The Neurological Effects of COVID-19 on Motor Function and Performance

09/03/2020
Written by: Parinita Ezhilarasan, Undergraduate Student
Edited by: Mike Haischer, Toni Uhrich, Sandra K. Hunter, PhD

Key Points

- **COVID-19 can cause neurological symptoms that affect motor function and performance**
- **COVID-19 enters the lungs and then the brain via the blood-brain barrier and ACE-2 receptor cells, ultimately resulting in some neurological damage that can be long term**
- **Understanding and communicating how COVID-19 can affect various body systems, such as the nervous system, may encourage the public to take better precautions against COVID-19 exposure**

While the most acknowledged pathophysiology of COVID-19 is the impact that the virus has on the respiratory system[1], new research and case studies show that COVID-19 can have neurological effects both while a person is infected and after the person has "recovered" from COVID-19[2]. The virus strain enters the body primarily through the ACE-2 receptor on the surface of respiratory epithelial cells, which line the lungs and airway[1]. This receptor is also found in the glial cells in the brain and spinal cord indicating that the virus can also spread into, and act on, areas of the brain[1]. As the illness progress, the blood-brain barrier is disrupted leading the virus to directly enter the brain[1,3]. Once the virus has entered, the lack of certain virus-killing immune cells in the brain make for a very difficult and long process to remove it[3].

While it is currently unclear whether the actual strains of the virus or the hypoxia, sepsis, or multi-organ failure from the virus cause the neurological deficits, it is apparent that the majority of severe cases of COVID-19 result in some form of neurological symptoms[4]. Findings show that "one-third of patients at the time of discharge have evidence of cognitive impairment and motor deficits"[2] ranging from impaired consciousness to acute cerebrovascular disease and skeletal muscle symptoms[4]. For the more severe COVID-19 cases seen in older patients (58.2 ± 15 years) with more co-morbid conditions, about 84% showed neurological symptoms[1] indicating that as the disease becomes more severe, so does its' toll on the neurological system.

A particular cause for concern in college students and other younger individuals would be the short-term and long-term motor impairments that COVID-19 can cause[2], especially given the busy lifestyle of a college student. In addition, because college students' brains are still developing, the long term neurological effects can have an impact on brain growth[5]. By increasing awareness of how COVID-19 affects various body systems including the nervous system, health experts may be able to encourage the public to take better precautions against COVID-19 exposure.

Figure 1: COVID-19 enters the body through the ACE-2 receptor cells in the lungs (yellow box) and in the brain (blue box). Within the lungs, the virus invades cell nuclei and begins virus replication using body cell's replication proteins (Replicase). Graphic: https://www.sciencedirect.com/science/article/pii/S0889159120303573?via%3Dihub

