Neurologic and neuroimaging findings in patients with COVID-19
A retrospective multicenter study

Stéphane Kremer, MD, PhD, François Lerisy, MD, Mathieu Anheim, MD, PhD, et al.

Cite as: Neurology® 2020;95:e1868-e1882. doi:10.1212/WNL.0000000000010112

Study question
What are the major neuroimaging findings and clinical and epidemiologic characteristics of patients with coronavirus disease 2019 (COVID-19) who have neurologic manifestations?

What is known and what this paper adds
Several studies have described neurologic manifestations in patients with COVID-19, but few have examined neuroimaging findings. This investigation shows that patients with neurologic manifestations frequently have brain MRI abnormalities.

Methods
This retrospective, observational study included 64 adults with COVID-19 (confirmed by positive nasopharyngeal/throat swabs) (67% male; median age, 66 years; range, 20–92 years) who had neurologic manifestations and received treatment in 11 French centers between March 16 and April 9 of 2020. The investigators extracted clinical data from electronic medical records. The patients underwent brain MRI scans with 1.5T or 3T machines (41 patients underwent gadolinium-enhanced MRI), and 2 blinded neuroradiologists reviewed the MRI scans to detect 3 types of abnormalities: ischemic stroke (IS), encephalitis, and leptomeningeal enhancement (LME). Categorical data were compared using Fisher exact test; quantitative data were compared using analysis of variance.

Results and study limitations
The neuroradiologists observed MRI abnormalities in 36 patients (56%), with 17 patients (27%) having IS, 11 patients (17%) having LME, and 8 patients (13%) having encephalitis. The most common neurologic manifestations were confusion (53%), impaired consciousness (39%), signs of corticospinal tract (CST) involvement (31%), agitation (31%), and headache (16%). Compared with patients who had encephalitis or LME, the patients with IS were less likely to have acute respiratory distress syndrome (18% vs 75% and 73%; \( p = 0.006 \)), but more likely to have signs of CST involvement (59% vs 13% and 31%; \( p = 0.02 \)). Compared with patients who had IS or LME, the patients with encephalitis were younger (mean 61 vs 74 years and 66 years; \( p = 0.007 \)). Compared with patients who had IS or encephalitis, the patients with LME were more likely to have agitation (64% vs 6% and 38%; \( p = 0.009 \)). The present study’s limitations include non-standardized and heterogenous MRI protocols, the lack of a follow-up MRI, and the lack of a general neurologic population as a control group.

Study funding and competing interests
This study received no funding. The authors report no competing interests. Go to Neurology.org/N for full disclosures.

Figure Radiologic ADEM

Man aged 60 years: White matter FLAIR hyperintensities (arrow heads), without contrast enhancement (arrows) corresponding to cytotoxic (stars) or vasogenic edema.