

Effect of COVID19 Pandemic on the Vital Function of the Central Nervous System: A Literature-based Prospective

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Abstract

The viruses harm brain functioning and cause severe neurological disruption. According to recent studies, the coronavirus exhibits neurotropic characteristics and induces neurological diseases. It also reported that the SARS-CoVs-2 virus could be found in the cerebrospinal matter or human brain. Likewise, the exact neuroinvasive mechanisms of viruses are still unknown and it is significant to find the viral effect on the nervous system. The imaging approach reveals the diffuse leukoencephalopathy and juxtacortical microhemorrhages critically sick in COVID19 patients. The coronavirus infection alters the CNS and also can lead the host immune responses to trigger into persistent disorder leading to neurological manifestation. The infected patients evaluated early for neurological symptoms with headaches, thinking dysfunction, paresthesia, and other pathologic symptoms. Due to pandemic, the adverse psychosomatic outcome expected to increase among individuals. Likewise, due to regular readily available data and reinforced messages acquired through social media of almost all forms. As a result, rapidly expands the mass of hysteria and panic regarding SARS-CoVs-2 infection may create permanent psychological issues among the public that could potentially even be more adverse in the long run than the viral infection itself. In this review, we have presented the effect of SARS-CoVs-2 infection on the human brain, how it alters the brain functions and discusses the current scenario affecting human wellbeing with its mechanisms to invade into the blood-brain barriers.

Keywords: COVID19; Central Nervous System; SARS-CoVs-2

Introduction

The human SARS-CoVs-2 is the member of enveloped RNA viruses composed of positive-sense single-stranded (~30 kb in length) RNA genome. The whole genome of the human coronavirus encodes glycoproteins such as spike protein (S), membrane protein (M), Nucleocapsid protein (N) and an envelope protein (E) [1]. Likewise, the genes and RNA polymerases for various accessory proteins infect the viral pathogenesis into which the nucleocapsid protein shows eminently conserved patterns in most of the Coronaviruses. The nucleocapsid protein generally expresses over the infection and acting as a critical agent in viral detection. The viral spike protein is critically infecting the individuals and considered as the integral having capability to reach the human brain. The SARS-CoVs-2 has seven strains into which three strains, namely MERS-CoV, SARS-CoVs and SARS-CoVs-2, can severely infect the respiratory tract of humans with high mortality and morbidity rate. Besides, the other four strains, such as HKU1, 229E, OC43, and NL63, are related to the common flu symptoms, thus proven relatively harmless to human beings [1]. Depending on the genome sequencing analysis, the OC43 strain showing 51.2% as well as 53.1% identity among SARS-CoVs-2 and SARS-CoVs relatively. However, the hCOVs show 50% and 79% identity among

MERS-CoVs and SARS-CoVs mutually. The respiratory viruses mainly considered as common symptoms of human coronaviruses, and it is related to acute respiratory syndrome i.e. hypoxia. The hypoxia inclines the brain to swell, metabolism disturbance, and causing successive neural manifestations [2]. Nevertheless, hypoxia is not the only way to consider a human coronavirus having relatedness with the central nervous system [1]. Several researchers concluded that the damage in the brain via COVID19 infection occurs in three stages. The first stage of viral infection limited with nose and mouth epithelial cells; symptoms have transiently lost the appetite, smell, and taste. In the second stage, the virus causes the cytokine storm and releases the toxic protein that may trigger the overactive immune responses. It starts from respiratory track and transferred via blood vessels to entire human organs forming blood clots that induce the brain strokes. However, in the third stage, the explosive state of cytokine storm damages the blood-brain barrier, the protective layer in brain blood vessels [3]. Resulting inflammatory responses, blood content, and viruses invade the patient's brain to expand confusion, cough, encephalopathy and seizure and the patient might even go into a coma [4]. The hCoVs also showing the capability to invade neural cells and hence exhibits the neuronal signs and symptoms.

