

Case Report: Intracerebral and Intraventricular Hemorrhage With COVID-19: A Case Report



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ABSTRACT

Background and Importance: SARS-CoV-2 virus causes COVID-19. The virus's primary target is the respiratory system, but it can also affect other systems, such as the cardiovascular and the central nervous system.

Case Presentation: In this study, we introduce an 83-year-old man who was referred due to a reduced level of consciousness and hemiparesis in the left part of his body without symptoms such as fever, cough, muscle aches, and fatigue. In High-Resolution Computed Tomography (HRCT) of the lung, the Ground-Glass Opacification/Opacity (GGO) view indicated COVID-19 disease, and in Computerized Tomography (CT) scans of the brain, hemorrhage was evident in the right thalamus, lateral and right ventricle. The Polymerase Chain Reaction (PCR) test performed on the upper part of the nose was also positive. This research is a case report of intracranial and intraventricular hemorrhage in an aged man with asymptomatic COVID-19.

Conclusion: Low level of consciousness in the elderly can be a sign of infection with the SARS-CoV-2 virus.

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Highlights

- In COVID-19 disease, in addition to respiratory symptoms, some patients have symptoms of the central nervous system.
- Stroke, cerebral sinus vein thrombosis, and cerebral hemorrhage have been reported in patients with COVID-19.
- SARS-CoV-2 virus disrupts the regulation of blood pressure by binding to Angiotensin-Converting Enzyme 2 (ACE2) receptors in brain tissue.
- This imbalance reduces the conversion of angiotensin 2, a vasoconstrictor, to angiotensin 1-7, a vasodilator.
- This reduction results in increased cerebral blood pressure and cerebral hemorrhage in older adults.

Plain Language Summary

This notion that SARS-COVID 2 virus only affects the respiratory system is incorrect because the virus can affect other systems, such as the heart and brain. Common symptoms of infection with the virus include high fever, cough, body aches, and shortness of breath. But other symptoms, such as a low level of consciousness, especially in adults, should be considered because this symptom can signify that the SARS-COVID 2 virus has entered the brain. In our study, an older person was admitted to the hospital with a low level of consciousness without other symptoms of COVID-19 disease. After the examinations, the images of the lungs showed that the patient was suspected of COVID-19 disease, and after the test, the result was positive. Brain imaging also showed cerebral hemorrhage. As the SARS-COVID 2 virus enters the brain cells through the bloodstream or olfactory system, the mechanisms involved in maintaining the balance of blood pressure are disrupted, and blood pressure rises. In the elderly, rupture of arteries and intracerebral hemorrhage may occur due to decreased elasticity of the vessel wall. In the elderly, care should be taken to reduce the low of consciousness, and the patient should be examined for COVID-19 disease to prevent the transmission of the disease to others and the complications of the disease that can threaten the lives of the elderly.

1. Background and Importance

SARS-CoV-2 can access the Central Nervous System (CNS) through general blood circulation and cerebral capillaries [1] or the nasal epithelium and the olfactory tract [2]. Neurological manifestations such as seizures due to fever, epilepsy, change in consciousness, and encephalitis has also been reported in some cases [3]. Older people with chronic diseases such as hypertension, diabetes, and coronary artery disease are more at risk [4]. We introduce a case that reported bleeding in brain tissue and cerebral ventricles following the COVID-19.

2. Case Presentation

The patient is an 83-year-old man referred to the emergency department due to decreased level of consciousness, hemiparesis on the left side of the body, and restlessness. He had no history of hypertension, diabetes, heart problems, or smoking. His Glasgow Coma Scale

(GCS) was reported at 11/15, and his vital signs were as follows: Blood Pressure (BP)= 160/70 mm Hg, Heart Rate (HR)= 52 bpm, Respiratory Rate (RR)= 22 bpm, and Temperature (T)= 37.4°C. He did not have clinical symptoms such as fever and cough on admission. The SPO2 of patients without oxygen was 83%.

The patient underwent Computerized Tomography (CT) scan of the brain and High-Resolution Computed Tomography (HRCT) of the lungs. In CT scans of the brain, Intracerebral Hemorrhage (ICH) was seen in the right thalamus along with Intraventricular Hemorrhage (IVH) in the lateral and third ventricles (Figure 1A). In HRCT of the lung, the Ground-Glass Opacification/Opacity (GGO) view in the middle lobe of the right lung was proposed by the radiologist (Figure 1B). The patient's Polymerase Chain Reaction (PCR) test, taken from the upper part of the nose, was reported positive. Laboratory tests demonstrated normal platelet count ($192 \times 10^3 / \mu\text{L}$), prothrombin time (14 s; international normalized ratio:1), activated partial thromboplastin time (34 s), hemoglobin (11.8 g/dL), white blood cells ($158 \times 10^3 /$

