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Evaluation of possible psychological trauma and brain injuries during COVID-19: A systematic review

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ABSTRACT

Introduction: With the outbreak of COVID-19, researchers started their studies on the various aspects of the infection by this newly-emerged virus. In addition to the pulmonary infection routes, some signs were discovered regarding psychological and physiological damages.

Materials and Methods: Our study aimed at collecting the results of the studies around the world on the possible psychological and physiological damages caused by COVID-19 in the neural system. Herein, we gathered 125 related articles up to June 2021 by searching the keywords COVID-19 brain infection, COVID-19 infection disease imaging findings COVID-19, mental health, and COVID-19 in the databases such as Scopus, Pubmed, Web of Science, Google Scholar, and Google. The articles unrelated to the objective of our study were excluded, and finally, 43 articles were used.

Results: In this study, reports indicate an increase in the volume of gray matter in the hippocampus and olfactory lobe and an increase in anisotropy in the white matter in people with the acute form of the disease compared to people without it. Therefore, psychologically, some forms of mental rumination and apathy were confirmed in affected people.

Conclusion: Considering the probable inability of the SARS-COV virus to cross the blood-brain barrier, the reason for the neuropathological lesions and brain encephalopathies has yet to be discerned, and this is a somewhat unknown mechanism

Keywords: Psychological damage, Brain, COVID-19

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Introduction

In December 2019, some new cases of corona virus-related pneumonia were diagnosed in a metropolis in China. Examinations showed that it was a new type of Coronavirus named SARS-COV-2 (1). This emerging Coronavirus is from the beta strain, which enters the alveolar cells of the optical surface of the lung by

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endocytosis and through angiotensin receptors (ACE II) (2). This disease has been much more dangerous in the elderly and individuals with underlying diseases such as asthma and diabetes than in the youth (3). The most common symptoms in diagnosed individuals include cough, fever, thrombocytosis, and lymphopenia (4). Considering the sudden changes in the lifestyle due to the COVID-19 pandemic, such as long-term quarantine, social distancing, and life threats to the individuals and their relatives, this disease may induce a huge threat to the mental health of the individuals (5,6). SARS-COV-2 not only infects the respiratory system and the lung tract but may also target the neural system (7). It may also be possible to reach the brainstem and medulla oblongata through a special neural pathway and chemical receptors in the lungs, which affects the respiratory system and the heart (8). Accordingly, some of the acute respiratory failures in patients with COVID-19 may result from damage to the central brainstem and medulla oblongata (8). Also, anosmia, which is a symptom of this disease and has been reported in the infection by some others, may be due to damage to the olfactory receptors in the nose (9, 10). In addition, the virus may travel through the bloodstream toward the brain (11), cross the blood-brain barrier, and attack and damage the brain parenchyma. This virus may also be connected to and damage the nerve cells and microglia (12). So, the risk of brain and psychological damage gets higher with blood-brain barrier impairment in patients with hypertension (13). This article reviews the research on brain and psychological trauma caused by acute types of SARS-COV 2, makes a list of these physiological and psychological traumas, and examines their probabilities and causes

Materials and Methods

In this study, 125 related articles published up to June 2021 were found by searching the keywords COVID-19 brain injury, the infection caused by COVID-19, imaging findings of COVID-19, mental health, and COVID-19 in Persian and English databases such as Scopus, Pubmed, Web of Science, Google Scholar, Google. The articles unrelated to the objective of our study were excluded, and finally, 43 articles were used.

Results

The SARS-COV2 is a beta coronavirus with a structure similar to its predecessor, the SARS-COV virus. Genetically, this virus has more than 70% similarity to SARS-COV and more than 50% to the virus causing Middle East Respiratory Syndrome (MARS) (14). The virus binds to angiotensin (ACE 2) receptors on the surface of epithelial cells of the lung and nests in this tissue, causing symptoms of a viral infection such as viral pneumonia and symptoms similar to MARS and SARS-COV disease. (15).

Neurological and Psychological Symptoms of SARS-COV Disease

During the SARS epidemic, in several cases, the virus was found in the postmortem reports of cerebrospinal fluid of patients, indicating that the virus may enter these parts of the body and cause damage to them (16-18). In addition to the potential for physiological damage, sometime after the outbreak of SARS, symptoms of emotional damages were observed in some parts of the world in subjects directly associated with the disease (18-20). They also showed psychological symptoms such as aggression, anger, and stress.

Evidence of Mental Illness Resulting from COVID-19

After recovery or during the disease, symptoms of some psychological changes such as increased suicide or self-harm ideations (21) or some behavioral biotypes were observed in many patients with this

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disease. Among these symptoms, many may result from loneliness during quarantine or increased negative thoughts considering the lack of knowledge about the emerging disease, fear of losing loved ones, or fear of death (22). On the psychological effects of COVID-19 on patients, Albogen et al. stated in a study that the effects of stress due to corona caused neurological and mental diseases more than other problems such as underlying physical problems, etc (23). Children and adolescents are also more likely to develop mental disorders such as depression, aggression, and anxiety due to these stresses (24). So, in addition to the physical and physiological effects of COVID-19, psychological factors should also be addressed (25).

Biotypes Created by COVID-19

In a study by Hogwarts et al, the relationship between intellectual biotypes and COVID-19 was investigated. Researchers could take COVID-19 as a promoter for developing these intellectual biotypes. The biotypes that were increasingly observed in various societies since the onset of the pandemic include mental rumination, anhedonia (decreased motivation and lack of pleasure), and emotional disorder (26).

Mental Rumination Biotype

In general, mental rumination is when the affected individual thinks about something annoying and painful. This problem is usually associated with depression and responds to distress (27).

