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Mini Review

Impact of COVID-19 on Cognitive Performance and Ways to Resolve

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ABSTRACT

Cognitive abilities are of immense importance for the normal life sustenance of a human being. As cognitive impairment ensues, the living caliber declines. Among multiple factors, the current epidemic coronavirus diseases 2019 (COVID-19) has been implicated in worsening cognitive performance of the COVID-19 sufferers. Present article pinpoints the etiology and pathophysiology as well as recommendations to overcome the COVID-19 led cognitive decline.

Keywords: Alzheimer's Disease (AD); Cognition; COVID-19; Dementia; SARS-CoV-2

INTRODUCTION

Among the grave concerns of COVID-19, the cognitive issue is foremost. Most of the COVID-19 survivors are either sufferers of cognitive impairment or remain vulnerable to the same as their short- or long-term consequences. Thus, the reasons behind this impediment should be delved out and appropriate recommendations should be formulated to save the global innumerable populace since December 2019, the Severe Acute Respiratory Syndrome CoronaVirus-2 (SARS-CoV-2) has been causing Coronavirus Disease 2019 (COVID-19). COVID-19 was discovered in Wuhan, China, and has now spread throughout the world. "Globally, as of 3:34 pm CEST, 7 April 2021, there have been 132,046,206 confirmed cases of COVID-19, including 2,867,242 deaths," according to the World Health Organization (WHO). The number of new deaths climbed by 11% with over 71 000 new deaths are reported. In this context, the present study reports the cognitive impairments of the COVID-19 sufferers, the etiopathology, pathomechanism and putative recommendations. In the advanced stages of Alzheimer's Disease, patients become completely reliant on family members and caregivers. Caregivers must constantly attend to their patients and assist them in all of their daily tasks, from eating to sleeping and even while using the restroom. COVID-19 management recommends wearing masks, keeping a social distance, avoiding physical contact, refraining from sharing personal possessions with others, and constantly washing hands with sanitizers.

Another widely used strategy in the COVID-19 pandemic is quarantine or self-isolation. All of these management solutions are incompatible with AD caregiving and management at home and in the hospital. Even so, an AD patient cannot take his or her own medicine and must rely on others for treatment, which contradicts the COVID-19 management method. Patients with Alzheimer's Disease and COVID-19 are forced to rely on one another, despite the fact that their management strategies are incompatible. Both sorts of patients' psychological changes, anxiety, and sadness prevent them from engaging in their usual management techniques.

Cognitive performance

Cognitive performance comprises a number of abilities, including but not limited to, attention and thinking, listening and understanding, viewing and judging, learning and memory, reasoning and problem solving, justifying and decision making, as a whole, mental well being [1]. Among different organs of the body, the Central Nervous System (CNS) is intricately linked with cognitive performance of a person [2]. Any perturbation of the CNS affects the organismal cognitive performance [2]. Though all of the cognitive attributes might not be affected equally, impairment of one type influences other, albeit modifies the normalcy [3]. Recently, this type of induced cognitive impairment have been noticed in the COVID-19 sufferers [3].

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COVID-19

Epidemic coronavirus diseases 2019 (COVID-19) has taken a heavy toll worldwide. It is caused by the Severe Acute Respiratory Distress Syndrome Coronavirus Serotype 2 (SARS CoV-2), COVID-19 affects mainly the respiratory system [4]. Unfortunately, the entry route of SARS CoV-2, the Angiotensin Converting Enzyme 2 Receptor (ACE2R), abounds in the CNS [4]. Consequently, the COVID-19 patients co-manifest CNS abnormalities along with respiratory anomalies [4]. As the CNS becomes affected, associated cognitive functions become disrupted [4]. In this way, the secondary complications of the COVID-19 patients has been the deranged cognitive attributes that warrant adequate withstanding and management strategy. Acute respiratory distress syndrome, acute cardiac problems, pneumonia, and multiorgan failure had also been observed in severe cases. CNS manifestations in about 25% of COVID-19 patients have been reported. The brain region (especially the hippocampus) responsible for memory and learning processes becomes affected due to deposition of Amyloid Beta (Aβ) or Neurofibrillary Tangles (NFT) in the AD patient.

