

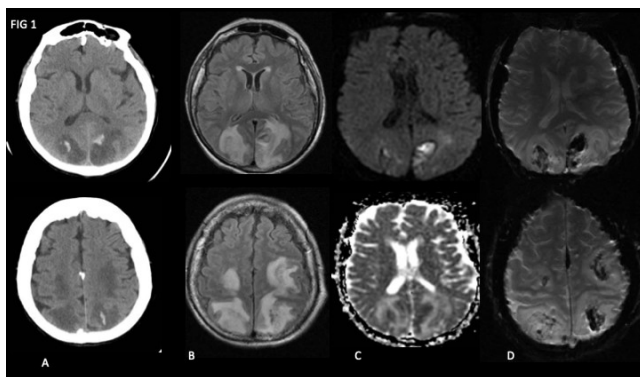
# Hemorrhagic PRES: an unusual neurologic manifestation in two COVID-19 patients

PRES hemorrágica: uma manifestação neurológica incomum em dois pacientes com COVID-19

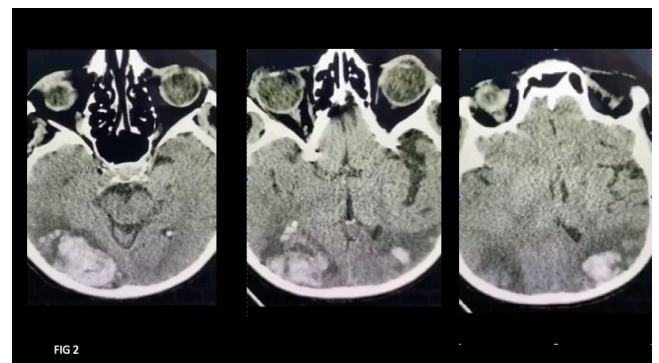
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Two patients with confirmed COVID-19 infection both manifesting with typical computerized tomography (CT) lung findings (less than 50% of lung parenchyma affected by ground-glass opacities) presented sudden altered mental status. By the time of neurologic deterioration, despite

improved respiratory parameters, they were still in an intensive care unit under mechanical ventilation. Both patients had parieto-occipital cortico-subcortical hypodensities with associated acute hemorrhage foci on brain CT (Figures 1 and 2). Brain magnetic resonance imaging (MRI) was additionally obtained in one of those subjects, confirming areas of vasogenic edema and hemorrhage (Figure 1). Such findings are compatible with atypical posterior reversible encephalopathy syndrome (PRES), complicated by hemorrhage. Angiographic studies (magnetic resonance angiography — MRA — for one patient and CT angiography — CTA — for the other) excluded venous thrombosis.



**Figure 1.** Patient 1: A — Non-contrast head computerized tomography revealing bilateral parieto-occipital subcortical hypodensities suggestive of vasogenic edema associated with bilateral hemorrhages in the same regions, findings compatible with hemorrhagic posterior reversible encephalopathy syndrome. B — Axial fluid-attenuated inversion recovery magnetic resonance imaging showing extensive bilateral parieto-occipital vasogenic edema; C — Diffusion weighted imaging and apparent diffusion coefficient map demonstrating restriction in some areas, probably due to the presence of blood products; D — Susceptibility weighted imaging showing areas of intense low signal, consistent with blood products. Magnetic resonance angiography (not shown) was normal.



**Figure 2.** Patient 2: Non-contrast head computerized tomography showing bilateral massive subcortical intra-parenchymal acute hematomas surrounded by edema. Computerized tomography angiography (not shown) was normal.

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Critically-ill patients with COVID-19 have an extreme inflammatory reaction, causing a cytokine storm syndrome that may damage the blood-brain barrier and complicate

with PRES<sup>1</sup>. The associated hemorrhage seen in our patients may also be explained by coagulation impairment, another common complication reported in COVID-19 patients<sup>2</sup>.

## References

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1. Mehta P, McAuley DF, Brown M, Sanchez E, Tattersall RS, Manson JJ; HLH Across Specialty Collaboration, UK. COVID-19: consider cytokine storm syndromes and immunosuppression. *Lancet*. 2020 Mar;395(10229):1033-4. [https://doi.org/10.1016/S0140-6736\(20\)30628-0](https://doi.org/10.1016/S0140-6736(20)30628-0)
2. Franceschi AM, Ahmed O, Giliberto L, Castillo M. Hemorrhagic Posterior Reversible encephalopathy syndrome as a manifestation of COVID-19 infection. *AJNR Am J Neuroradiol*. 2020 Jul;41(7):1173-6. <https://doi.org/10.3174/ajnr.A6595>