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Case Report
Cerebral venous sinus thrombosis sequel of COVID encephalitis; a rare presentation

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1. Introduction
Coronavirus disease 2019 (COVID-19) is a disease with a significantly broad spectrum of presentation and clinical syndromes. This novel infectious disease has been associated with acute respiratory distress syndrome (ARDS), thromboembolic syndrome, severe metabolic syndromes, severe acute tubular necrosis, electrolyte abnormalities, neurologic syndromes and cardiac events, including myocarditis and arrhythmias. COVID-19 possesses neuroinvasive potentials, which makes the central nervous system (CNS) an important target.

Cerebral venous sinus thrombosis (CVST) is an uncommon condition and can occur as a result of various genetic or acquired risk factors. Infections are one of the most important etiological factors in development of cerebral venous sinus thrombosis. Neurological manifestation of COVID-19, encephalitis and thrombotic event CVST have been progressively appreciated.

2. Case report
A 30 years old gentleman presented with history of acute delirium and on arrival developed generalized tonic-clonic seizures. He had history of body aches and fever one week prior to presentation. There was no history of hypertension, diabetes mellitus or drug intoxication.

His presenting GCS was 12/15 (E3, M5, V3). On examination he was afebrile, there were no signs of meningeal irritation. There was no focal deficit and cranial nerve examination was also unremarkable.

The SARS Covid-19 pneumonia became a pandemic in 2019 affecting millions worldwide and carried a significant high mortality rate. The common presentation of this novel virus is upper and lower respiratory tract infection. However, its popularity as neuropathogen has increased dramatically. Patient presents a wide range of symptoms. We report a case of Covid-19 encephalitis which was incidentally found to have cerebral venous sinus thrombosis, presented with acute delirium and then developed new onset seizures.

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3. Discussion

With the progression of COVID-19, reports of neurological manifestations are increasing. These manifestations can be associated as direct effects of the virus on the nervous system, parainfectious or post-infectious immune-mediated disease, and neurological complications of the systemic effects of COVID-19. Over a 3-weeks period, 39 (31%) patients had altered mental status, which included 16 (13%) with encephalopathy (of whom seven [6%] had encephalitis), and 23 (18%) with a neuropsychiatric diagnosis, including ten (8%) with psychosis, six (5%) with neurocognitive (dementia-like) syndrome, and four (3%) with an affective disorder. Notably, 77 (62%) patients had a cerebrovascular event: 57 (46%) ischemic strokes, nine (7%) intracerebral hemorrhages, and one (<1%) CNS vasculitis, and ten (8%) other cerebrovascular events are seen in one registry.5

The main concern for SARS-CoV-2 infection concern the routes of entry into the nervous system and the relative contribution of viral infection versus host response to the subsequent damage as with other neurotropic viruses.

One possible mechanism is viral entry to the brain through the olfactory bulb—the only part of the CNS not protected by Dura—could be one conceivable route for SARS-CoV-2, especially given the anosmia in COVID-19.4 This entry route is thought to be used by the herpes simplex virus, the most common cause of sporadic viral encephalitis.2

Alternative entry routes include carriage across the blood–brain barrier, following viraemia, or through infected leukocytes.8 The angiotensin converting enzyme 2 receptor, to which SARS-CoV-2 binds for entry into cells,9 is found in brain vascular endothelium and smooth muscle.10 SARS-CoV-2 replicates in neuronal cells in vitro.11 One proposed criterion for diagnosis of encephalitis is given in (Table 1) according to which our patient falls in probable criteria.

The treatment of COVID-19-related encephalitis is mainly supportive. A variety of treatments, including high-dose IV steroids, IV immunoglobulin, and immunomodulators (e.g., rituximab), have been tried in various cases, with somewhat limited outcomes.17

CVST is an uncommon condition. There are several cases reported in literature of CVST and COVID 19.

It has several risk factors including genetic and acquired. CVST has a favorable prognosis if diagnosed and treated early. SARS-CoV-2 is known to produce a thrombophilic state. Early indicators suggest that cerebrovascular disease in COVID-19 might be due to a coagulopathy. SARS-CoV-2 can cause damage to endothelial cells, activating inflammatory and thrombotic pathways.9 Endothelial cell infection or monocyte activation, up regulation of tissue factors, and the release of micro particles, which activate the thrombotic pathway and cause microangiopathy, might occur for SARS-CoV-2 as for other viruses.12,13 Monocyte activation is postulated to constitute part of the secondary haem phagocytic lymphohistiocytosis described in severe COVID-19.14 Thrombocytopenia with elevated D-dimer and C-reactive protein in severe COVID-19 and stroke are consistent with a virus-associated micro angiopathic process.15 Endothelial dysfunction can potentially lead to

![Fig. 1. Comparison of T1 with and without contrast images showing bilateral transverse filling defect.](image)

![Fig. 2. Sagital T1 with contrast showing thrombosis in superior sagittal sinus.](image)
Table 1
SARS-CoV-2 meningitis, encephalitis, myelitis, or CNS vasculitis.18

| Tests                          | Patient’s results | Normal value |
|-------------------------------|-------------------|--------------|
| Lupus anticoagulant (LA1)     | 46                | 35–53 s      |
| Antithrombin-III              | 80                | 75–125% activity |
| Factor V Leiden               | 1.1               | >0.80        |
| ProC Normalise Ratio          | 1.5               | >0.80        |
| PCAT                          | 141.0             | 85–200 s     |
| PCAT/O                        | 43.0              | 35–55 s      |
| Anti Cardiolipin Antibodies IgG| 2                 | <10 GPL-U/mL |
| Anti Cardiolipin Antibodies IgM| 1                 | <7 GPL-U/mL  |

Biomedical Research involving human subjects. Any change in the protocol be notified to the committee prior to approval. All the informed consents should be retained for future reference.

Consent for publication

Patient consented for the study and publication.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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