

## Case Report

# Brain perfusion single-photon emission computerized tomography/computerized tomography: Stroke-like manifestations of COVID-19 with transient antiphospholipid elevation

## ABSTRACT

COVID-19 is a viral respiratory disease associated with neurologic complications such as encephalitis or stroke in a minority of patients. The wide variety of neurologic manifestations with often unclear etiology may confound diagnosis and management. We present a young man admitted following an 8-day onset of self-resolving episodes of left hemiplegia and hemifacial droop. Diagnostic work up for seizures and stroke was largely negative. "Intra-ictal" ECD-single-photon emission computerized tomography/computerized tomography was consistent with right middle cerebral artery ischemia. Subsequent diagnostic work up revealed positive COVID-19 screening and newly-elevated antiphospholipid antibodies. Antiepileptic medications were discontinued, and the patient was successfully treated as an outpatient with corticosteroids leading to resolution of symptoms.

**Keywords:** Brain, COVID-19, ECD, severe acute respiratory syndrome coronavirus-2, transient antiphospholipid

## INTRODUCTION

COVID-19 is a viral respiratory disease caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). Most patients are either asymptomatic or show mild respiratory symptomatology, however, a minority can present acute respiratory distress syndrome and cardiovascular and neurologic manifestations including loss of smell and taste.<sup>[1]</sup>

Neurologic manifestations associated with COVID-19 encompass a wide variety of symptoms with different proposed etiologies. The most common manifestations are headache and anosmia but, less commonly, patients may also present seizures,<sup>[2]</sup> ischemic stroke,<sup>[3]</sup> and GuillainBarre syndrome.<sup>[4,5]</sup>

Determining the etiology of serious neurologic manifestations, such as seizures, in patients with COVID-19 can be a challenging undertaking as their pathophysiologic mechanisms are often unclear. Some authors have proposed different mechanisms for seizures including cytokine storm,

breakdown of bloodbrain barrier, electrolyte imbalance, and abnormal coagulation, among others,<sup>[2]</sup> suggesting their manifestation may be multifactorial.

We present a case of a patient with recurrent self-resolving episodes of seizures and left hemiplegia, where the brain of

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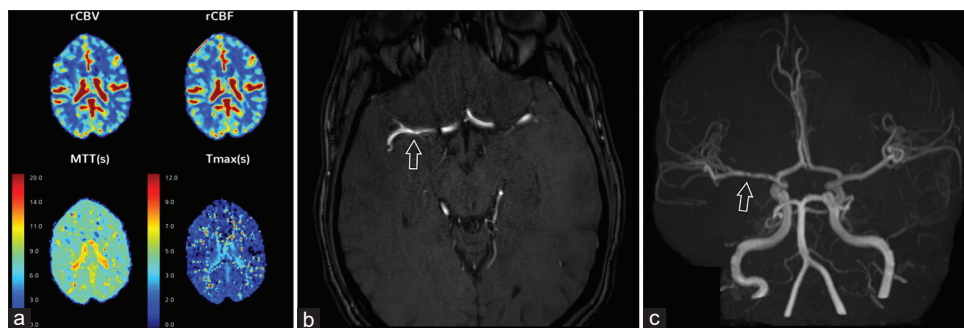
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**Figure 1:** (a) brain CT perfusion scan was unremarkable for epileptogenic foci. (b) Magnetic resonance angiography of the brain revealed an equivocal irregularity in the M1 segment of the right middle cerebral artery, as shown on axial view (b) and maximum intensity projection (c), which was favored to be artifactual in etiology in an otherwise-normal magnetic resonance angiography

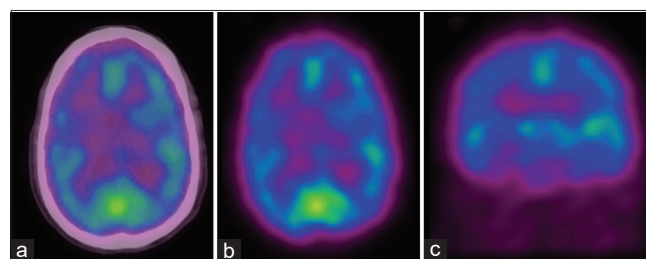
<sup>99m</sup>Tc-bicisate (ECD)-single-photon emission computerized tomography/computerized tomography (SPECT/CT) was successfully utilized for diagnosis and management guidance of COVID-associated ischemia secondary to flare antiphospholipid syndrome.

## CASE REPORT

A 35-year-old male patient without major cardiovascular risk factors presented after eight days of recurrent episodes of left hemiplegia, facial droop, and dysarthria. Each spell was sudden, not associated with aura- or ictal-like symptomatology and self-resolved within 10–20 min of onset. Initial diagnostic work up including electroencephalogram and CT brain perfusion scan was unremarkable for epileptogenic foci. Magnetic resonance angiography (MRA) [Figure 1] of the brain revealed an equivocal irregularity in the M1 segment of the right middle cerebral artery, that was favored to be artifactual in an otherwise normal scan.

Following consultation with the nuclear medicine department, an “intra-ictal” ECD Brain SPECT/CT was requested for evaluation of a suspected epileptogenic focus [Figure 2]. Approximately 1-minute following initiation of left hemiplegia, the patient received approximately 1,110 MBq of ECD intravenously. Attenuation-corrected SPECT/CT was acquired approximately 45 minutes following administration of ECD, which revealed relatively decreased perfusion in the distribution of the right middle cerebral artery. Retrospectively, the M1 irregularity seen in the right middle cerebral artery on MRA was believed to correspond to a real lesion.