The COVID-19 pandemic is causing global morbidity and mortality. Older people presented a five times higher risk of mortality than the general population, straining health systems and disrupting societies, as well as putting individuals with AD and Related Dementias (ADRD) at risk of significant harm. Coronaviruses are RNA viruses that cause common respiratory infections in humans and they are an infectious agent responsible for mild respiratory tract infections. Coronavirus Disease 2019 (COVID-19) is caused by Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) that predominantly attacks the human respiratory system and has also Central Nervous System (CNS) targeting and neuroinvasive capabilities. Incubation period of SARS-CoV-2 is 5 days, and the mostly noted symptoms of COVID-19 include fever, cough, and fatigue followed by or associated with headache, dyspnea, and hemoptysis. Possible route of SARS-CoV-2 entry into the human body includes neural parenchyma, the nasal mucosa, the lamina cribrosa, retrograde axonal transport, and the olfactory bulb. Alzheimer's Disease (AD) is a neurodegenerative condition that is associated with a number of co-morbidities, including Cardiovascular Disease (CVD), diabetes, hypercholesterolemia, hypertension, and oxidative stress. These co-morbidities exacerbate the AD-COVID-19 link, which has serious consequences for the elderly. According to accumulating evidence, COVID-19 patients are 7-10 times more likely to suffer CVD problems. COVID-19, on the other hand, adds to the already existing CVD problems [10]. COVID-19 has been shown to have a bidirectional effect on diabetes patients, amplifying overall metabolic dysregulation. Pneumonia is the most common symptom of COVID-19. Patients with Alzheimer's Disease and dementia have an increased risk of acquiring pneumonia [12].

COVID-19 and deranged cognition - the Achilles heel

The "brain fog", manifested through cognitive deficit are the etiological and patho-physiological resultants COVID-19. Following etiological and patho-physiological concerns could be attributed to this muddle.

ACE 2 over expression: SAR-COVs, 10–20-fold increased affinity of SARS-CoV-2 spike protein towards ACE2 has been found . Bypassing the ACE2 receptor, SARS-CoV-2 might utilize the olfactory bulb and avail the trans-synaptic route directly upon invasion, SARS-CoV-2 stimulates reactive astrogliosis, microglial activation, and neuroinflammatory cascade. Consequently, the Blood-Brain Barrier (BBB) becomes compromised due to systemic inflammation followed by disrupted brain homeostasis and neuronal death. COVID-19 patients exhibit hyper expression of the ACE2 receptor that welcome the invading SARS-CoV-2 exceedingly [4,5]. Later on, pro-inflammatory cytokine led "cytokine storm" cripples both the respiratory system and CNS. Deranged CNS can hardly afford cognitive performance [4,5]. Shockingly, hippocampus and temporal lobes, the brain regions involved in memory and cognition, express ACE2 receptors that only worsen the cognitive level of the COVID-19 sufferers [4,5].

Neurotoxicity: SARS-CoV-2 led direct neurotoxicity vandalize the neurogenesis, synaptic plasticity, neurotransmission that are the neuropsychiatric hallmarks of cognitive decline [4,6].

Hypoxic ischemic brain inury: Depleted supply of oxygen to the CNS due to pulmonary debility attenuate CNS performance . Besides, cerebrovascular injury and bursting of pro-inflammatory cytokines scars the CNS. Also, ischemic brain damage and stroke are seminal hallmarks of dementia and cognitive impairment [7-8].

Neurovascular dysfuction: Blood Brain Barrier (BBB) and endothelial dysfunction leading to cerebral microvascular damage propensities SARS-CoV-2 malediction, otherwise accentuates cognitive malfunction [9-10].

Co-morbidity: Cognitive decline in COVID-19 patients are co-morbid expression of multiple pathophysiological symptoms [11]. Besides, pre-existing cognitive decline associated with dementia and Alzheimer's Disease (AD) had been found to be overly diminished in COVID-19 sufferers [12]. Diabetes and hypertenstion are among the modifiable co-morbidities of COVID-19 and cognitive decline. Alzheimer's Disease (AD), the most common form of dementia, has been reported to be interlinked with COVID-19 [13-16].

CONCLUSION

COVID-19 has plagued the global humanity, especially those who are already cognitively impaired. Even, *de novo* cognitive impairments have been detected among the COVID-19 sufferers. Immediate measures against COVID-19 led cognitive impairment could reduce global economic burden. Further studies are called for withstanding this global crisis. Because COVID-19 has severely hampered worldwide healthcare, psychological, economic, educational, cultural, and political systems, quick action against this pandemic is unavoidable. However, human endeavour since the current period appears modest in comparison to the worldwide crisis. Following mitigation techniques and offering psychosocial assistance to

COVID-19 patients who have already been affected appear to be appropriate. At the same time, the hunt for an effective vaccination and treatment for SARS-CoV-2 remains hopeful. The persisting COVID-19 complications, its long-term consequences have been shaking the healthcare professionals globally. Alzheimer's Disease stands among the top-notch outturn of COVID-19. In addition to the ongoing COVID-19 difficulties, the long-term consequences have shaken healthcare professionals all across the world. Alzheimer's Disease is one of COVID-19's outstanding results. The etiological cofactors and physiological co-manifestations identified in this analysis might aid in the development of therapeutic methods for both COVID-19 and AD. We must recognise that, we have relied solely on the data at our disposal, and we must look to the scientific community for future directions in order to avert global calamities like as COVID-19 and AD.

RECOMMENDATIONS

People suffering from cognitive impairments during COVID-19 crises,

- Should be checked through COVID-19 tests.
- Should have adequate behavioral support.
- Should be supplied with medication that minimizes the consequences of neurovascular injury.

National and international health care professionals should formulate state of the art guidelines to lower the burden of cognitively impaired persons.

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