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NEWS

Cerebral Microstructural Alterations in Post-covid-Condition Are Related to Cognitive Impairment, Olfactory Dysfunction and Fatigue

PURPOSE

In the aftermath of the Corona Virus Disease 2019 (COVID-19), approximately 10-25% of patients developed a “Post-COVID-condition” (PCC) which is characterized, among other symptoms, by neurocognitive deficits, disturbed olfaction and fatigue. However, the pathophysiological basis of this condition is poorly understood. Diffusion microstructure imaging (DMI) is a promising approach to fill this gap, as it detects even small volume shifts between microstructural compartments of a neural tissue model.

METHODS AND MATERIALS

Prospective cross-sectional study of n=89 patients with PCC who received DMI. DMI parameters were read for the whole gray matter and tested for association with clinical data. To reveal the spatial distribution of microstructural alterations, we carried out voxel-wise group comparisons with threshold-free cluster enhancement and FWE-correction after adjustment for age and sex.

RESULTS

Due to PCC-symptoms, 53% of patients could not return to the previous level of independence/employment. The cognitive performance measured by the MoCA-test was impaired in 41% (26, IQR [4] points, < 26/30 is cut-off value). The olfactory performance was impaired in 73% (9, IQR [4] items identified, < 11/12 is cut-off value). The WEIMuS questionnaire indicated fatigue in 78% (43, IQR [17] points, > 33/68 is cut-off value). PCC patients were compared to matched healthy controls (healthy non-COVID, HNC; n = 47) and controls that passed COVID-19 without developing a PCC (unimpaired post-COVID, UPC; n = 38). Analysis of whole-brain DMI-data revealed a volume-shift from the extraneurite compartment (V-extra) into the free water fraction (V-CSF) for the gray matter that was positively associated with the severity of initial COVID-19 infection (P = 0.004). To further determine microstructural correlates of PCC-associated symptoms after COVID-19, voxel-based associations of V-extra with clinical scores were performed. Here, symptom-specific networks emerged that were significantly correlated with impaired MoCA- or olfactory-performance and fatigue.

CONCLUSIONS

In summary, DMI revealed long-lasting microstructural changes after COVID-19 infection with different patterns in patients with and without PCC. Expression of PCC-symptoms was associated with affection of specific cerebral networks, suggesting a pathophysiological basis of this syndrome.

CLINICAL RELEVANCE/APPLICATIONS

Due to the high prevalence of PCC, our findings are of high relevance as they allow for an insight into the pathophysiology of neurological symptoms.