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# Bilateral Large Vessel Occlusion Causing Massive Ischemic Stroke in a COVID-19 Patient

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The case of a 70-year-old male presenting an ischemic stroke related to COVID-19 infection is described. He was initially admitted to the hospital with respiratory insufficiency syndrome secondary to pneumonia caused by SARS Co2. In the next days, he developed rapid neurological deterioration characterized by drowsiness which progressed to deep coma. D-dimer was elevated. Brain CT scan showed bilateral massive ischemic stroke located in the anterior circulation, CT angiogram showed occlusion in the left internal carotid artery and the right middle cerebral artery. The deterioration of the patient continued and he subsequently died. Large vessel occlusion has been reported in COVID-19 patients, but this clinical presentation is usually unilateral. Cases of bilateral occlusion of large vessels have not been previously reported in COVID-19 patients. This report shows that bilateral massive stroke may occur in COVID-19 cases and it should be suspected in patients who show rapid neurological deterioration without focal deficits.

**Key Words:** COVID-19 stroke—Large vessel occlusion—Bilateral ischemic stroke—Massive stroke

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## Case presentation

A 70 years old male was admitted to the hospital with a 4-day history of fever, cough, anosmia, and diarrhea. The patient was previously healthy without any apparent vascular risk factors. Vital signs revealed a body temperature of 37.5, blood pressure of 110/72, heart rate of 80 beats per minute, and oxygen saturation of 91%. Laboratory studies revealed hemoglobin 15 g, hematocrit 46.5, platelets 465,000, D-dimer 3670 (normal range 0–500 ng/ml); testing for SARS-Co-2 was positive. A CT of the thorax showed mixed interstitial infiltrate, consolidation, and typical pattern of COVID-19 infection. The day before to experience neurological deterioration he was alert, the speech was

normal and motor deficit was not observed. He only referred cough and fatigue. On day 10, the patient was drowsy and a decline of the state of consciousness was observed, progressing to coma and bilateral mydriasis the same day. Tracheal intubation was performed and a brain CT scan and CT angiogram were ordered. Lab tests showed leukocytosis and normal hemoglobin and platelets, D-dimer was 9500. Brain CT scan showed bilateral mild cerebral hypodensity and generalized effacement of brain sulci. CT angiogram showed occlusion of the main trunk of the right middle cerebral artery and occlusion of the left internal carotid artery in the supraclinoid portion. The next day, another brain CT scan was performed which showed a bilateral massive ischemic stroke of the anterior circulation. Ischemic zones were observed in the right middle cerebral artery territory and left anterior and middle cerebral arteries territories, posterior circulation was normal. An echocardiogram was performed to rule out cardioembolism but it was negative for clots or valve anomalies. No treatment was performed and the patient was pronounced dead in the next hours [Figs. 1 and 2](#).

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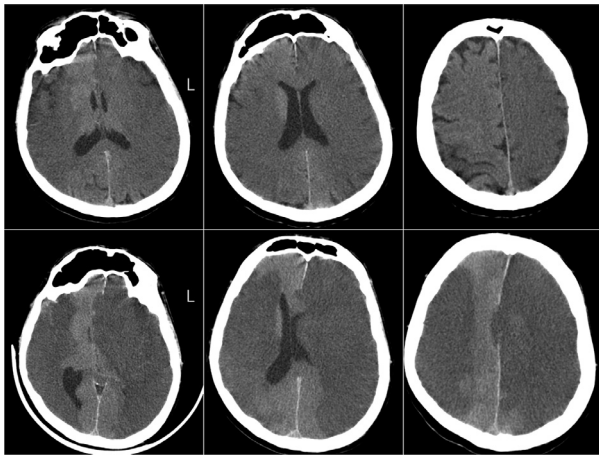
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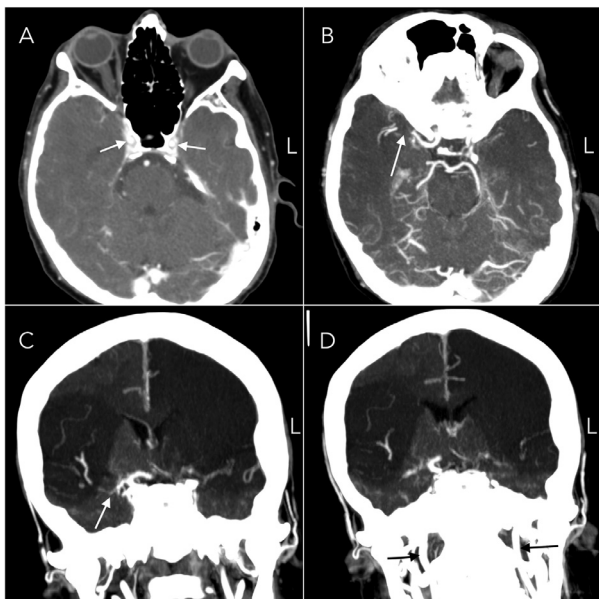
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**Fig. 1.** Initial (upper row) and subsequent (lower row) brain CT scans. Initial study shows bilateral mild hypodensity of both brain hemispheres, note the decrease of brain sulci predominately on the left side. Follow-up shows bilateral massive ischemic stroke in the anterior circulation. The right ischemic zone is located in the territory of the middle cerebral artery and in the left anterior and middle cerebral arteries. The midline is shifted to the left side. Only the right anterior cerebral artery and posterior circulation are preserved.

