INTRODUCTION

In early December 2019, people living in a wholesale food market in Wuhan, China started having some symptoms as seen earlier during Severe Acute Respiratory Syndrome (SARS), which was a single stranded RNA virus originated from China in 2002.

This was the onset of what was going to be the most lethal pandemic ever existed and a disease which was even more deadly for humankind than World war 1 and 2. Although, in the human history there’ve been a no. of viruses which have caused mass destruction but soon thereafter their vaccines were created and eventually those pandemics were eradicated. Smallpox, HIV, influenza virus were the challenges medical science gradually overcame and today we do possess the respective vaccines of most of the viruses. But, still some viruses such as SARS which is from the Coronaviridae family do not have confirmed treatment, and supplemental oxygen as well as steroids are given to the patients but even these aren’t effective on everyone.

Earlier the affects of Covid-19 were only focused upon the working of lungs and respiratory system, but later on when some cases of destructive encephalopathy, loss and impaired cognition, seizures and strokes in the patients of Covid-19 were reported, the probability of manifestation inside the human nervous system by this virus turned into confirmation.

After this, neurologists and scientists started to look at the effects of Covid-19 on the neurological functioning, and it turned out to examining and looking at the issues on how the virus affects the nervous system directly versus indirectly. Because of the metabolic effects and similar bodily problems in diseased people, it was a bit obvious that those who are having respiratory issues must have been having certain direct or indirect effects of the virus on the brain. Although the information was a bit nebulous and mixed as to whether nervous system is involved or not. But, studies and clinical evaluations of patients in Wuhan clearly suggest direct involvement of the nervous system by the virus. Still, the reliability of these studies is still in question and there is a definite overlap between the direct involvement and indirect involvement through respiratory system.

The most reliable study till now carried out categorized the neurological manifestations due to Covid-19 into manifestations in the Central nervous system, Nerves and the muscles. Also, a lot has been said about the loss of certain sensory parts in the patients of Corona virus like loss of taste
and smell etc. but it’s association can also be seen as the involvement of the respiratory tract by Covid-19, which is an indicator of this disease. But, the theory that contradicts this is that Covid-19 is not the only Neurological and viral disease that causes these symptoms, also the question is there can be the effect of the virus on the olfactory nerve, the first cranial nerve. California reported about some of the patients having similar issues of having respiratory problems along with impaired olfaction and taste, and once they recovered from the virus they had a rapid recovery in their taste and smell as well. Usually this doesn’t happen with this pace but, the epithelium can regenerate really quickly. So, it can be assumed that the respiratory epithelium too has the roots of this problem of olfaction and smell.

Delirium, although relatively infrequent (only around 7%) is another neurological impairment has been found to have induced by Corona. The presumptions can be made that the compromization and lowlevels of oxygen in the lungs and brain can be some of the manifestations of Delirium or even comma. As stated earlier, these are just presumptions as delirium can be the result of not only respiratory but also of metabolic issues.

SARS virus, which preceded this virus in 2002, 2003 had numerous reports of damaging the blood vessels in the patients. The neurological manifestations are really hard to say and highly uncertain. In all the cases where imaging of the brain has been done in order to see the neurological manifestations of the brain, the imaging abnormalities have been generally regarded as unrevealing or often “normal”. It can be seen as a good sign, that there aren’t irreversible damages to the brain due to Corona. Although, some exceptions are definitely there, especially in the patients having strokes as it shows the involvement and damage of the nervous system due to Covid-19. Now, because the mechanism of the strokes occurring in the Covid-19 patients is unclear as it may also be the worsening of pre-existing conditions, for example- people having hypertension, smoking history, blood vessels damage are already predisposed to strokes and now because of added respiratory system impairment precipitates as the consequence of the stroke. Based on the past influenza pandemics, like that in 1918, we should be on the lookout at insomnia, anxiety and depression in addition to all those worse we’ve already mentioned.

Guillain-Barre syndrome, a neurological impairment of the peripheral nerves too is reported in some of the Covid-19 patients. It has indirect impact of the Corona virus and also had association with swine flu in 1970s.

The SARS-CoV-2 virus enters the body via nose or mouth binding onto cells using the cells surface receptors called Angiotensin-Converting Enzyme 2 or ACE-2. It then injects its genetic material called RNA in the cells and hijacks the machinery to make the more copies of itself which then move on to attack more cells. Eventually, the virus makes its way down the throat to the lungs, where it takes the residence and makes more even havoc. In the tiny air droplets where the oxygen gets absorbed into the bloodstream, called the Alveoli, the fight between neuroimmune system and this reassortment virus can cause inflammation, degeneration and excess fluid. At times when the infections are really harsh, this combination can lead to Acute Respiratory Distress Syndrome (ARDS) in which the lungs are so coughed up that the body is unable to absorb oxygen. This is usually when a person ends up procuring ventilation to support their breathing and even that doesn’t always work.

