available therapies, especially in cases of refractory chronic pain, with emphasis on the pulsed or ablative radiofrequency neuromodulation method. Ablative radiofrequency (ARF) consists of radiofrequency emission through a catheter through an electrode, positioned near a nociceptive pathway. The tissue adjacent to the current undergoes an increase in temperature. The area to be reached can be well delimited, being restricted to the nerves responsible for transmitting and modulating the painful sensations. In the case of occipital neuralgia, there is placement of the electrode implant in the C2 ganglion, allowing induction of low intensity electric field around these nerves and modulation the activity of A-delta fibers and C fibers. Its advantages are the generation of predictable lesions without adhesion or carbonization of tissues, using needles and thin probes with minimal

damage to adjacent parts.<sup>8,10-13</sup>

On the other hand, pulsed radiofrequency (PRF) consists of maintaining the same frequency intensity emitted, but in short pulses, making intervals between emissions to allow the affected tissue to cool. This technique aims to reduce neuronal exposure to higher than ideal temperatures, preserving the sensitivity of the dermatome and maintaining the analgesic character of the procedure. It is a safer procedure than ARF and may also be more effective in the treatment of neuropathic pain.<sup>11,14,15</sup>

The pulsed radiofrequency consists of the application of a frequency of 500,000 Hz in pulses of 20 ms every 0.5 s, aiming to avoid the increase in temperature and consequent tissue damage. PRF acts by two mechanisms, tissue injury through temperature and also through the electromagnetic field generated by the electrodes, which end up genetically modifying laminae I and II of the spinal cord, generating an alteration in the response to pain. PRF is well indicated in cases of cervicogenic headache, peripheral nerve lesions, pelvic pain, trigeminal neuralgia and other. But it is contraindicated in cases of systemic infection or at the site of pain, clotting disorders and other.<sup>11,12</sup>

## Conclusion

The diagnosis of occipital neuralgia implies a careful investigation and carries a wide possibility of treatments, which, in cases of chronic headache, pulsed radiofrequency neuromodulation acquires notoriety along with its promising results with reduction of intensity and frequency of pain episodes, and efficacy superior to other techniques, being used for the management of various disorders such as tension headaches, migraine, in salvos, among other neurogenic painful conditions.

Given the complexity related to the pathophysiology of Covid-19 infection, which is still not fully elucidated and remains under research for a better understanding of the mechanisms associated with this inflammatory chain linked to SARS-CoV-2, the dissemination of information on the clinical conditions and prognosis of patients presenting with post-Covid syndromes is of great importance. Thus, in view of the cases already reported in literature and the frequent neurological complaints of post-covid syndromes, it is relevant that further studies and case reports discuss this theme, and that future works clarify more on the subject, implementing the clinical management of these patients.



### Authors contribution

CCV, conceptualization, original draft, project administration, supervision; JVCC, BGFG, MEPC, GVP, JLG, GCS, JFAN, OCFN, LFFM, VEP, AAPL, VRXC, data curation, writing- original draft, writing-review & editing; JALN, conceptualization, project administration; HRCAF, supervision, conceptualization, validation, formal analysis, resources, project administration; LSBJ, conceptualization, validation, formal analysis, resources, project administration, supervision.

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