

# A Novel Corona Virus: Impact On Cognitive Disorder

Ranjitha M<sup>1</sup>, Dr. Hanumanthachar Joshi<sup>2</sup>

<sup>1</sup>Department of Pharmacology, Sarada Vilas College of Pharmacy, Mysore, Karnataka, India

<sup>2</sup>Principal, Department of Pharmacognosy, Sarada Vilas College of Pharmacy, Mysore, Karnataka, India

Correspondence Author

**Ms. Ranjitha M**

Assistant Professor,

Sarada Vilas College of Pharmacy, Mysore, Karnataka, India

ranjithamadhu1226[at]gmail.com

Contact Number: 9110232946

**Abstract:** A wide range of viruses are arising in different geographical areas with different virus families because of their neurotropic characters. Infection by these neurotropic viruses can directly interrupt the structural and functional complexity of the central nervous system leads impairment in cognitive disorder. Keeping in this aspect, some of the research established that the Corona virus also belongs to a neurotropic virus which was first isolated as a pathogen from the respiratory tract. SARS-COV-2 was jumped to a human at one of the wet markets present in Wuhan through open air. This was first identified in 1965 with a crown-like appearance. Seven types of Coronavirus can affect humans, but out of seven SARS emerged in southern China in 2002. In 2003, 8,000 people were affected with SARS and the small outbreak was made in 2004 with four cases but suddenly 54 cases were reported viral pneumonia which was first emerged in Wuhan, China. Noticed that SARS-affected patients experienced CNS defects during their course of quarantine illness. At present COVID-19 pandemic rocketed around the globe in 2019 by disrupting functions of another system of the body like the CV system and CNS. A better understanding of molecular, epidemiological, and pathological characteristics of this infection with a CNS system with a particular mechanism may be expected to provide tools for the development of more effective intervention strategies by reducing the release of chemomediators in the brain from the inflammatory process which would prevent the structural complex of BBB of the CNS.

**Keywords:** COVID-19, SARS Virus, Inflammatory mediators, and Central Nervous system

## 1.Introduction

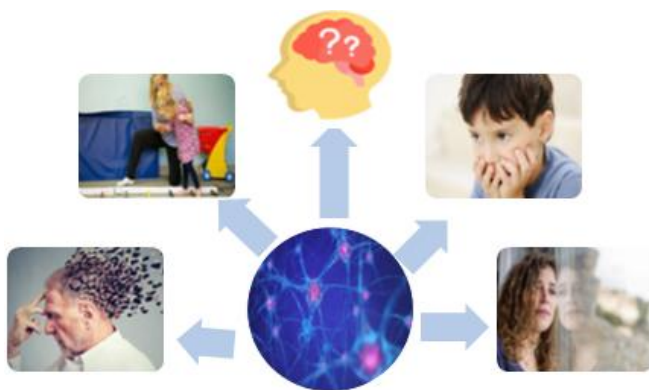
A global outbreak is done by a novel corona virus-19 throughout the world wide. First, a novel coronavirus was identified in the 1960s which is contagious and harmful towards upper respiratory tract infection in children. At least 15 new human coronaviruses have been identified from 2003, which causes significant morbidity and mortality. It is not a bacteria, a kind of virus known as Coronaviridae. Because of the presence of viral materials antibiotics will not work against pandemic viruses. But some conditions COVID patients will develop some bacterial infections as a complication, in such cases antibiotics will prefer<sup>1</sup>. No licensed drugs are available at present to cure COVID<sup>2</sup>. People who are affected with Coronavirus had a wide range of symptoms like- Fever followed by chills, cough, throat pain, fatigue, persistent headache, nausea, vomiting, and shortness of breath ranging from the common cold to Severe Acute Respiratory Syndrome (SARS). These symptoms appear from 2- 14dys of exposure. Organic mental syndromes are known as Cognitive Disorders which is mainly occurred due to damage in any part of the brain that affects memory, learning, judgment, abstract reasoning skills of the brain<sup>4</sup>. During the early phase of the COVID pandemic, about 36% of patients developed neurological symptoms and 26% proved direct involvement of coronavirus with the central nervous system. Dizziness, headache, impaired consciousness, and seizure are the complications seen in covid patients<sup>5</sup>. Increasing reports have shown that SARS-CoV-2 infection involves the central nervous system