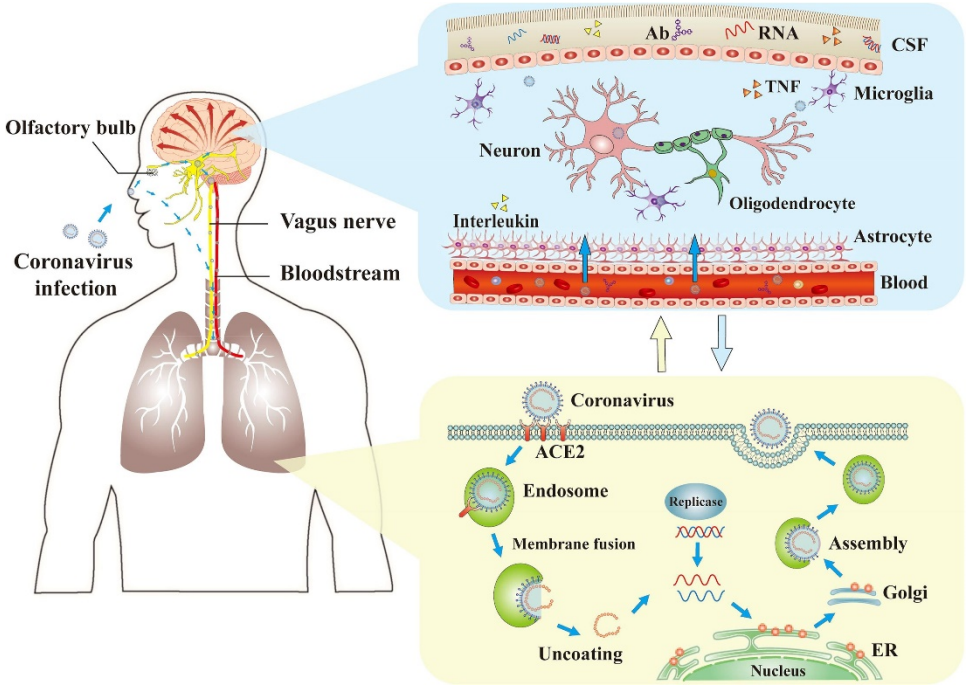
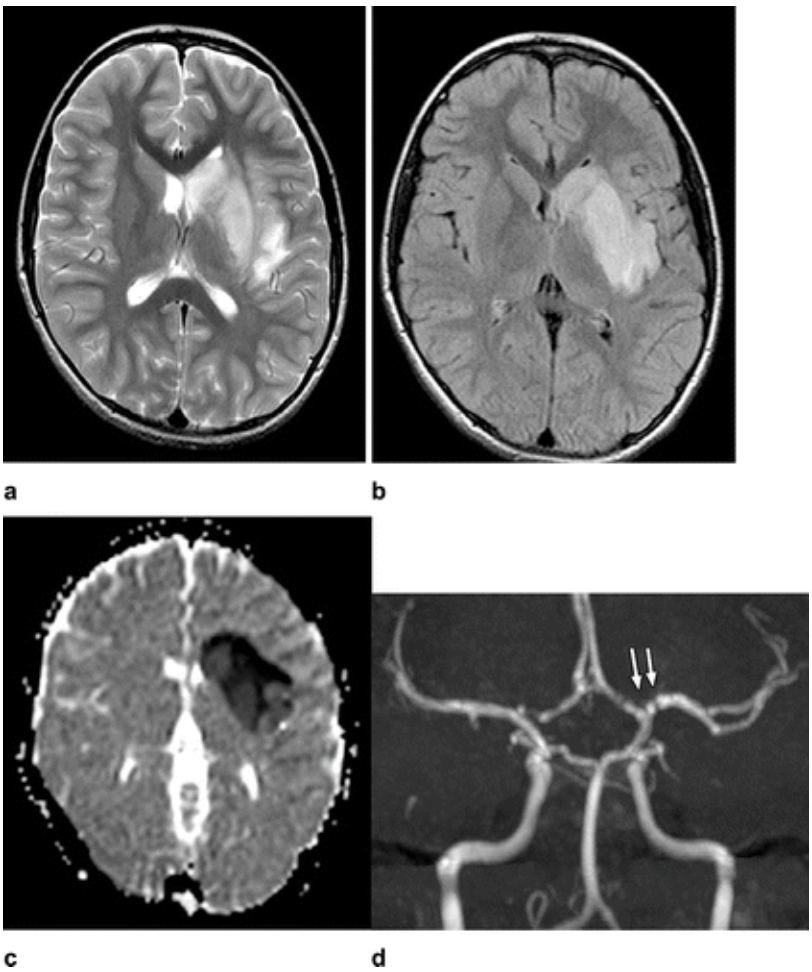


Figure 2: An MRI scan of a 12-year-old COVID-19 patient's brain. Images are of a previously healthy 12-year-old who presented with an ischemic stroke, seizure, difficulty speaking, and focal cerebral arteriopathy (FCA) as a result of COVID-19 infection. Images a, b, and c show the blood clot that lead to the stroke while image d shows the irregular shape and blood flow of the cerebral artery. Graphic: https://pubs.rsna.org/doi/10.1148/radiol.2020202197



References

1. Ahmad I, Rathore F (2020) Neurological manifestations and complications of COVID-19: A literature review. *Elsevier Public Health Emergency Collection* 8-12. DOI: 10.1016/j.jocn.2020.05.017
2. Heneka M, Golenbock D, Latz E, Morgan D, Brown R (2020) Immediate and long-term consequences of COVID-19 infections for the development of neurological disease. *Alzheimer Research and Therapy* 12:69. DOI: 10.1186/s13195-020-00640-3
3. Wu Y, Xu X, Chen Z, Duan J, Hashimoto K, Yang L, Liu C, Yang C (2020) Nervous system involvement after infection with COVID-19 and other coronaviruses. *Elsevier Public Health Emergency Collection* 18-22. DOI: 10.1016/j.bbi.2020.03.031
4. Ng Kee Kwong, K. C., Mehta, P. R., Shukla, G., & Mehta, A. R. (2020). COVID-19, SARS and MERS: A neurological perspective. *Journal of clinical neuroscience*: official journal of the Neurosurgical Society of Australasia, 77, 13–16. https://doi.org/10.1016/j.jocn.2020.04.124
5. Sumrie O, Marx W (2020). COVID-19 and children: Doctors see link between virus and neurological side effects. NBC News. https://www.nbcnews.com/health/health-news/covid-19-children-doctors-see-link-between-virus-neurological-side-n1235501