

## CASE REPORT

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# Ischemic Vasculitis as a Cause of Brain Disorder's in Patients with Long Covid: Case Report

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**Background:** The new coronavirus SARS-CoV-2 caused a pandemic that threatened all aspects of life and health while worsening the socio-economic situation of the entire population. COVID-19 affects all organs and organ systems. The symptoms of the affected organs can last for a long time after the acute infection. About 1/3 of patients develop neuropsychiatric signs in the clinical course of the disease. The most common symptoms are mental fog, headache, cognitive changes, behavior changes, muscle weakness, anosmia and ageusia. These symptoms may develop due to a direct effect of the virus on the neurons or hyper reactive immune response. **Objective:** The aim of this article is to describe 2 young adults who developed neuropsychiatric symptoms in the course of Long COVID-19 syndrome. Ischemic vasculitis was proved using CT imaging. **Case report:** We collected data of two younger females who had previously recovered from the acute form of COVID-19 without respiratory complications. They developed in the next 1-2 months a clinical picture of a brain disorder. In both cases, CT and angiography scans of the brain showed signs of ischemic vasculitis. Neurological therapy has led to an improvement of the neuropsychiatric symptoms. **Conclusion:** Neuropsychiatric disorders in Long Covid syndrome are common and diverse. Two cases of young adults who developed signs of neurological disorder in the post COVID-19 period were presented, and CT scans of the brain showed signs of ischemic vasculitis.

**Keywords:** Long Covid, Ischemic Vasculitis, neurological disorders, COVID-19, brain damage

## 1. BACKGROUND

The new coronavirus SARS-CoV-2 caused a pandemic that threatened all aspects of life and health while worsening the socio-economic situation of the entire population. COVID-19 affects all organs and organ systems. The symptoms of the affected organs can last for a long time after the acute infection. About 1/3 of patients develop neuropsychiatric signs in the clinical course of the disease (1). Patients may develop a wide range of symptoms ranging from mild sensory loss disorders, anxiety, headaches to more severe forms of psychotic behavior, delirium, stroke, peripheral severe neurological disorders (Guillain-Barre syndrome), and coma. The most common symptoms are mental fog, headache, cognitive changes, behavior changes, muscle weakness, anosmia and ageusia (1, 2).

These symptoms may develop due to a direct effect of the virus on the neurons or hyper reactive immune response (1). The presence of the virus in brain tissue and spinal fluid has been proven. The direct effect of the virus SARS-CoV-2 can occur on the brain cells themselves, or on the endothelium of the blood vessels of the brain. Immune disorders during COVID-19 are common. Mediators of inflammation, especially cytokines, can cause an overactive immune system which can lead to vasculitis. The blood coagulation system during Covid-19 may also be activated. Thromboembolic complications can lead to severe brain disorders (3, 4). Brain CT and MRI imaging are the most important diagnostic parameters in neurological disorders. Angiography can rule out some pre-existing abnormalities in the bigger blood vessels. Vasculitis of the central nervous system (CNS) affects small arteries and is a rare condition. It can be part of systemic vasculitis. Many viral infections can trigger CNS vasculitis (3). SARS-CoV-2 vasculitis has been associated with severe brain dysfunctions. There are several theories why the brain may be damaged:

- a) Severe infection caused by virus entering the brain,

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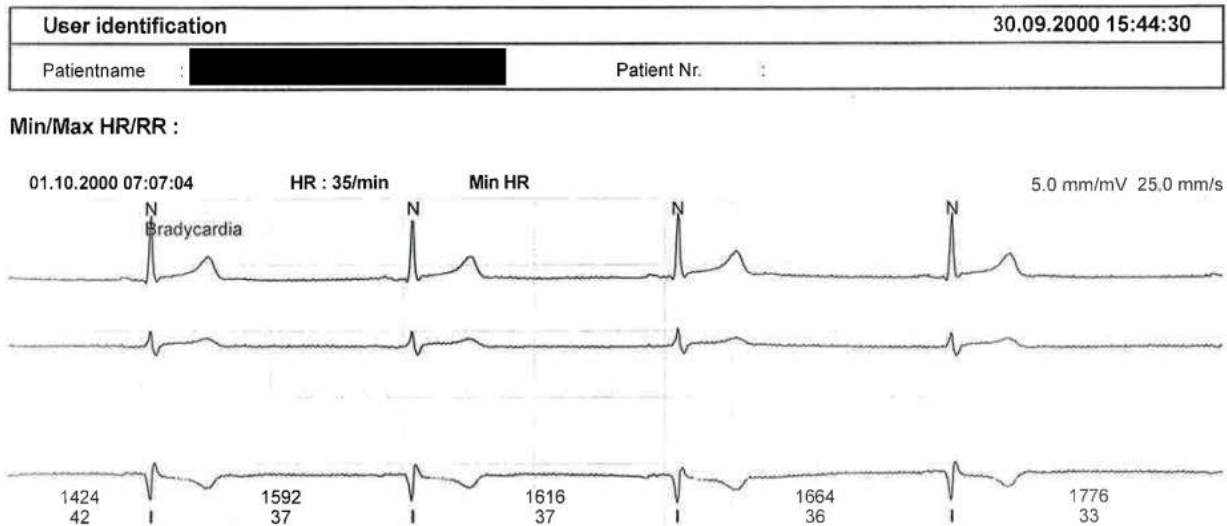


Figure 1. ECG: sinus bradycardia.

