



Alexia without agraphia in an elderly man due to stroke secondary to COVID-19 infection

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Introduction

Infection with coronavirus disease 2019 (COVID-19) has been associated with several neurologic manifestations with headache and anosmia being the most common symptoms [1]. Less common manifestations include seizures, stroke, Guillain Barre syndrome, encephalopathy, posterior reversible encephalopathy syndrome and cerebral sinus venous thrombosis have also been reported [1]. Moreover, complications from such manifestations are of great concern. Herein, we describe a patient with COVID-19 infection who developed difficulty in reading with preserved writing following arterial and venous stroke.

Case presentation

A 61-year-old right handed man, with ten years of education, diagnosed with diabetes and hypertension presented with one week history of COVID-19 infection associated with sudden onset clumsy vision within his right visual hemifield and difficulty in reading sentences and words. However, he was able to read only individual letters and had no difficulty in writing. A comprehensive neurologic examination revealed presence of right homonymous hemianopia with normal visual acuity, clumsiness of right upper limb, impaired reading with preserved writing skills and cognition. All other sensorimotor functions were intact. Routine safety laboratory results including hemogram, serum electrolytes, liver and renal function tests were normal. His

brain magnetic resonance imaging (MRI) demonstrated left occipito-temporal ischaemic stroke with involvement of splenium of corpus callosum and left thalamus (Fig. 1A). MR angiography showed occlusion of P3/P4 segment of left posterior cerebral artery (Fig. 1B) along with restricted diffusion in the left occipito-temporal region (Fig. 1C). Magnetic resonance venography (MRV) showed occlusion of left transverse and sigmoid sinus suggestive of cerebral venous sinus thrombosis (CVT) (Fig. 1D, E). His SARS-CoV-2 PCR test was positive. D-dimer and fibrinogen levels were elevated. Laboratory investigations including homocysteine, antinuclear antibody profile, protein C, S, antiphospholipid antibodies and antithrombin III were negative. The patient was treated with antiplatelets, anticoagulants and neurorehabilitation in form of cognitive behaviour therapy.

Discussion

To the best of our knowledge, this is the first reported case of COVID-19 related arterial and venous stroke in an elderly man presenting with alexia without agraphia. Patient had alexia without agraphia, due to involvement of dominant medial occipito-temporal gyrus (also known as the visual word form area) and the splenium of corpus callosum. Most cases are caused by left posterior cerebral artery occlusion resulting in infarction of left occipital lobe extending to splenium of corpus callosum.

Dejerine described the first case in 1892, a patient who was able to write but unable to read the self-written script. Involvement of splenium disrupts the connection between intact right visual cortex with the left angular gyrus, as a result words perceived in the right visual cortex cannot cross over to the language areas and the patient cannot read [2]. Patient's reading difficulty cannot be attributed to hemianopia, because he was able to compensate for the deficits. The preserved writing ability is due to intact left angular gyrus, which obtains its supply from middle cerebral artery

