



When Pandemic is Over: We Need to Deal with Long Term Sequelae of COVID

Salim Surani^{1*} and Pahnwat Taweeseedt²

¹Adjunct Clinical Professor, Texas A&M University, Texas, USA

²Pulmonary Associates, Corpus Christi, Texas, USA

*Corresponding Author: Salim Surani, Adjunct Clinical Professor, Texas A&M University, Texas, USA.

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COVID-19 first started in Wuhan China in December 2019 and before the world realized, it became a global issue. So far it has affected almost 110 million people worldwide with 2.47 million mortality globally [1]. The USA, India, and Brazil are leading in the number of infections (28.7 million, 10.9 million and 10.1 million respectively) and mortality of (509K, 156K and 246K respectively). As the world is scrambling for the vaccine, while the variant of the covid-19 virus is spreading, our complete attention is towards the vaccinating the public and also consideration of the booster vaccine dose to combat the variant of SARS-CoV-2. In addition to focusing those issues, the focus also needs to be diverted towards the long-term sequelae of the COVID-19 infections.

The experience from patients who have suffered previously from coronavirus infection as, severe acute respiratory syndrome (SARS) in the year 2003 and Middle East respiratory syndrome (MERS) in 2012 have taught us that those surviving patients have also suffered from the long-term sequelae of those infections [2]. A study by Tansey and colleagues showed that at one-year intervals 18% of the patients who had SARS had shortness of breath, fatigue, and a decrease in 6-minute walking distance traveled [3]. Moreover, 15-year follow-up among healthcare workers who have suffered from SARS had reduced lung function and residual radiological abnormalities [4]. Moreover, patients who have suffered from MERS had a reduction in the quality of life (QoL) score, fatigue, and psychiatry issues at one-year post-MERS infection [2].

The COVID-19 surviving patients are also having significant lingering symptoms months after infection or recovery. They include

fatigue, cough, loss of taste and smell, headache, body ache, nausea, diarrhea, abdominal pain and confusion [5]. Since it is barely a year since the COVID-19 infections started, not much is known about the long-term sequelae. However, the recent data is pointing towards the long-term issues as it relates to the respiratory system, neurological system, cardiovascular, psychiatry and renal system.

SARS-CoV-2 primarily being the respiratory virus, it is not unusual to see respiratory symptoms on presentation and also to see the long-term respiratory sequelae. According to the World Health Organization (WHO) conservative estimates, one-third of the survivors who have been infected with the SARS-CoV-2 virus will develop some pulmonary fibrosis [6,7]. If that estimate holds true, that can create a catastrophic pulmonary situation where more than 40 million people globally will have some degree of pulmonary fibrosis. We have also seen patients who had a mild infection and no hospitalization and emergency room visit have presented with shortness of breath with fibrosis and restrictive lung disease months after exposure to SARS-CoV-2 infections [8]. Given the possibility of having pulmonary fibrosis at a later stage, the focus should be on prevention and consideration for early treatment of viral infection and cytokine storm. The data though is not there yet for the use of anti-fibrotic agents for helping prevent future pulmonary fibrosis.

In addition to the pulmonary issue, neurological injury, as well as long-term neurological sequelae, has been suggested [6]. The olfactory nerve, as well as vascular endothelial cells of the blood-brain barrier and the immune cells, have been suggested as the po-

tential pathway for the SARS-CoV-2 entry into the brain [9,10]. Loss of smell and taste is one of the primary symptoms of COVID-19. Several neurological conditions as Alzheimer’s disease, Parkinson’s disease, Multiple sclerosis have been suggested as the possible long-term neurological sequelae of the COVID-19, but data is not enough at this time to substantiate this as shown in table 1.

Disease	Pathology	COVID-19 effect
Alzheimer Disease (AD)	Synaptic pruning, neuro-inflammatory response, and neuronal loss form the basis of AD	SARS-CoV-2 infection can accelerate these processes, but the data currently is lacking
Parkinson Disease	Involvement of substantia nigra is seen leading to impairment of cognitive and motor function	There is no direct evidence, but the ACE2 receptors where the virus binds are present in vast number in the CNS
Multiple Sclerosis	It’s a demyelinating disease, accompanied by neurodegeneration caused by the inflammation	Cytokine storms in COVID-19 infection can cause neuroinflammatory damage as well as demyelination. Recent case report supports this hypothesis [11]

Cardiac injury and elevated troponin levels have been seen commonly among COVID-19 patients [12]. In a study from Germany, cardiac involvement was seen in 78% of patients and myocardial inflammation was seen in 60% of patients 70 days (median) post-infection on cardiac magnetic resonance imaging [13].

Seemingly, renal function is usually affected among patients who are hospitalized. Surprisingly, 13% of the patients who had normal renal function during their hospital course developed a decline in their renal function during the out-patient follow-up [14,15].

Besides, the above long-term sequelae, mental health, and post-traumatic stress disorders are rapidly emerging among the patients with COVID-19 [12]. As we are trying to deal with the acute wrath of the COVID-19 and trying to get the world vaccinated, we should not take our eyes from the long-term sequelae of the CO-

VID-19. The regulator and health care administrators, societies, and physicians should focus their attention to prepare themselves for the influx of patients with long-term issues, so they don’t get caught unprepared. More studies are needed to shed more light on the long-term sequelae of this devastating global pandemic.

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