As the no. of patients of Covid-19 is climbing, scientists are noting down more and more symptoms linked to the Central Nervous System. After headache, seizures, strokes and loss of taste and smell, a recent patient of Covid-19 was reported to be going through Acute Necrotizing Hemorrhagic Encephalopathy with the information in her brain led to memory loss and disorientation. As the SARS-CoV-2 is a new virus and we are not entirely sure about its manifestations, a lot of these hinges of whether or not this virus can cross the blood brain barrier, because the brain is too fragile and easily damageable it has evolved a special set of blood vessels and properties that helps in keeping most of the things like foreign pathogens out of the brain.

So, the blood brain barrier is capable of preventing infections but, it is not good for letting in the drugs in the system to treat any infection that makes its way through it. Case studies and reports from the scientists working on the patients in China have evidence that SARS-CoV-2 is able to cross the blood brain barrier and like any inflammation causing in the brain, that is definitely a bad news. Inflammation in the brain can cause whole host of problems like swelling or Encephalitis. This swelling puts pressure on the brain causing everything from mild flu like symptoms, headaches and up to seizures and hallucinations, paralysis and loss of consciousness. Viruses like corona virus can also cure brain cells called Oligodendrocytes, which wrap around neurons and act as insulations to help them send signals. When Oligodendrocytes die, they cause demyelination of neurons causing muscle weakness, vision problem, pain and changes in sensations. Viral infections an also activate brain’s immune cells called Microglia and make them attack the brain’s healthy tissue when it shouldn’t be.

Everything is happening very quickly and to keep up with the infection we got to have a great task force to sequence the corona virus strains from patients. So, the urgency of doing this is that as the virus propagates through people who acquire mutations and these mutations can sort of follow the virus around and understand the case of community spread. In Wuhan, a left over sample, a random sample was studied although it wasn’t sure about how the sequencing was going to go because from the nasal swab most of what we’re going to detect is human nucleocassette, and not the virus. But a genomic sequencing was made which means every nucleocassette was taken from that nasal swab, working to little pieces and put it over “x” sequences.Hundreds of millions bits of sequences were taken into consideration and it was found that more than 10,000 of these bits corresponded to the virus. If we can map all these mutations we can map all of these mutations, it’ll be possible to trace the transmission.

Menachery et al. in 2014 did a study which revealed the similarity and differences in the immune system response and approach in the influenza virus, SARS-CoV, MERS-CoV, H5N1 influenza and the coronavirus. They identified a common trail of hostility among these two through Type 1 interferon, which is a cytokine.

Yeshun et al. in 2020, tried to examine the researches that were based on the neurological aspects of the SARS-CoV-2 and
stated that it is still unknown how is the virus affecting human nervous system. This paper stated a no. of studies that revealed strokes, seizures, severe headache, trauma etc. in the patients of coronavirus in Wuhan, China. It reported some very significant points such as the case reports of the virus attacking the central nervous system and also that SARS-CoV-2 virus existed in the Cerebrospinal fluid too.

Asia Filatov et al. in 2020, studied the involvement of the virus in the nervous system through case study of a 74 years old male. This person had a medical history and was taken to the hospital after some medical condition, his tests were taken with the suspicion of Covid-19, but they were negative. He was then discharged from the hospital, but within a day he started having severe neurological conditions and was taken to the hospital where his CT and EEG was carried out. The reports revealed a loss of brain tissue and slowing of the brain waves both in the left temporal lobe. He was given AEDs for it was suspected that he might start having seizures, but when again his test was carried out, he was found to be positive for Covid-19.

AsadiPooya and Simani L. in 2020, using the dataset did a review study on the effects of SARS-CoV-2 on the CNS. They also said that we still do not have enough evidence to comment on how and whether this virus is having neurological manifestations. Although we are witnessing patients with Covid-19 showing neurological impairment, but those aren’t enough to prove the direct involvement of SARS-CoV-2 on the nervous system.

Fernanda G. De Felice et al. in 2020, talked about the disorder due to the cell death in SARS-CoV-2. They also highlighted the effects SARS, MERS and other viruses of earlier times had on our nervous system and their similarities with Covid-19 which has potential of brain damage and emphasized a lot on ischemic Cerebrovascular attack.

RESULTS AND DISCUSSION

Covid-19 is a new virus, but it is a kind of good old fashioned SARS virus we’ve witnessed in 2002-2003. Even if we look at the DNA and genetic composition of these two viruses, it shows a lot of overlap. Almost every decade we are encountering a new virus, 2003 it was SARS, in 2013 it was MERS and now here we are almost a decade later with Covid19.

The vulnerability of neurological implications is up to how significant and how dangerous are our underlying comorbidities. In other words, do we have chronic medical problems, immunosuppressive diseases etc. The neurological spectrum of complications in the Covid-19 is being underestimated, be it clinical evaluations or enough neuroimaging.

References


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