In infected patients exhibit the lack of involuntary controlled breathing due to supposed indulgence of the inspiratory range of brain stem and the reports of infected patients showing the symptoms such as ataxia, convulsions, and loss of smell [5]. In recent imaging studies of infected patients also shows the impact of COVID19 infection in humans brain. The imaging approach reveals the diffuse leukoencephalopathy and juxtacortical microhemorrhages critically sick in COVID19 patients. This study reported that imaging features between 11 critically ill patients have persistent mental depression status who go through MRI between 5 - 25 April 2020 [6]. Likewise, in the long exposure, determine that infected patient's survivors having risk for severe mental illnesses i.e. post-traumatic stress disorder (PTSD), fatigue, depression, and anxiety for a month and years followed through discharge from hospitals. The current pandemic situation is stressful for the people, having stress about this deadly disease, overwhelming to the adults and children [7]. Due to isolation, social distancing can also make people feel isolated, which might be responsible for generated depression in individuals. However, these activities are significant in overcoming the spread rate of SAS-CoVs-2 infection [4]. However, excessive stress can also cause a disturbance in brain homeostasis. It also reported that stress also hinders the significant area of the brain. Due to pandemic, the adverse psycho-somatic outcome expected to increases among individuals. Likewise, also due to regular readily available data as well as reinforced messages acquire through social media of almost all forge. As a result, rapidly expands the mass of hysteria and panic regarding SARS-CoVs-2 infection may create permanent psychological issues among the public that could potentially even more adverse in the long run than the viral infection itself [8].

In this review, we have present the effect of SARS-CoVs-2 infection on the human brain, how it alter the brain functions and also discusses the current scenario affect human wellbeing with its mechanisms to invading into the blood-brain barriers.

Impact of COVID19 on brain function

In the current pandemic situation, the entire nation locked down and the situation is likely to continue due to increasing cases. Thus, most health professionals have recommended working from home. Due to the avoidance of workplace surroundings, it can create stress and depression among people and those who have a preexisting mental disorder [9]. Likewise, we are very well familiar with that social distancing is the only way to break the chain of infection in the current pandemic. Peoples have to engage themselves in useful activities to keep their good mental health. It is also reported that SARS-CoVs-2 infection can adversely affect the central nervous system and damage the human respiratory system [10]. As each passing day, it becomes more apparent that the SARS-CoVs-2 infection triggers neurological problems in a vast range [4]. The severe neurological behavior signs stated via at least one-third of corona infected patients having weakness, fatigue, headaches, dizziness, lost smell and taste, and defective thinking. However, the stroke's incident is reported increasingly; it might be the vascular complexities besides having a direct alteration of coronavirus on the human central nervous system [5]. The COVID19 related long term brain dysfunctions have not yet appropriately defined; nevertheless is likely to occur depending on the longer-term emanation of other coronavirus epidemics [11]. Amidst inflation in the attention to central nervous system symptoms, more

psychiatric and neurologic symptoms will be documented. Therefore, it is significant to be informed of the various possible neurological indications of hCoVs symptoms during severe sickness and potential long-term consequences on individuals having preexisting cases. Peoples having preexisting illnesses for Parkinson's disease, epilepsy, and those who had a genetic history of brain stroke attack are highly exposed to elevated seizures, dizziness, damaged consciousness, and lost smell symptoms [8].

Imaging approach in COVID19 patients

Several recent radiological experimentations conduct from China, Italy, New York and Iran to show how viral infection can affect the patient's brain. It suggested that in a subgroup of infected peoples having acute coronavirus infection may possess the cytokine storm syndrome could activate for chlorosis strokes [12]. Likewise, other dysfunctioning would also found in the patient's brain imaging research. The COVID19 manifestation initially thought to similar to flu, respiratory manifests. It reported in the past couple of months that SARS-CoVs-2 could affect the other human organs such as the brain, lungs, kidney, vascular system, heart, and begin venous thromboembolism and multi-organ dysfunctioning. The patient's brain detected with intracranial hemorrhage, ischemic stroke, hypoxic-chlorosis encephalopathy, encephalitis, and severe hemorrhagic necrotic encephalopathy. Therefore, it is poorly understood that the correct understanding of psychometric and neurological manifest in infected individuals originated from an acute illness or direct invasion of coronavirus in the central nervous system [12,13].

The imaging approach reveals the diffuse leukoencephalopathy and juxtacortical microhemorrhages critically sick in COVID19 patients. In this study reported that imaging features in between 11 critically ill patients having persistent mental depression status who go through MRI between 5 - 25 April 2020. Likewise, in the long exposure, determine that infected patient's survivors having risk for severe mental illnesses i.e. post-traumatic stress disorder (PTSD), fatigue, depression and anxiety for a month and years followed through discharge from hospitals. Several researchers are also working to find the exact neuronal complexities in infected patients and possibly damage machinery to the nervous system [5]. Hence it is found in most cases that viral invasion through diverse pathways is the leading cause of damage to the nervous system.