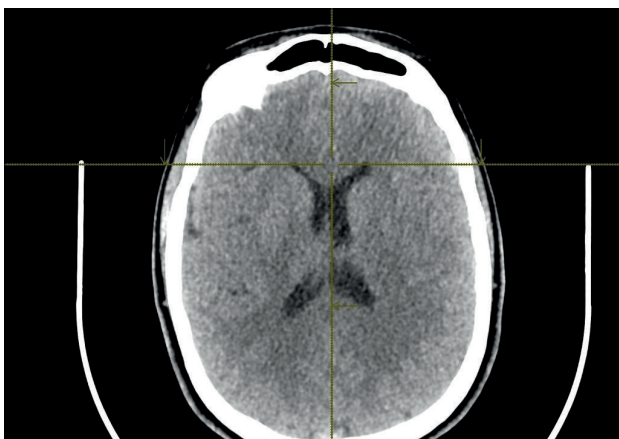


Figure 2. Brain CT scan of the patient shows diffuse micro ischemic and micro hemorrhagic changes

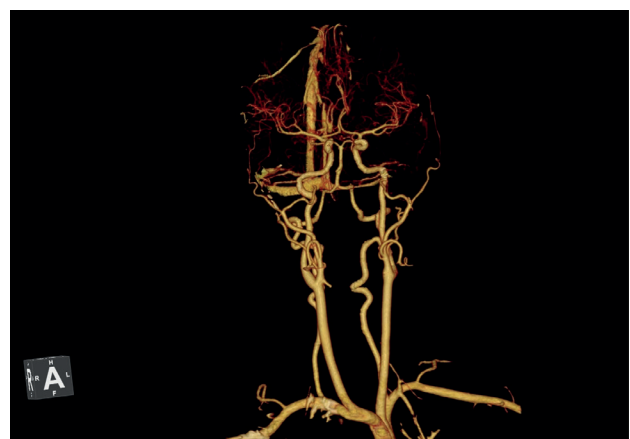


Figure 3. Cervical and cerebral angiography didn't show any pathological changes.

- b) “Maladaptive” inflammatory response by cytokines,
- c) Blood-clotting abnormalities (3, 4).

## 2. OBJECTIVE

The aim of this article is to describe 2 young adults who developed neuropsychiatric symptoms in the course of Long Covid syndrome. Ischemic vasculitis was proved using CT imaging.

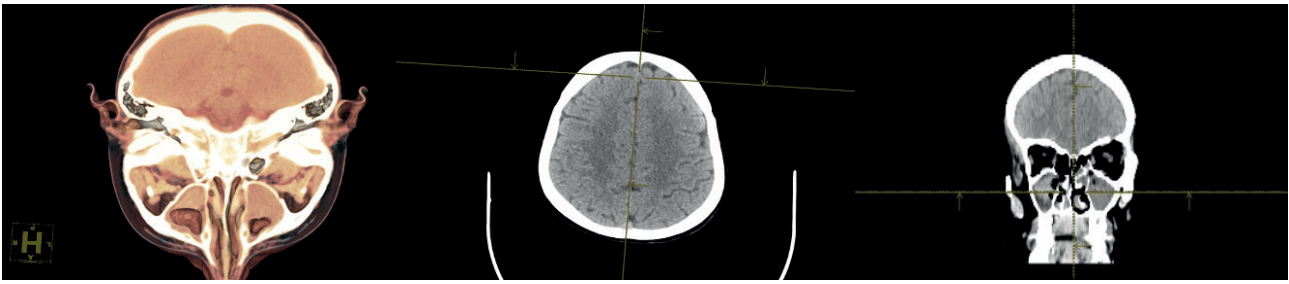
## 3. CASE REPORT

Our first patient was the 31-year-old female with a history of hypothyroidism and obesity. She had an acute form of Covid -19 in April 2020. The clinical course of COVID-19 was accompanied by loss of taste and smell, fever, and dry cough. Laboratory findings only showed elevated CRP. PCR for SARS-CoV-2 was positive while neutralizing antibodies were negative. Chest CT imaging was normal. In the spring of 2021, she received 2 doses of Pfizer vaccine. At the end of October 2021, fever, cough, back pain, dizziness, and muscle pain reappeared. ECG monitoring showed signs of arrhythmic disorder in the form of sinus bradycardia and tachycardia (35-133bpm).

