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LETTER TO THE EDITOR

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Explanation for COVID-19 infection neurological damage and reactivations

A new pathogenic virus, COVID-19, appeared in 2019, in Wuhan, China, typically causing fever, cough, diarrhoea and fatigue and significant mortality (Mao et al., 2020). From mid-January to mid-February in 2020, 214 patients with both non-severe and severe COVID-19 infections confirmed by nucleic acid tests were examined by a panel of neurologists. Seventy-eight patients (36.4%) displayed neurological symptoms, including central nervous system symptoms of dizziness, headache, impaired consciousness, acute cerebrovascular disease with either ischemic stroke or cerebral haemorrhage, ataxia, seizures; peripheral nervous system symptoms of taste impairment, smell impairment, vision impairment and nerve pain; and skeletal muscle injury (Mao et al., 2020).

The reactivation of previous COVID-19 infections after recent previously negative test results has also been reported in about 9% of a small study of patients (55 total patients with five reactivations, but the time window of reactivation observation was only 17 days long, and more reactivations could likely have been seen over a longer time period), and this and other disturbing reports of COVID-19 reactivation will likely be unwelcome and met with skepticism (Ye et al., 2020). The patients, aged 27–42 years old, who had reactivation of COVID-19 did not have any underlying diseases, such as diabetes, chronic hypertension or cardiovascular disease; and reactivations occurred regardless of any anti-viral therapy received, without any discovery of any clinical characteristics to enable the prediction of future viral reactivation (Ye et al., 2020). COVID-19 has also shown about 80% genetic similarity to the severe acute respiratory symptom (SARS) virus, which is already known to be derived from a bat virus (Ye et al., 2020).

The reports of neurological symptoms from COVID-19 could potentially be disputed. And the unwelcome reports of reactivation of the COVID-19 virus in patients who had previously tested negative could potentially be disputed as being the result of defective testing procedures, or the result of defective viral tests reporting a false-negative on a previous COVID-19 infection.

However, there are actually good reasons to believe the veracity of these disturbing reports concerning COVID-19, because both the reported neurological symptoms and the reported reactivations of the virus are consistent with previous reports regarding a well-documented bat-derived enveloped RNA virus. Nipah virus causes many of the same neurological symptoms after infections, and the reactivation of Nipah virus from latent infections of patients even months and years later has been reported in the scientific literature (CDC, 2014; Luby, 2013; Thibault, Watkinson, Moreira-Soto, Drexler, & Lee, 2017; WHO, 2018; Wong et al., 2002; World Health Organization, 2018). Nipah virus symptoms match several COVID-19 symptoms and include fever, drowsiness, headache, disorientation/confusion, giddiness, myalgia (muscle pain), coughing, convulsions, vomiting, reduced consciousness, myoclonus (muscle twitches), hyporeflexia/areflexia (of spinal nerves), seizures, cranial nerve palsy, pyramidal signs (voluntary motor cortex nerve damage), nystagamus (involuntary eye movement), dysphasia (communication impairment from brain damage) and so forth (Wong et al., 2002). Nipah virus is another untreatable and lethal virus, transmissible by bodily secretions of humans and other mammals, and even considered fully capable of a world-wide pandemic spread after mutation (CDC, 2014; Luby, 2013; Thibault et al., 2017; WHO, 2018; World Health Organization, 2018).

The COVID-19 virus and Nipah virus illustrate the virulence of some viral pathogens after transmission from animals to humans. Some viral pathogens can display a high replication rate in host cells after transmission to secondary hosts of other species, such as in the case of viruses that originally evolved high replication rates while they infected animals such as bats and thereby were selected by the fast immune responses of bats (Brook et al., 2020). This is characteristic of several enveloped RNA viruses, including Nipah virus of the genus *Henipavirus* and severe acute respiratory syndrome (SARS) virus of the genus *Betacoronavirus* (Brook et al., 2020; Flint, Racanielllo, Rall, Skalka, & Enquist, 2015).

There is a very good reason for viruses, such as COVID-19 and Nipah virus, to selectively infect neurons, because this enables them to evade attacks from the immune system of the host. Almost all T-cell activations require that an antigen (i.e., a molecular pattern that a patient's immune system recognizes as foreign to the patient) be presented by another cell, such as a dendritic cell, on a specific surface protein known as a major histocompatibility complex (MHC) (Alberts et al., 2015). In humans, this is also called a human-leukocyte-associated (HLA) protein (Alberts et al., 2015). T cells predominantly are α:β T cells with the MHC requirement for antigen presentation to activate α:β T cells, such as MHC class II for presentation to CD4 T cells and MHC class I for presentation to cytotoxic CD8 T cells (Alberts et al., 2015). But neurons carry very few of these MHC proteins, so they cannot easily present viruses on MHC class I to cytotoxic CD8 T cells to induce an attack on the infected neurons (Murphy, 2012).

Therefore, several viruses, such as the herpesviruses including the herpes simplex virus and the herpes zoster virus, also evade the

host immune system by going into a state of latency with low replication while they infect neurons, and by this means they can create lifelong infections that can be reactivated whenever some stress weakens the host immune system (Murphy, 2012). Although some viral infections can be lifelong, it should be noted that at this early stage, there is no evidence that COVID-19 infections could be lifelong in any survivors.

In conclusion, reports of widespread reactivation of the COVID-19 virus and its neurological symptoms are actually consistent with a similar well-studied enveloped RNA virus known as the Nipah virus. Nipah virus causes many of the same neurological symptoms, and the reactivation months or years later of Nipah virus from latent infections have been noted. The overall similarity of COVID-19 to the Nipah virus also implies that the pandemic infections of COVID-19 will be a greater public health challenge than previously believed in terms of its neurological damage to survivors and its ability to reactivate later from latent infections of some survivors, even after previously negative virus test results.

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CONFLICT OF INTEREST

The author has no potential conflicts of interest.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analysed in this study.

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