Current pandemic affect human wellbeing

The human coronavirus emerges as a dangerous threat to people's lives. The massive global situation created by deadly coronavirus is vital and affects people in different ways, resulting in many psychiatric challenges [14]. Approximately one-third of individuals accounted for the mentally ill due to this pandemic situation neglected in society and closely associates with corona affliction outbreaks. The mental illness is not limited to infected individuals but also expands to health workers and similar association members [14,15]. However, it is significant to limit viral transmission during the pandemic, and it also suggested that psychiatric health intervention should include in the public health responses scheme. Due to deadly virus transmission, it is necessary to lock down the whole nation, which directly affects all generations and minority groups, albeit differently [16]. Due to social distancing, isolation may trigger to raise the stress, depression, and anxiety among individuals. The viral infection outbreaks also associate with xenophobia as well as stigma. To rescue the mental wellbeing and establish the mitigating scheme is quite complicated but crucial [14]. The anxious and acuminate methods comprise the long term scheme for short term crisis response is enticing. This under-recognized intimidation is likely to have a grave effect on human beings [15-17].

Impact of CoVs on neurodegenerative diseases

Many viruses infect and cause critical damage to the nervous system with acute encephalitis and develop severe demyelinated lesions after coronavirus infection [18]. Some viruses are neurotropic that can invade in nervous tissues and infect the functioning of immune responses, or astrocytes in the brain central nervous system, macrophages [18]. The patients who have cerebrovascular diseases and confirmed with COVID19 infection may develop severe respiratory complexities. One study reported that ischemic encephalopathic pa-

tients are ~20% of 113 patients who died with COVID19. According to recent research evaluation in China, 214 patients diagnosed with a viral infection, 36% of patients are found with neurological symptoms with severe cerebrovascular symptoms and damaged thinking [5]. The viral infection connection with central nervous system pathologies is antiquated. Besides the COVID19 infection associate with a neurological disorder, it is still not clear that the symptoms may results from direct invasion to neural injury or via another reason. Most of the neurological manifestations of viral infection are not specified and secondary to the systemized illness [19]. Likewise, it also reported that COVID19 patients are associated with Guillain-barre syndrome [18]. It has no clear evidence that can prove that the covid19 infection can directly infect humans' nervous systems. Therefore, the infected patient's surveillance will require optimizing the possible post-corona infected peoples with neurologic manifestation. COVID19 also enhances the family burden of Parkinson's disease (PD) patients. COVID19 pandemic situation wants extra care for the PD patients [20,21]. PD is the second most common neurodegenerative disease after Alzheimer's disease and characterized by several motor and nonmotor symptoms [22]. Herbal plant-like *Mucuna pruriens*, *Withania somnifera* and *Tinospora cordifolia* play a vital role in preventing PD progression [23-25]. Also, Ursolic acid and Chlorogenic acid improves the motor symptoms in the toxin-induced PD mouse model [26-29]. There is a strong need to test these herbal plant and chemical compounds for COVID19 affected PD patients.

Discussion

The human coronavirus emerges as a dangerous threat to people's lives. The massive global situation created by deadly coronavirus is vital and affect peoples in different ways resulting in psychiatric challenges for many. The SARS-CoVs-2 virus is contemplated as a neuropathological. Other viruses are also considered as neuropathological such as influenza virus (IV), human respiratory syncytial virus (hRSV), as well as human metapneumovirus (hMPV) [4-30]. Therefore, the blood-brain barriers can protect our brain from these deadly viruses. Some researchers are reported that sometimes the coronaviruses can cross these barriers and infect the human brain. While the exact mechanism is still unclear, the viral entry appears from the olfactory bulb. The coronavirus can cause all kinds of havoc in the brain. It can cause brain inflammation (encephalitis) and encephalomyelitis resulting from various severe manifestations such as headaches, fatigue, loss of taste and smell [14]. The harmful effects of coronavirus of demyelination suspected in the MS onset. It is also suggested that coronaviruses are gliotropic and causes glia to secrete all variety of element along with interleukins, chemokines that involve in MS onset.

Conclusion

It reported that coronavirus infection alters the CNS and also can lead the host immune responses to triggers into persistent disorder leading to neurological manifestation. The infected patients evaluated early for neurological symptoms with headaches, thinking dysfunction, paresthesia and other pathologic symptoms [9]. The timely evaluation of cerebral-spinal fluid and managing the neurological complexities in infected patients are the key to improving the prediction of chronically ill people. This viral infection also causes complex brain diseases that progress towards neurodegenerative diseases like PD. Ultimately, social wellbeing is affected, which reduces the quality of life of the individual. Proper management and care should be needed for those infected patients to improve their mental health and quality of life.

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