Figure 1 shows the presence of bradycardia during an onset of headache.

Echocardiography was normal. Elevated values of ferritin (376 mg / L) and iron (34.9 mmol / l) can be seen in laboratory values. PCR on SARS-CoV-2 was positive. X-ray of the chest showed sequelae of previous infections with minimal fibrotic changes. In November 2021, a month after the onset of the disease, a patient came to our clinic as an emergency case due to an intense headache that didn't react to strong analgesics. At the same time, anxiety along with cognitive symptoms that included mental fog and memory impairment appeared. The patient's laboratory findings were normal, ferritin was still elevated and neutralizing antibodies to SARS-CoV-2 appeared for the first time. The patient underwent urgent brain CT and angiography imaging. Cervical and cerebral vessels had normal radiological characteristics (Figure 2). Brain CT imaging shows diffuse micro ischemic changes bilaterally frontoparietally, more pronounced on the left. There were several diffusely distributed micro hemorrhagic changes (Figure 3).

After consulting a neurologist, piracetam (800 mg) and analgesics were prescribed. Over the next 10 days,



**Figure 4.** Brain CT scan shows minimal microischemic changes frontoparietally and supraventricularly on both sides, predominantly right.

clinical symptoms improved, however, mental fog persisted.

Another 31-year-old female patient suffered from COVID-19 in the 7th month of 2020. During the 15 days of the acute phase, she had general weakness, loss of taste and smell and intense headache. Routine laboratory findings, including a lung chest x-ray were normal. She received 2 doses of Pfizer in late 2020. In October 2021, general weakness, the headache, and anosmia reappeared. Repeated PCR on SARS-CoV-2 was positive. Neutralizing antibodies to SARS-CoV-2 also appeared in December. 2 months after the initial COVID-19 infection, intense headaches, weight loss and muscle aches occur. Patient was referred to the brain CT imaging where minimal microischemic changes were seen frontoparietally to the left and supraventricularly on both sides, predominantly right (Figure 4).

A neurologist was consulted and piracetam was prescribed. 10 days after the treatment was finished, the patient reported that headaches are less intense and last a shorter period of time, but anxiety and insomnia are still present.

#### 4. DISCUSSION

Many clinical studies indicate that brain damage with a variety of neuropsychiatric symptoms is present in a large number of patients. Changes occur in the acute phase, however, they are more common in the Long COVID-19 Syndrome. The same studies recommend that more attention should be paid to research into brain damage in long-term follow-up of patients. CT scan should be done with appearance of neurological and psychiatric symptoms (1).

Several studies have shown that peripheral neurological deficits occur due to multiple axonal mononeuropathies (5).

Encephalitis can be caused by direct infection with the SARS-CoV-2 virus since there was the presence of viral RNA and specific antibodies in the cerebrospinal fluid (1). The virus enters the brain most commonly through the olfactory nerve and enters cells via ACE-2 receptors present on neurons and vascular endothelium of the brain. Expression of ACE2 receptors in neurons and cerebral endothelial cells indicates a high level of invasiveness for the virus SARS-CoV-2 (6). Encephalopathy caused by the virus can present as a headache with mild cognitive impairment, however, it can result in delirium, dementia, and coma (6). Altered mental status in young-

er patients is common (the second most common presentation in UK-wide surveillance study) (4, 7).

Our patients are younger women who did not have symptoms of respiratory infection. The described brain changes may be related to disorders of the immune system. Inadequate response with inflammatory cytokines can cause changes in the small brain blood vessels (8).

Emergence of positive igg antibodies to SARS-CoV-2 at the time neuropsychiatric symptoms appeared in our patients supports this theory. Neutralizing antibodies can act against myelin sheaths of nerves causing nerve damage which in turn results in muscle weakness. There is a possibility of hematological disorders with increased coagulability and thromboembolism lead to ischemic vasculitis and neuronal degeneration. These focal areas can be detected by neuroimaging. In the future, it is necessary to develop and implement guidelines for management of brain disorders in younger COVID-19 patients (6, 9, 10).

#### 5. CONCLUSION

Neuropsychiatric disorders in Post COVID-19 syndrome are common and they vary. Two cases of young adults who developed signs of brain disorders in the post COVID-19 period were presented, and CT scans of the brain showed signs of ischemic vasculitis. In the future, it is necessary to develop and implement guidelines for management of brain disorders in younger COVID-19 patients.

- **Author's contribution:** All authors were involved in the preparation of this article. Final proofreading was made by the first author.
- **Conflict of interest:** None declared.
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