MR Imaging of the Olfactory Bulbs in Patients with COVID-19 and Anosmia: How to Avoid Misinterpretation

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We recently read the article entitled "Brain Imaging of Patients with COVID-19: Findings at an Academic Institution during the Height of the Outbreak in New York City," a retrospective neuroimaging cohort by Lin et al.[1] The authors reported T2-FLAIR postgadolinium olfactory bulb (OB) signal abnormalities in 4 patients positive for coronavirus disease 2019 (COVID-19) with only 1 having documented anosmia. This finding was subsequently interpreted as olfactive neuritis and a correlate of the anosmia.

Anosmia has been identified as one of the first or only recognizable symptoms of the Severe Acute Respiratory Syndrome coronavirus 2 (SARS-CoV-2) infection, accounting for >50% of Western patients.[2] It is now known that post-SARS-CoV-1 anosmia could persist for as long as 2 years. It, thus, becomes relevant to identify MR imaging biomarkers of OB involvement, including signal and volume changes, that might be predictive of the olfactory disorder outcome. We, thus, find it important to draw the attention to the OB signal and volume analysis.

The OB signal intensity can vary according to the field strength applied, the MR imaging manufacturer, and the acquisition parameters of T2-FLAIR sequences. Furthermore, it has previously been reported that OBs could appear hyperintense on T2-FLAIR in healthy subjects.[3] Lin et al[1] reported that they recruited patients who had undergone brain MR imaging from 3 different machines (1.5T and 3T), increasing the risk of signal variation in tiny structures and thus making the results more questionable.

Age- and sex-matched healthy controls scanned on the same MR imaging scanner need to be analyzed to overcome these technical issues and avoid an incorrect OB edema/gadolinium-enhancement description. In our institution, a blind, independent comparison by 2 experienced neuroradiologists of 10 patients with COVID-19–associated anosmia and 10 age- and sex-matched subjects negative for COVID-19 without olfactory dysfunction was performed. It showed that visual analysis of OB high-resolution T2-FLAIR signal could not distinguish the 2 groups because all the subjects presented with the same T2-FLAIR high signal intensity (Fig 1).

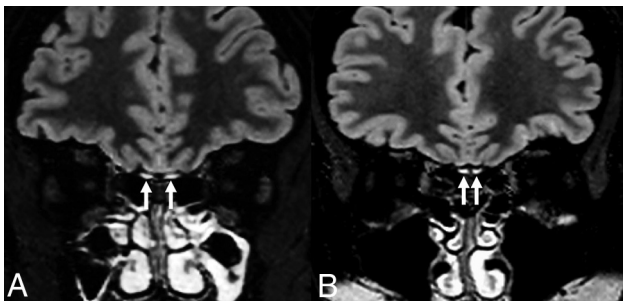

FIG 1. 3T brain MR imaging in a healthy subject (*A*) and a patient with COVID-19–related anosmia (*B*). Coronal reformatted 3D FLAIR images show OB hyperintensity (*arrows*) compared with the cortex in both subjects.

Thus, the OBs described by Lin et al[1] as being abnormally "hyperintense" can probably correspond to a normal signal intensity.

It has been shown that the OB volume decreased in postinfectious anosmia.[4] Because the OBs are tiny structures surrounded by CSF, sequences with high resolution such as CISS should be used for volume segmentation. As for the signal on an individual scale, the signal intensity evolution of the OB could be compared with the surrounding structures, such as the cortex or the optic nerves. Subjective appreciation, especially for such a small structure, could lead to misinterpretation.

In summary, OB imaging is challenging, and one should be careful while interpreting its signal and volume, especially in the context of COVID-19.

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