

Neurochemical evidence of astrocytic and neuronal injury commonly found in COVID-19

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Study question

What is the extent of CNS involvement, as measured using levels of glial fibrillary acidic protein (GFAP) and neurofilament light chain (NfL) in patients with COVID-19?

What is known and what this paper adds

Case series report that CNS involvement is common in patients hospitalized with severe COVID-19. This investigation's results show that patients with moderate-to-severe COVID-19 have plasma biomarker patterns indicative of neuronal injury and glial activation.

Methods

These cross-sectional analysis uses data from 47 patients with COVID-19 (68% male; median age, 57.8 years; interquartile range [IQR], 48.0–69.5 years) and 33 age-matched controls without psychiatric or neurologic disorders (52% male; median age, 67.0 years; IQR, 42.3–77.8 years) from Sweden. The severity of COVID-19 was classified as mild (i.e., not necessitating hospitalization), moderate (i.e., necessitating hospitalization and oxygen supplementation), or severe (i.e., causing death or necessitating admission to an intensive care unit and mechanical ventilation). Real-time PCR was used to confirm the presence of SARS-CoV-2 in nasal and throat swab specimens. Single-molecule array methods were used to measure plasma levels of GFAP and NfL. Thirty-one patients provided follow-up serum samples (mean interval, 11.4 ± 5.06 days after first sampling). The primary outcome was the between-group comparison of plasma GFAP and NfL levels.

Table Group-specific plasma GFAP and NfL levels

| Group | Median plasma level (IQR) of | |
|-------------------|------------------------------|------------------|
| | GFAP, pg/mL | NfL, pg/mL |
| Controls | 141 (108–207) | 13.1 (9.4–21.0) |
| Mild COVID-19 | 90.5 (53.5–139) | 9.5 (5.1–12.2) |
| Moderate COVID-19 | 204 (158–341) | 19.3 (12.1–22.6) |
| Severe COVID-19 | 206 (106–308) | 32.7 (19.3–56.3) |

Results and study limitations

Relative to the controls, the patients with severe COVID-19 (n = 18) had elevated plasma levels of GFAP and NfL while the patients with moderate COVID-19 (n = 9) had elevated plasma GFAP levels. In the patients with severe COVID-19, the GFAP levels peaked early and then decreased, but NfL levels remained elevated. The present study's limitations include the lack of thorough neurologic and cognitive assessments and the inability to fully account for potential confounders, such as vascular risk factors.

Study funding and competing interests

This study was funded by the Swedish government and the Wallenberg Scholars program. Some authors report additional competing interests. Go to [Neurology.org/N](https://www.neurology.org/N) for full disclosures.

A draft of the short-form article was written by M. Dalefield, a writer with Editage, a division of Cactus Communications. The corresponding author(s) of the full-length article and the journal editors edited and approved the final version.

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