Brain scans of people with MS can help us understand the effects of COVID

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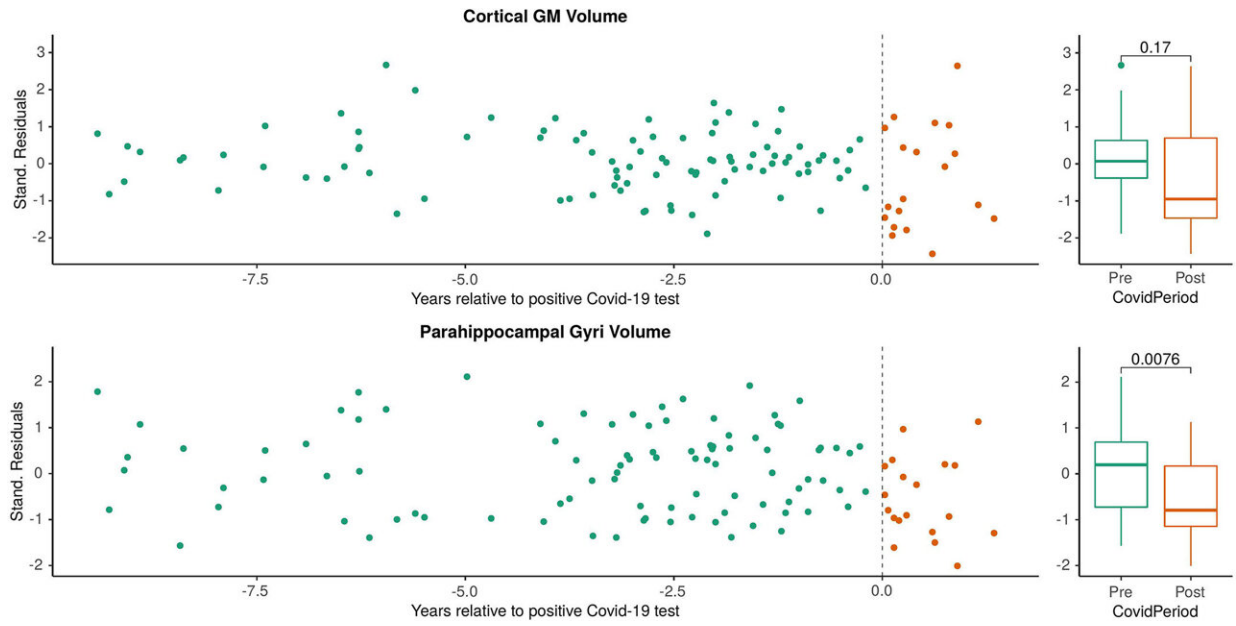

An increased atrophy rate of the parahippocampal gyri after SARS-CoV-2 infection using FreeSurfer for atrophy analysis. Longitudinal atrophy rates for individual patients are depicted in Figure S3. Analogous results from the DL+DiReCT software are presented in Figure S4. Abbreviations: COVID-19: Corona Virus Disease 2019; GM: gray matter; SARS-CoV-2: severe acute respiratory syndrome coronavirus type 2; Stand.: standardized. Credit: *CNS Neuroscience & Therapeutics* (2022). DOI: 10.1111/cns.14050

People affected by multiple sclerosis need to undergo regular MRI brain scans. The images are now being used to visualize the effects of a

coronavirus infection.

Brain fog, memory problems, loss of the sense of smell—COVID-19 affects the brain in a number of ways, yet the mechanisms behind this remain largely unknown. This is because disease-related changes in our brains are almost impossible to detect if no comparable data are available for the affected persons prior to a SARS-CoV-2 infection.

However, there is one group whose brains are exceptionally well documented prior to infection: people with multiple sclerosis (MS) generally have their brains checked with an MRI scan at least once a year to monitor the progression of the disease and the side effects of their medication. This vast volume of imaging data offers a unique opportunity for us to understand the effects that a COVID-19 infection can have on the brain structure—according to researchers at the University of Bern and the Inselspital hospital in Bern.

"The large number of scans enables us to compare a person's brain before and after a COVID-19 infection," says biomedical engineer Michael Rebsamen, a Ph.D. student at the University Institute for Diagnostic and Interventional Neuroradiology in Bern. According to Rebsamen, this kind of longitudinal study of individuals is potentially far more useful than previous studies that compared MRI images of groups of healthy people to those of COVID-19 patients.

Shrinkage in the cortex

To assess the feasibility of this type of analysis, the researchers conducted a small-scale study: thus far, they have evaluated 113 MRI brain scan images for 14 MS patients at the Inselspital in Bern who have had a SARS-CoV-2 infection. For the study, the researchers selected people whose MS condition remained stable during the relevant time period—this meant that any changes detected in the brain should not

have been caused by a multiple sclerosis relapse. For the analysis, the researchers measured the volume of different brain regions over the course of several years right up to and then a few months after a COVID-19 infection.

The analysis showed that the gray matter volume remained constant overall. But one particular cortical region, the parahippocampal gyrus, was found to be statistically smaller following a COVID-19 infection. This regional change had little impact on the overall volume owing to its small size. The result matches the findings of one of the cross-sectional studies from the U.K. mentioned above.

As the parahippocampal gyrus region of the brain is associated with smell and memory (among other functions), there is a hypothetical link to the sense of smell and memory losses commonly associated with a COVID-19 infection. The mechanism by which the SARS-CoV-2 virus leads to these changes is the subject of ongoing research.

Vast volume of imaging data worldwide

It goes without saying that the preliminary study with its small number of participants does not yet provide a sufficient basis for drawing definite conclusions. "But worldwide there is a vast volume of imaging data for MS patients," says Rebsamen. Analyzing this material could make it possible to look much more specifically at the causal links—to assess, for example, whether the severity of a COVID-19 infection makes a difference. Or whether the same changes to the brain structure occur in vaccinated and unvaccinated people.

"The big question is also whether the changes that have been measured are reversible or if they persist," says Rebsamen. "Our focus was on the first few months after infection." A longer period of observation in a larger study could show what occurs in the brain during long

COVID—as this is often associated with a negative impact on cognitive functions.

With their preliminary study, the Bern-based team have already proven that their approach works in principle. "We are now calling on MS research groups around the world to analyze their patients' scans using this method." The researchers will provide the specially developed software package free of charge.

The study is published in the journal *CNS Neuroscience & Therapeutics*.

More information: Michael Rebsamen et al, Multiple sclerosis as a model to investigate SARS-CoV -2 effect on brain atrophy, *CNS Neuroscience & Therapeutics* (2022). DOI: 10.1111/cns.14050

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