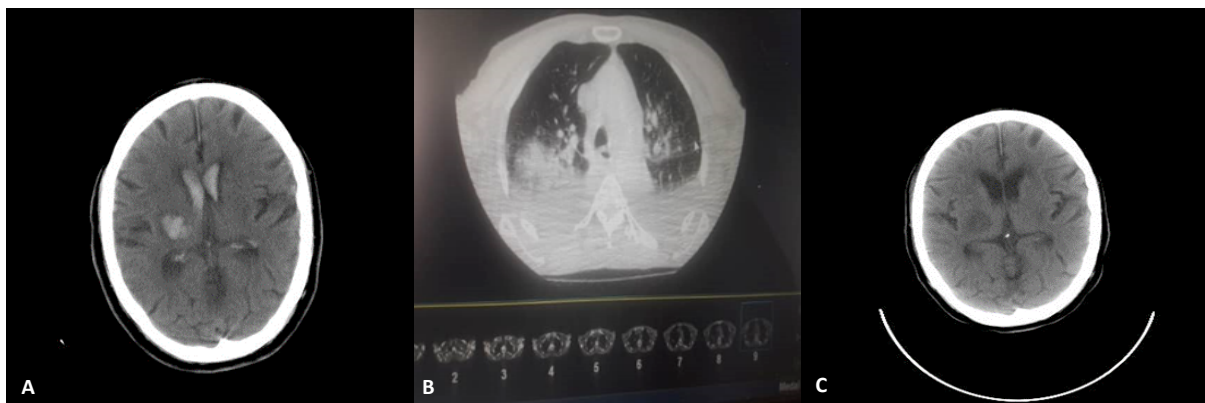


Figure 1. The patient's brain and lungs CT scans

A: CT scan on admission; B: CT scan of the lungs; and C: CT scan at discharge time.



mL), neutrophil (97%), erythrocyte sedimentation rate (35 mm), C-reactive protein (1⁺) and blood sugar (205 mg/dL). Other hematologic and chemical tests were also unremarkable.

The patient was hospitalized in the intensive care unit at the neurology service and received oxygen with a face mask at a rate of 6 L/min. He was restless during the hospitalization and was visited by a psychiatrist. He received preventive antiepileptic and antihypertensive drugs. Because he had leukocytosis, antibiotics were administered. Insulin protocol was performed for hyperglycemia. He was hospitalized for 20 days, and chest physiotherapy and passive Range of Motion (ROM) were performed for the upper and lower left limbs. During the hospitalization, the patient underwent three CT scans of the brain. In the second CT scan, the blood volume inside the ventricle was reduced, and the External Ventricular Drain (EVD) was not placed in the patient. In the third CT scan of the brain, the ICH-induced hypodense area was visible, but the cerebral hemorrhage was absorbed (Figure 1C). The patient was discharged with a GCS of 13/15 and prescribed antihypertensive and antidiabetic drugs. He was recommended for further follow-up.

3. Discussion

Gradually, symptoms of central nervous system involvement with SARS-CoV-2 were reported in patients and are still increasing. Hypoxia, inflammation, and hypercoagulability are the possible mechanisms of neurological and cerebrovascular events during a COVID-19 infection [5].

The SARS-CoV-2 enters the cell membrane by binding to Angiotensin-Converting Enzyme 2 (ACE2) receptors

[1]. The role of ACE2 in the body is to regulate various brain functions, such as regulating hormone production and the adrenal sympathetic system, regulating water and sodium, vascular self-regulation, and regulating cerebral blood flow [6].

When ACE2 receptors are affected in the brain tissue, the conversion of angiotensin 2, a vasoconstrictor, to angiotensin 1-7, a vasodilator, is disrupted. So the self-regulation of cerebral blood pressure and endothelial function may impair, and ICH could occur [6]. Also, hypoxia caused by lung involvement following the onset of SARS-CoV-2 can affect the CNS and reduce consciousness and restlessness in the patient [4]. Hypoxia may affect the CNS in one of two ways: 1) hypoxic effects lead to metabolic acidosis, further causing intracellular accumulation of lactic acid, increasing free radicals, and diminishing ATP production of neuronal cells, 2) decreased blood oxygen causes dilation of the intracranial vasculature which increases the permeability of the neuronal cell tissue fluid composition resulting in neuronal swelling, interstitial brain edema, and injury [5].

As our patient has no history of hypertension and diabetes on admission but had hyperglycemia in the clinical laboratory test, it can be stated that he may already have hypertension and diabetes, and the patient was unaware of it. COVID-19 patients often have increased WBC's, neutrophils, and CRP observed in laboratory reports. These elevations pose a significant risk for cerebrovascular events for patients with underlying comorbidities such as hypertension and diabetes [5]. Our patient also had leukocytosis, neutrophilia, positive CRP, and increased ESR, and it may be said that changing these values is a sign of an inflammatory process in the body that leads to cerebrovascular events. In the end, it can be said that having risk factors such as

hypertension, diabetes, inflammatory process, and hypoxia caused an intracranial hemorrhage in our patient, or that this event presented to the patients could have been a coexistence and not a causation relationship.

4. Conclusion

Neurological symptoms of intracerebral hemorrhages, such as a low level of consciousness and restlessness, may be the first symptoms of COVID-19 in older people. As the person had no other common clinical symptoms such as fever, cough, muscle aches, and so on, clinicians should be aware of this correlation and carefully monitor the patient's neurological status as part of their routine care.

Ethical Considerations

Compliance with ethical guidelines

This manuscript was approved by the Clinical Ethics Committee of Imam Jafar Sadegh Hospital in Aligoudarz and by the Ethics Committee of Lorestan University of Medical Sciences after obtaining the patient's consent (Code: IR.LUMS.REC.1399.118).

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Authors' contributions

All authors contributed equally in all stages of the study.

Conflict of interest

The authors declared no conflict of interest.

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