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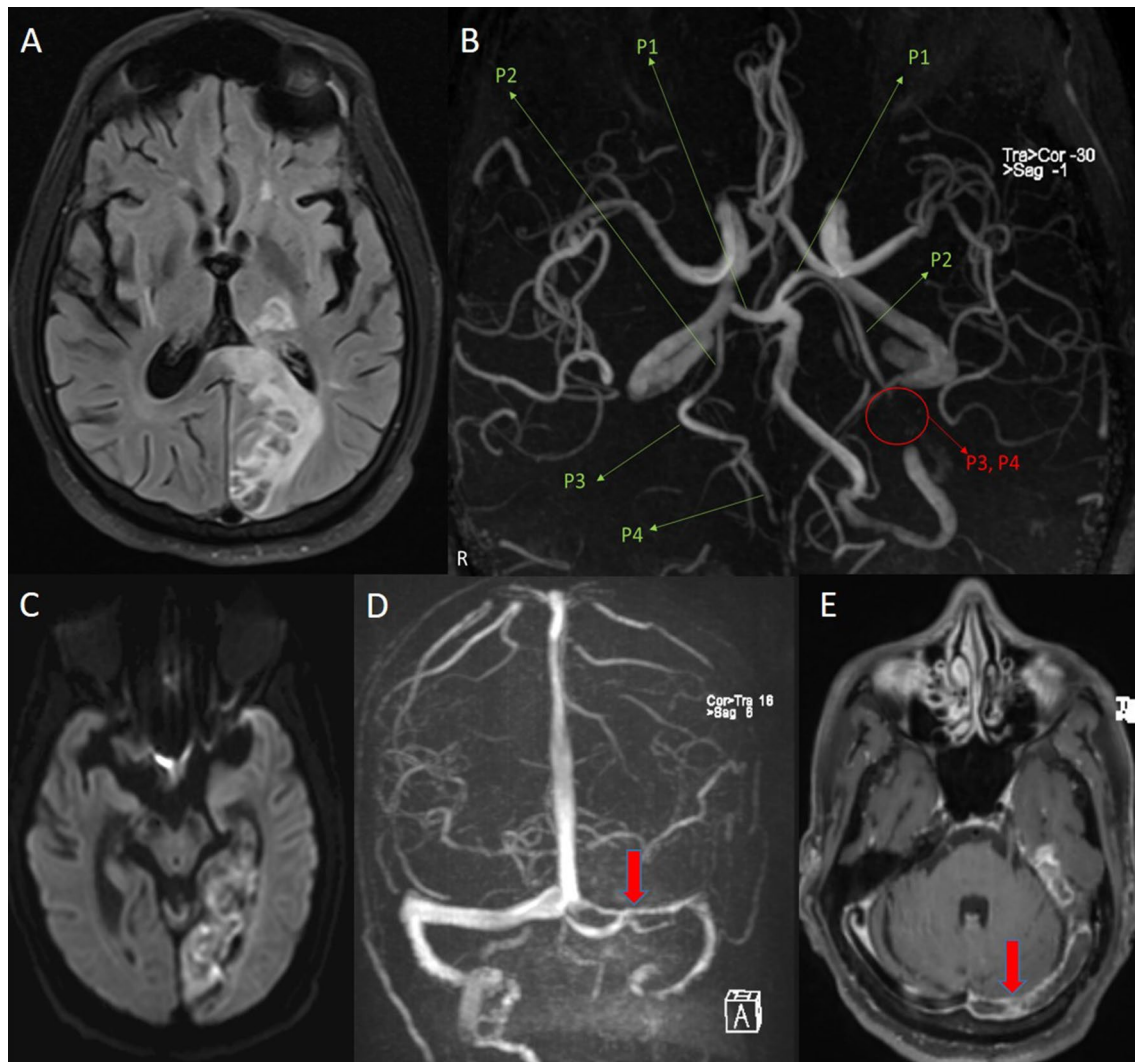


Fig. 1 Posterior cerebral artery stroke and transverse sinus venous thrombosis in a post-COVID-19 affected patient. **A** Brain MRI axial FLAIR sequence depicts left occipito-temporal hypertense lesion extending to splenium of corpus callosum and left thalamus. **B** MRA shows absent left P3 and P4 (red encircled area with red arrow) segment of posterior cerebral artery compared to normal P3 and P4 on

the right side (green arrows). **C** Diffusion weighted image (DWI) showing restricted diffusion in the left occipito-temporal region. **D**, **E** MRV and contrast imaging depicting long segment intraluminal thrombus in left transverse and sigmoid sinus suggestive of cerebral venous sinus thrombosis (CVT) (red thick arrows) (Color figure online)

and does not depend on the intactness of the splenium of corpus callosum. Such deficits should be localised at the processing level before the input orthographic lexicon and the grapheme-to-phoneme conversion mechanism. [2]