(CNS) and the peripheral nervous system (PNS) and directly or indirectly damages the brain, leading to long-term cognitive impairment. Cognitive disorders belong to any disorder which significantly impairs the function of cognitive behavior of an individual, who cannot perform normal functions in society without treatment. Clinical experience from the eleven different countries of Physical Medicine and Rehabilitation specialists have shared about patients suffering from COVID. Most of the patients are observed and reported that they are having Cognitive-CNS impairments, Respiratory, deconditioning and myopathy, neuropathy, and pain related to joints as well as psychiatric patients. Finally, they concluded that SARS-COV-2 and other Cognitive or respiratory illnesses can be managed by rehabilitation programmes<sup>6</sup>. Cognitive disorders are a type of mental health disorder that mainly affects learning, perception, hallucination, problem-solving ability and also includes amnesia, delirium, and dementia<sup>7</sup>. Six problems will fall under the umbrella of cognitive disorder they are:

1. Amnesia
2. Delirium
3. Dementia
4. Developmental disorders
5. Motor skill disorder
6. Substance-induced cognitive impairment

Most of the cognitive disorders are occurring due to some hormonal imbalances in the womb, this type can be seen in infants. Other factors are genetic predisposition or some environmental factors, this is mainly due to lack of proper

nutrients. In case due physical injury or damage to the brain leads to memory impairment or cognitive impairments. Last but not the least cause for the cognitive disorder is a viral infection which directly counteracts the brain functions which are very essential to maintain cognitive function. For example SARS-COV-2 virus. Confusion, loss of long-term memory or short-term memory function, loss of thinking capacity, confusion in the identification, inability in perfect judgment, Poor motor coordination are signs and symptoms of cognitive disorders<sup>8</sup>. As we know SARS-COV-2 virus mainly affects in respiratory system but one of the more treacherous effects of COVID-19 is on the brain leads to memory or cognitive impairment. Now it's very clear that most of the COVID affecting people are suffering from neurological symptoms. Which starts with loss of smell to delirium and finally to stroke. And some factors are also long-lasting symptoms can be seen in COVID patients are Guillain-Barre syndrome and myalgic encephalomyelitis /chronic fatigue syndrome. All these effects are mainly due to viral infection to the brain tissue. It has increasingly been recognized that nowadays viruses can also attack the nervous system and damage the brain neurons and tissues. But additional evidence is proved that indirect action of the virus on epithelial tissue or cardiovascular system or decreased immune response towards virus and inflammation contributes neurological changes after COVID infection<sup>9</sup>.



**Figure 01:** Impact of Covid on Cognitive disorder

### Neurocognitive sequelae of SARS-COV-2 illness

COVID pandemic is rocketed around the worldwide from 2019 which appears to affect other body systems mainly the brain and the cardiovascular systems. As the pandemic started many peoples felt the only loss of smell and taste but following days thousands of people are admitted to hospitals because of curious symptoms related to nervous systems. As more accounts of patients accounted for cognitive or other neurological symptoms as well as stroke. Coronavirus can directly or indirectly affect the central nervous system (CNS) and subsequent neuropsychological functioning by acting as neuroinvasive or neurovirulent. Where it can cross the blood-brain barrier or gain entry into the central nervous system via different routes leads to short-term or long-term neurological defects or neurocognitive defects mainly because it enters into systemic effects. These defects sometimes arise from respiratory distress syndrome. There is an increased proportion of corona patients are suffering from