## Discussion

Several studies have described a higher incidence of stroke in patients affected by SARS-CoV-2, it is reported that the incidence of stroke in COVID-19 patients is



**Fig. 2.** Brain CT angiogram. A) Axial view, both internal carotid arteries show contrast filling in the cavernous segment (arrows). B) A higher view shows occlusion of the right middle cerebral artery (arrow), the left middle cerebral artery is not observed. Note the normal anatomy of the basilar artery bifurcation. C) Coronal view, bifurcation of the right carotid artery is observed showing adequate filling of the anterior cerebral artery; however, the middle cerebral artery shows a very important narrowing (arrow). The left carotid artery and its bifurcation are not visible. D) Both internal carotid arteries show a normal size before entering the intracranial compartment (arrows).

1.1–1.4%.<sup>1,2</sup> Respiratory symptoms are the main manifestations of this viral infection, but evidence shows that these patients may develop coagulopathy resulting in thromboembolic complications such as deep vein thrombosis, pulmonary embolism, myocardial infarction, and stroke.<sup>3</sup> Compared to non-COVID-19 ischemic stroke patients, patients with stroke-related to COVID-19 are younger, have a higher frequency of large vessel occlusion, and show a higher mortality.<sup>1</sup> Although ischemic stroke related to COVID-19 has been reported in young patients without apparent risk factors, it mainly occurs in patients with severe infection and those with preexisting vascular risk factors.<sup>1,4</sup> The proposed mechanisms for ischemic stroke in these patients include a hypercoagulable state from systemic inflammation and cytokine storm, postinfectious immune-mediated responses, and direct viral-induced endotheliitis, which may lead to angiopathic thrombosis.<sup>5,6</sup>

Several studies of COVID-19 ischemic stroke secondary to occlusion of large vessels have been reported in the literature.<sup>4,7,8</sup> In these cases, the vascular occlusion is usually observed in a single large vessel. The most common location of large vessel occlusion is the middle cerebral artery and the internal carotid artery,<sup>4,8</sup> some patients may have tandem occlusions of these vessels.<sup>7</sup> Less frequently, cases of occlusion of the basilar artery, vertebral artery, posterior cerebral artery, and anterior cerebral artery have been also reported.<sup>4,8</sup>

In the present case, synchronic bilateral large vessel occlusion was observed on imaging studies, this scenario has not been previously reported in the literature. Although this patient was 70 years old, he did not have any apparent vascular risk factors. The high levels of D-dimer observed in this case strongly suggests that a hypercoagulability state was the primary cause of occlusion of these blood vessels.

Patients with ischemic stroke usually manifest with focal signs such as speech problems, unilateral motor deficits, and other symptoms. In the current case, the difficulty to identify a motor deficit or other focal neurological signs can be explained because focal neurological signs were masked by the altered consciousness state.

In summary, this case corroborates the statement that COVID-19 ischemic strokes are more severe and entails a worst prognosis compared to non-COVID-19 strokes. Bilateral large vessel occlusion should be suspected in patients with SARS Co2 infection who present with an altered state of consciousness.

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