Given the current pandemic, COVID-19 infection has been associated with 7.6 fold increased risk of stroke. SARS-CoV-2 virus is well known to bind angiotensin-converting enzyme (ACE)-2 receptors, which are invariably present in the arterial and less frequently in the venous vascular endothelium. Other mechanisms include a hypercoagulable state from systemic inflammation and cytokine storm, postinfectious immune-mediated responses and direct viral-induced endotheliopathy, potentially affecting haemostasis

and the coagulation cascade leading to angiopathic thrombosis [3]. Similarly, cerebral venous sinus thrombosis (CVST) is an unrecognized rare complication of COVID-19 infection with wide range of presentations, thus making imaging studies crucial in diagnosis [4]. These findings may suggest a common mechanism for COVID-19-associated arterial stroke and cerebral venous sinus thrombosis as seen in our patient. Priftis et al., reported a patient who had alexia without agraphia secondary to ischaemic stroke involving left occipito-temporal region and diagnosed to have COVID-19 infection [5]. Both arterial and venous strokes have been reported independently, presenting either as large artery occlusions or as cerebral venous sinus thrombosis [6, 7].

There have only been two previous reports of simultaneous arterial and venous stroke [8, 9]. The sigmoid sinus, transverse sinus, and jugular vein along with middle cerebral artery were all involved in these patients. However, in our patient left posterior cerebral artery, transverse and sigmoid sinus were all involved simultaneously, which has not been reported previously.

Regardless of the aetiology, this case highlights the importance of a high index of suspicion for a pro-coagulable state in patients with COVID-19 infection. Early diagnosis, treatment of the underlying cause and neurorehabilitation will help in management, avoiding further episodes of stroke and may lead to improved outcomes.

Declarations

Conflict of interest The authors declare no competing interests.

Consent to participate Informed consent was obtained from participant included in the study.

References

- Whittaker A, Anson M, Harky A (2020) Neurological manifestations of COVID-19: a systematic review and current update. *Acta Neurol Scand* 142(1):14–22
- Mani J, Diehl B, Piao Z et al (2008) Evidence for a basal temporal visual language center: cortical stimulation producing pure alexia. *Neurology* 71(20):1621–1627
- Zhang S, Zhang J, Wang C et al (2021) COVID 19 and ischemic stroke: mechanisms of hypercoagulability (Review). *Int J Mol Med* 47(3):21
- Dakay K, Cooper J, Bloomfield J et al (2021) Cerebral venous sinus thrombosis in COVID-19 Infection: a case series and review of the literature. *J Stroke Cerebrovasc Dis* 30(1):105434
- Priftis K, Prior M, Meneghetti L, Mercogliano T, Bendini M (2021) Alexia without agraphia in a post COVID-19 patient with left-hemisphere ischemic stroke. *Neurol Sci* 42(6):2179–2181
- Oxley TJ, Mocco J, Majidi S, Kellner CP, Shoirah H, Singh IP, De Leacy RA, Shigematsu T, Ladner TR, Yaeger KA, Skliut M (2020) Large-vessel stroke as a presenting feature of Covid-19 in the young. *N Engl J Med* 382(20):e60
- Kananeh MF, Thomas T, Sharma K, Herpich F, Urtecho J, Athar MK, Jabbour P, Shah SO (2020) Arterial and venous strokes in the setting of COVID-19. *J Clin Neurosci* 1(79):60–66
- Bermúdez S, Forero PA, Salej V, González S, Toro J (2021) Simultaneous Arterial and Venous Brain Infarctions in a Patient with COVID-19: Case Report. *SN Compr Clin Med* 3(12):2622–2625
- Malentacchi M, Gned D, Angelino V, Demichelis S, Perboni A, Veltri A, Bertolotto A, Capobianco M (2020) Concomitant brain arterial and venous thrombosis in a COVID-19 patient. *Eur J Neurol*. <https://doi.org/10.1111/ene.14380>

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