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Review of Human Coronaviruses and Other Respiratory Viruses and their Neurological Impact on the Central Nervous System

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Comprehensive reporting shows that some pathogens, including COVID-19, influenza A and SARS-CoV have sometimes caused pandemics and were linked to more serious diseases and death. A number of respiratory viruses can travel from the respiratory tract to the central nervous system, causing alterations and damage and resulting in long-term neurological diseases.⁵

Through researching human brain autopsy samples, researchers have found neuroinvasion by coronaviruses and their link to multiple sclerosis.² In one study, electron microscopy revealed particles closely resembling coronaviruses in the brain tissue of a MS patient.⁹ Research into coronavirus found in the brains of multiple sclerosis patients indicates that such viruses should be considered a potential cause of multiple sclerosis.⁴ Inflammatory molecules that have been linked to MS could have originated from infection of glial cells by coronaviruses.⁶

A February 2020 case of a man in Wuhan, China who suffered from COVID-19 resulted in another associated neurological problem, rhabdomyolysis, a life-threatening disorder that can be characterized by muscle pain and fatigue.⁷ Before being diagnosed through a throat swab, the patient was running a high fever and coughing, and a chest CT scan showed that texture of the lungs was shattered with ground glass shadows and thickened. Days later the lower limbs of the patient felt weak and painful. Subsequent laboratory exams and urinalysis indicated early stages of rhabdomyolysis.⁷

Encephalitis, a potentially fatal neurologic syndrome that manifests as brain inflammation, can also be linked to coronaviruses: a case study explains the presence of the virus in the brain of a patient with viral encephalitis symptoms.⁸ Additionally, human coronavirus has also been detected in cerebrospinal fluid of someone with acute disseminated encephalomyelitis.¹⁰

Human coronaviruses were also found to impact astrocytes, neuroblast and neuroglial cells among other cells of the nervous system.¹

A hurdle in dealing with such infections is pinpointing the root of the CNS infection.⁵ Since symptoms can vary and the infections can stem from a countless number of viruses, positively identifying the cause can be challenging.^{5,3} Symptoms of both viral meningitis and encephalitis may include seizures.^{5,3}

Conclusion

These studies clearly show a relationship between coronaviruses and the central nervous system.

While a lot of attention at the present time is focused on the diagnosis and treatment of coronaviruses as it affects the respiratory system, more studies are needed to properly assess the effect of these viruses on the central nervous system.

References

1. Arbour, N. et al. "Acute and Persistent Infection of Human Neural Cell Lines by Human Coronavirus OC43." *Journal of Virology* vol. 73, 4, April 1999.
2. Arbour, Nathalie et al. "Neuroinvasion by Human Respiratory Coronaviruses." *Journal of Virology* vol. 74, 19 Oct. 2000.
3. Bookstaver P B et al. "Management of Viral Central Nervous System Infections: A Primer for Clinicians." *Journal of Central Nervous System Disease* 1 May 2017.
4. Burks J S, et al. "Two coronaviruses isolated from central nervous system tissue of two multiple sclerosis patients. *Science* 1980; 209: 933-934.
5. Desforges, Marc et al. "Human Coronaviruses and Other Respiratory Viruses: Underestimated Opportunistic Pathogens of the Central Nervous System?" *Viruses* vol. 12, 14. 20 Dec. 2019.
6. Edwards, Julie et al. "Activation of Glial Cells by Human Coronavirus Infection CO43 Infection." *Journal of Neuroimmunology* vol. 108, 1-2. 1 Aug. 2000.
7. Jin, Min and Qiaoxia Tong. "Rhabdomyolysis as Potential Late Complication Associated with COVID-19." *Emerging Infectious Diseases* vol. 26, 7. 2020.
8. Morfopoulou, Sofia et al. "Human Coronavirus OC43 Associated with Fatal Encephalitis." *The New England Journal of Medicine* 2016. 375: 497-498.
9. Tanaka, R et al. "Intracisternal virus-like particles in brain of a multiple sclerosis patient. *Journal of the Neurological Sciences* vol. 28, 1. 28 May 1976. 121-126.
10. Yeh, E. Ann et al. "Detection of Coronavirus in the Central Nervous System of a Child with Acute Disseminated Encephalomyelitis." *Pediatrics* vol. 113, 1. January 2004. e73-e76.