The patient underwent additional work up with beta-2 glycoprotein and cardiolipin antibodies which were positive. Additional testing revealed positive IgG and IgM antibodies for SARS-CoV2 indicating convalescent stage of COVID-19,<sup>[6]</sup> although the patient denied any recent respiratory or other COVID-related symptomatology. The patient was treated with a course of corticosteroids leading to complete resolution



**Figure 2:** Transaxial fused single-photon emission computerized tomography/computerized tomography (a) and single-photon emission computerized tomography (b), and transcoronal single-photon emission computerized tomography (c), showed relatively decreased perfusion in the distribution of the right middle cerebral artery

of symptoms and progressive decrease of antiphospholipid antibodies and has remained asymptomatic for several months after this episode.

## DISCUSSION

Prior case series have shown an increased incidence of stroke<sup>[3]</sup> and deep venous thromboembolism, including younger patients,<sup>[7]</sup> suggesting an increased risk for hypercoagulable states such as antiphospholipid syndrome. In the case presented, brain perfusion ECD-SPECT/CT evaluation supported a diagnosis of cerebral ischemia rather than epilepsy in a patient with nonspecific neurologic manifestations and largely negative neurologic work up – in the setting COVID-19 and newly-elevated antiphospholipid markers.

Antiphospholipid syndrome has been associated with viral infections,<sup>[8]</sup> including COVID-19.<sup>[9-11]</sup> A case series of 86 critically-ill patients with COVID-19 reported a 65% incidence of neurologic manifestations and a higher prevalence of antiphospholipid antibodies in those with ischemic stroke.<sup>[12]</sup> Other authors have suggested various pathophysiologic mechanisms leading to stroke in patients with COVID-19 including coagulation pathway activation, virus-induced vascular inflammation, and myocardial injury.<sup>[13]</sup>

A case series could be useful to determine the role of brain ECD SPECT/CT in the evaluation of COVID-19 associated with nonspecific neurologic manifestations. As in this case, the use of brain perfusion scintigraphy may be individualized and particularly considered in patients with equivocal diagnostic work up.

#### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

#### Conflicts of interest

There are no conflicts of interest.

#### REFERENCES

- Ye Q, Wang B, Mao J. The pathogenesis and treatment of the 'Cytokine Storm' in COVID-19. *J Infect* 2020;80:607-13.
- Nikbakht F, Mohammadkhanizadeh A, Mohammadi E. How does the COVID-19 cause seizure and epilepsy in patients? The potential mechanisms. *Mult Scler Relat Disord* 2020;46:102535.
- Tan YK, Goh C, Leow AS, Tambyah PA, Ang A, Yap ES, *et al.* COVID-19 and ischemic stroke: A systematic review and meta-summary of the literature. *J Thromb Thrombolysis* 2020;50:587-95.
- Caress JB, Castoro RJ, Simmons Z, Scelsa SN, Lewis RA, Ahlawat A, *et al.* COVID-19-associated Guillain-Barré syndrome: The early pandemic experience. *Muscle Nerve* 2020;62:485-91.
- Toscano G, Palmerini F, Ravaglia S, Ruiz L, Invernizzi P, Cuzzoni MG, *et al.* Guillain-Barré syndrome associated with SARS-CoV-2. *N Engl J Med* 2020;382:2574-6.
- Requena M, Olivé-Gadea M, Muchada M, García-Tornel Á, Deck M, Juega J, *et al.* COVID-19 and stroke: Incidence and etiological description in a high-volume center. *J Stroke Cerebrovasc Dis* 2020;29:105225.
- Dulipsingh L, Ibrahim D, Schaefer EJ, Crowell R, Diffenderfer MR, Williams K, *et al.* SARS-CoV-2 serology and virology trends in donors and recipients of convalescent plasma. *Transfus Apher Sci* 2020;59:102922.
- Uthman IW, Gharavi AE. Viral infections and antiphospholipid antibodies. *Semin Arthritis Rheum* 2002;31:256-63.
- Zhang Y, Xiao M, Zhang S, Xia P, Cao W, Jiang W, *et al.* Coagulopathy and antiphospholipid antibodies in patients with Covid-19. *N Engl J Med* 2020;382:e38.
- Parodi A, Gasparini G, Cozzani E. Could antiphospholipid antibodies contribute to coagulopathy in COVID-19? *J Am Acad Dermatol* 2020;83:e249.
- Maria ATJ, Diaz-Cau I, Benejean JM, Nutz A, Schiffmann A, Biron-Andreani C, *et al.* Flare of antiphospholipid syndrome in the course of COVID-19. *TH Open* 2020;4:e207-10.
- Fan S, Xiao M, Han F, Xia P, Bai X, Chen H, *et al.* Neurological manifestations in critically ill patients with COVID-19: A retrospective study. *Front Neurol* 2020;11:806.
- Guo T, Fan Y, Chen M, Wu X, Zhang L, He T, *et al.* Cardiovascular implications of fatal outcomes of patients with coronavirus disease 2019 (COVID-19). *JAMA Cardiol* 2020;5:811-8.