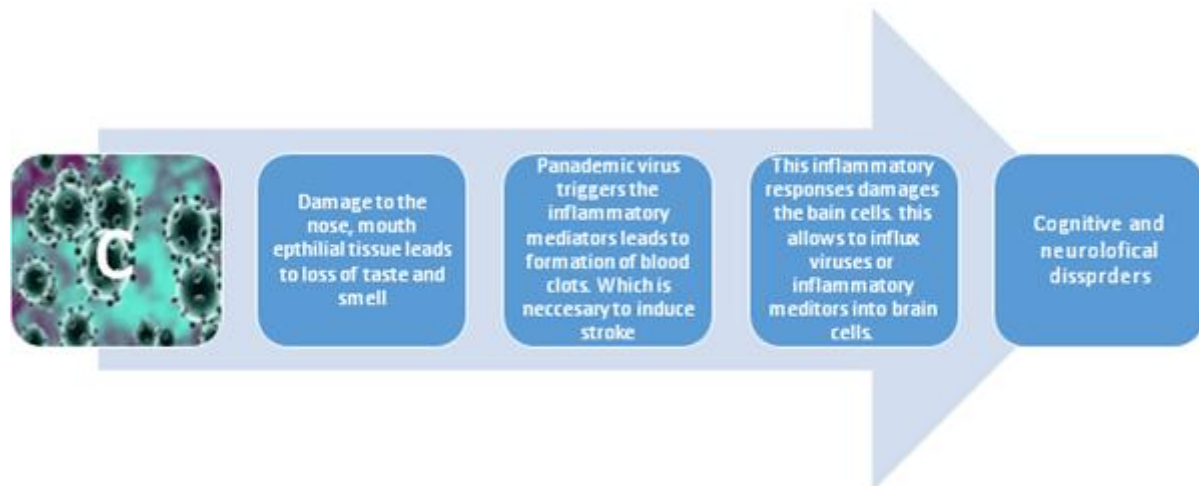
neurological disorders is mainly due to pre-existing medical conditions that are associated with neuropsychological deficits, containing hypertension, cardiovascular disease, diabetes, and chronic respiratory illness<sup>10</sup>.

A different family of viruses is surviving in different geographical areas with a wide range which may cause early or delayed defects in nervous systems leads neuropathological changes in humans as well as animals. Especially neurotropic viruses infections are the major economic burdens for society due to increased mortality and morbidity rate and unique problems in the treatment, this is mainly because of the unique or complex structure of the central nervous system with interconnected cell types or intertwined neuron system and their function, or its due reduced immune surveillance with the virus or less capacity of regeneration of neurons in the Central nervous system. Most neurotropic viruses will irreversibly disrupt the complex structure of the CNS as well as the functional behavior of the CNS. So in this manner, the COVID virus can abruptly damage the structural complexity of the brain or impairs the functional nature of the CNS leads neurocognitive changes in the COVID patients. At present inflammation of the brain is caused by a novel coronavirus which may have subtle consequences in COVID patients. Because of this infection in one British study out of 12 patients who were dying because of this encephalitis, 10 were cured and one died and most of the covid patients suffering from a stroke. Stroke is also one of the risk factors caused by this coronavirus. Meanwhile due to lack of oxygen supply to the brain tissue leads to brain damage in COVID patients was revealed from autopsy data. The presence of Megakaryocytes (parts of the clotting system) in dead COVID patients' brain capillaries was confirmed in Johns Hopkins University and Harvard Medical School. Patients who are survivors of intensive care unit (ICU) stays due to COVID showed profound cognitive impairment. Such impairment affects attention, difficulty in managing daily medications, finance management, and conversation with their own family and friends. These symptoms were identified in Britain, Canada, and Finland covid patients who were admitted to COVID ICU Units. Now it's clear that COVID can affect the brain function directly as encephalitis or by decreasing the oxygen supply to the brain tissue or by causing a stroke. As we know persistent occurrence stroke can cause dementia or large stroke, this can be seen in Coronavirus affected patients 17. Recent reviews proved that access to telemedicine by the neurodegenerative disorder patients like Parkinson's or Alzheimer's patients affected by the COVID virus can change the patient care by rehabilitative therapies by administering cognitive tests which is support to the caregivers. This will give changes in the patient care, treatment adjustment, and referral for medication as well as support to COVID patients<sup>13</sup>. During lockdown of Corona pandemic, adolescent psychiatric disorders were identified due to extended home confinement, increased use of mobiles or laptops or television, intrafamilial violence, and stress full life are factors that could influence the mental health of an adolescents leads to a post-traumatic stress disorder, this potential effects by the COVID outbreak on adolescents leads to an impact on