Anhedonia Biotype

This biotype leads to a lack of pleasure from activities and stimuli that the subject enjoyed. The main clinical symptoms of this biotype are the ones mentioned above (28). These symptoms are observed mostly in subjects who are somehow struggling with the virus due to the excessive stress caused by COVID-19.

Central Nervous System Disorders due to SARS-COV-2

Many studies have and are being performed globally on the effects of Coronavirus on the central nervous system. On the one hand, this virus causes many manifestations such as anosmia, headache, impaired consciousness, and stroke in patients with clinical symptoms (29). Infection of the central nervous system with viruses in many diseases, such as harmless respiratory viruses (30), cerebral hepatitis (31), or chronic inflammation of the brain, indicates that it could be confirmed that viruses may intrude the central nervous system (32). Based on previous examinations and history of the virus, after individuals became infected with the SARS-COV virus, the virus could be found in the patient's cerebrospinal fluid and the CNS by sampling and performing RT-PCR (33). Based on the MRI scans of various parts of the brain of patients with acute symptoms in the central nervous system, microhemorrhages lesions were observed in the white matter and especially in the temporal lobe (34). In other larger studies, reports indicated that neurological symptoms had affected a higher percentage of patients with acute SARS-COV-2 even up to three months after recovery (35). Also, in some patients with acute SARS-COV-2, the volume of the gray and white matter of the brain had changed (36). The ACE2 receptor plays an important role in the virus intrusion in the host body's cells (37). As the main target of the virus, the pulmonary epithelial cells express large amounts of the angiotensin receptor (i.e., ACE2) (38). The brain, central nervous system, and related cells are other body parts that express this receptor. This expression has been made in the glial and neural cells (39). Some studies have proved that the coronavirus can induce cell death in mice by attacking the brain through the olfactory epithelium (40). There have been

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many patients reported throughout the world who had experienced intracranial hemorrhage (41). Signs of ischemic and hemorrhagic stroke have also been observed on post-mortem autopsy.
It should be noted that in all patients with this type of hemorrhage, the coagulation process had not occurred (42). Although this type of hemorrhage may not be due to the virus alone also resulting from hypoxia, it can be argued that focal ischemic strokes, which are fatal for the patient, may occur with increased cytokine storms (43, 44). In the meantime, given the brain damage mechanism in COVID-19, it should be argued that the virus itself intrudes the brain and CNS through a yet-unknown mechanism, leaving some damage (45).

Discusion

Considering the limited number of studies on the effects of the SARS-COV-2 virus on brain damage, the stresses, and pressures caused by this pandemic, as well as the ability of some viruses to cross the blood-brain barrier, the possibility of brain and psychological damage caused by this virus and this pandemic, as mentioned above, should not be easily overlooked. So, there is a need for further studies in this area. Also, with the obtainment of useful data about the mechanism of brain injuries by this virus, we can successfully set new protocols to deal with this virus. In addition, evidence from the neurological symptoms of the disease also indicates that affected by the new coronavirus, 6% of patients were affected by acute strokes, and 15% had a mood change (46). Due to the neurotrophic nature of the coronavirus, it may be the cause of neurological complications in patients (47, 48). Another mechanism that may cause neurological symptoms in this disease is inflammatory and cytokine storms (49). During coronary infection, in addition to encephalitis, there may be an increase in the rate of thrombosis. This could be a symptom in patients with a similar coronavirus (acute respiratory syndrome). Despite anticoagulant treatments, they still had venous thrombosis and pulmonary embolism (50). Also, there was evidence of arterial stroke in patients with acute respiratory syndrome treated with intravenous immunoglobulin (50). It was reported in a study in France that neurological symptoms had been observed in 84% of hospitalized patients with COVID-19, and out of 58 patients, 13 MRIs were performed on their brains, showing evidence of increased lipomeningeal in 8 patients (51). In a study using MRI imaging, severe cortical abnormalities were observed in about 37% of patients (10 out of 37 patients) (52). The imaging of acute respiratory syndrome also showed symptoms similar to SARS-COV-2, such as limited cerebral cortex diffusion and increased leptomeningeal symptoms in patients, as well as symptoms of infectious and autoimmune encephalitis, seizures, hypoglycemia, and hypoxia (53 ، 54). In patients with COVID-19, small hemorrhages have been observed in the cortex and blood vessels of the brain, which can be attributed to hypoxia due to this disease because, in hypoxia, hemorrhages follow the same pattern. In SARS-COV-2, the risk of infectious and autoimmune encephalitis increases due to its neurotrophic potential (55, 56). Listing and differentiating them may help in some areas. However, due to the lack of knowledge about the possible patterns of brain damage caused by the coronavirus, its symptoms cannot be accurately identified. Also, by confirming the results of molecular tests for the presence of the new coronavirus, meningitis and encephalitis in these subjects may be caused by crossing the blood-brain barrier and reaching the cerebrospinal fluid (57). The reports in this article can help patients and the medical staff treat patients with acute COVID-19 and those involved with this pandemic in any way. Considering the physiological and immunological changes in patients with the new coronavirus, the development of mental disorders, and the proof of the virus

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in CNS-related fluids, subjects should be informed on how these lesions are caused. In subjects with acute symptoms and hospitalized patients with acute symptoms, MRI imaging should be used after recovery to check the possibility of brain damage. This type of imaging should be performed to reject any changes in the central nervous system so that these symptoms can be quickly preventer or treated before worse events occur. Also, the importance of mental health for those who come and go in high-risk places such as hospitals and public places, such as medical staff, and subjects working in the market is twice others. It is hoped that the results of this study will be used by all individuals, especially the medical staff, to prevent mental injuries after recovering from COVID-19.

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Conflicts of Interest

The authors declare that they have no

Author Contribution

All the authors of this article participated in choosing the topic, searching, writing, submitting and revising.

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