adolescent cognition with traumatic symptoms<sup>14</sup>. Prevalence, outcomes, and clinical presentation of dementia among the COVID patients were analyzed in the Acute Hospital in Brescia province, Northern Italy. Analysis of dementia was recorded retrospectively in 627 patients and 82 patients were diagnosed with dementia. From that 62.2% showed mortality among the dementia patients compared to unaffected dementia patients. The most frequently observed symptom in dementia patients is delirium especially in the hypoactive form, and functional status was worsened. So the diagnosis of dementia in the early stages prevents the mortality rate among the COVID

patients with clinical representation in subjects is a unique and recognition of symptoms and hospitalization<sup>15</sup>. Several cognitive domains with response to inflammatory mediators were analyzed in COVID recovered patients with the help of an iPad-based online tool which also includes Sign Coding Test (SCT), Digital Span Test (DST), Continuous Performance Test, and Trail Making Test (TMT). Finally revealed that due to release of inflammatory mediators such as (IL-2), IL-4, IL-6, IL-10, tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ), C-reactive protein (CRP), and interferon- $\gamma$  (IFN- $\gamma$ ) in COVID patients is a factor to induce cognitive impairments.<sup>16</sup>

### A Neurological network of COVID-19



**Figure 2:** Flow Chart of COVID

Inoculated suspension of Brain tissue of 39-year-old doctor's sample showed the presence of severe acute respiratory syndrome (SARS) coronavirus (SARS-CoV) in RT-PCR with a predicted fragment of about cDNA fragment (BNI-1) of ~ 08 bp specific for SARS-CoV which is amplified from Vero-E6 cell culture inoculated with the brain suspension. Final examines confirms the presence of SARS-CoV which was in the form of enveloped particles of a diameter of ~80–90 nm and surface morphology similar to SARS-COV<sup>12</sup>. Traumatic life stressor event is potentially considered during lockdown period which accounts for adaptive behavior skills of individual Covid patients with Down syndrome. Data showed that increased depression burden during the post lockdown period and most of them showed depression symptoms compared to the pre-lockdown period. This analysis was carried out by assessing psychosocial, cognitive, and functional parameters of COVID patients.<sup>19</sup>

### 2.Conclusion

Generally Most neurotropic viruses disrupt the complex structure of the Central nervous system by the process of antigen-antibody reaction by releasing various inflammatory mediators. In this review, we concluded that a novel coronavirus has capable to cross the blood-brain barrier by attracting various inflammatory mediators in the CNS. Due to the release of chemo mediators rupturing of the Blood-brain barrier will take place in the CNS, so it can invade the brain easily through this pathway and

finally arise different types of cognitive and neurological disorders. Hence this review suggests that prevention of the release of inflammatory mediators during illness could be the management for cognitive disorder in COVID patients.

### References

- [1] Kahn, J.S. and McIntosh, K., 2005. History and recent advances in coronavirus discovery. *The Pediatric infectious disease journal*, 24( ), pp.S223-S227.
- [2] Who.int. 202. COVID-19 Mythbusters – World Health Organization. [online] Available at: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public/myth-busters?gclid=CjwKCAiAyc2BBhAaEiwA44>
- [3] Centers for Disease Control and Prevention. 2021. Coronavirus Disease 2019 (COVID-19) – Symptoms. [online] Available at: <https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html>.
- [4] Mentalhelp.net. 202. Introduction to Cognitive Disorders. [online] Available at: <https://www.mentalhelp.net/cognitive-disorders/>.
- [5] Heneka, M.T., Golenbock, D., Latz, E., Morgan, D. and Brown, R., 2020. Immediate and long-term consequences of COVID-19 infections for the development of neurological disease. *Alzheimer's research & therapy*, 2(1), pp. -3.

- [6] Carda, S., Invernizzi, M., Bavikatte, G., Bensmail, D., Bianchi, F., Deltombe, T., Draulans, N., Esquenazi, A., Francisco, G.E., Gross, R. and Jacinto, L.J., 2020. COVID-19 pandemic. What should Physical and Rehabilitation Medicine specialists do? A clinician's perspective. *European journal of physical and rehabilitation medicine*, 56(4).
- [7] <https://www.longdom.org/scholarly/cognitive-disorders-journals-articles-ppts-list-2527.html>.
- [8] PsychGuides.com. 2021. Cognitive Problem Symptoms, Causes and Effects - PsychGuides.com. [online] Available at: <https://www.psychguides.com/neurological-disorders/cognitive/>.
- [9] Tronson, N., 2021. How COVID-19 Might Increase the Risk of Memory Loss and Cognitive Decline - The Wire Science. [online] The Wire Science. Available at: <https://science.thewire.in/health/how-covid-19-might-increase-the-risk-of-memory-loss-and-cognitive-decline/>.
- [10] Ludlow, M., Kortekaas, J., Herden, C., Hoffmann, B., Tappe, D., Trebst, C., Griffin, D.E., Brindle, H.E., Solomon, T., Brown, A.S. and van Riel, D., 2016. Neurotropic virus infections as the cause of immediate and delayed neuropathology. *Acta neuropathologica*, 3 (2), pp. 59- 84.
- [11] Xu, J., Zhong, S., Liu, J., Li, L., Li, Y., Wu, X., Li, Z., Deng, P., Zhang, J., Zhong, N. and Ding, Y., 2005. Detection of severe acute respiratory syndrome coronavirus in the brain: potential role of the chemokine mig in pathogenesis. *Clinical infectious diseases*, 4 (8), pp. 089- 096.
- [12] Adams, J.L., Myers, T.L., Waddell, E.M., Spear, K.L. and Schneider, R.B., 2020. Telemedicine: a valuable tool in neurodegenerative diseases. *Current Geriatrics Reports*, 9(2), pp.72-81.
- [13] Guessoum, S.B., Lachal, J., Radjack, R., Carretier, E., Minassian, S., Benoit, L. and Moro, M.R., 2020. Adolescent psychiatric disorders during the COVID-19 pandemic and lockdown. *Psychiatry research*, p. 3264.
- [14] Bianchetti, A., Rozzini, R., Guerini, F., Boffelli, S., Ranieri, P., Minelli, G., Bianchetti, L. and Trabucchi, M., 2020. Clinical presentation of COVID 19 in dementia patients. *The journal of nutrition, health & aging*, 24, pp.560-562.
- [15] Zhou, H., Lu, S., Chen, J., Wei, N., Wang, D., Lyu, H., Shi, C. and Hu, S., 2020. The landscape of cognitive function in recovered COVID- 9 patients. *Journal of Psychiatric Research*, 29, pp.98- 02.
- [16] Andrew E. Budson, M., 202. The hidden long-term cognitive effects of COVID-19 - Harvard Health Blog. [online] Harvard Health Blog. Available at: <https://www.health.harvard.edu/blog/the-hidden-long-term-cognitive-effects-of-covid-2020-0082133>.
- [17] <https://www.apa.org>. 2021. How COVID-19 attacks the brain. [online] Available at: <https://www.apa.org/monitor/2020/ /attacks-brain>.
- [18] Villani, E.R., Vetrano, D.L., Damiano, C., Paola, A.D., Ulgiati, A.M., Martin, L., Hirdes, J.P., Fratiglioni, L., Bernabei, R., Onder, G. and Carfi, A., 2020. Impact of COVID-19-Related Lockdown on Psychosocial, Cognitive, and Functional Well-Being in Adults With Down Syndrome. *Frontiers in Psychiatry*, , p. 150