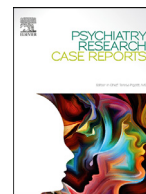




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# Tinnitus and biopsychosocial ramifications of COVID-19 associated with severe suicide attempt-a case report

Anum Khan<sup>a,\*</sup>, Sara Heide<sup>b</sup>, Andrew Flatley<sup>b</sup>, Aliya Khan<sup>c</sup>, Mitchell Nobler<sup>d</sup>

<sup>a</sup> Columbia University Irving Medical Center, Department of Psychiatry, NY, United States

<sup>b</sup> New York Medical College, Department of Psychiatry, NY, United States

<sup>c</sup> Broward Health, Department of Internal Medicine, Fort Lauderdale, FL, United States

<sup>d</sup> Westchester Medical Center Health System-System-New York Medical College, Department of Psychiatry, NY, United States



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## ABSTRACT

The COVID-19 disease has been linked to multiple physical and mental health consequences which may be partially attributed to multi-system modulation by inflammatory cytokines. Post-acute sequelae (PASC) of SARS-CoV-2 infection, colloquially known as "Long Covid", has become an established entity. However, screening guidelines and interventions for COVID-19 survivors remain elusive. The neuropsychiatric sequelae of COVID-19 seem to originate from a cumulation of biopsychosocial factors which may predispose individuals to acute psychiatric decompensation irrespective of a previously diagnosed mental illness. We present a case report which illustrates how cognitive issues and medical complaints may negatively interact resulting in significant depression and a severe suicide attempt.

## 1. Introduction

The SARS-CoV-2 received global recognition in 2020, with unbridled transmission escalating to pandemic status within months of recognition of the index case. Clinicians and scientists are still attempting to characterize the complexity of the disease and identify potential post-acute sequelae (PASC). The PASC often result in neurological, cardiovascular, gastrointestinal, endocrine, dermatological, as well as less recognized, psychiatric manifestations. SARS-CoV-2 uses ACE2 to invade the host, which may partially explain the multi-systemic nature of the illness. (Gupta et al., 2020; Beyersstedt et al., 2021)

Multiple neurological and psychiatric manifestations have been associated with the COVID-19 infection, with research showing an increased incidence of cognitive deficits, depression, anxiety, insomnia and even psychosis on outpatient follow up in COVID-19 survivors (Taquet et al., 2021). Many of the cytokines which are activated in COVID-19 appear to be associated with major depression and anxiety (e.g. IL-1B, IL-6, TNF- $\alpha$ ) (Amruta et al., 2021). In addition, the psychosocial stressors of the pandemic may contribute to depression and suicidal ideation. [Fig. 1.1]

The neurologic manifestations which have been most commonly identified are intracranial hemorrhage, ischemic stroke, and Parkinson's disease. Additionally, some recent studies have described tinnitus as a feature of PASC. (Taquet et al., 2021; Chirakkal et al., 2021; Jeong et al., 2021) Direct infection of the ear has been implicated in the development of audio-vestibular sequelae from COVID-19. (Jeong et al., 2021)

## 2. Case report

Mr. R is a 63 year old male with no past psychiatric history who was admitted to the psychiatry inpatient service in December 2021 after medical stabilization following an overdose on his prescribed medication and subsequent self-inflicted stab wounds with suicidal intent in the context of debilitating COVID-19 sequelae.

### 2.1. Background

Mr. R. had been diagnosed with COVID-19 infection in February 2021. He developed constitutional symptoms with an upper respiratory tract illness which led to a brief hospitalization and monoclonal antibody treatment. Additional information about the course of his illness and resultant medical treatment was not available as treatment occurred at a different hospital. His upper respiratory symptoms resolved but he continued to experience headaches, fatigue, memory difficulties and tinnitus.

In the following months, Mr. R experienced waxing and waning cognitive issues, "brain fog", difficulty with sustained attention, low mood, disruptive tinnitus and fatigue. Additionally, memory lapses resulted in missed pain medication doses and recurrent back pain. Further compounding his medical symptoms, the tinnitus interfered with his sleep.

He saw his primary care provider and ENT specialist for fatigue and tinnitus which led to an audiometric evaluation. He was informed that

\* Corresponding author: 1051 Riverside Drive, NY 10032, United States.

E-mail address: [ak4923@cumc.columbia.edu](mailto:ak4923@cumc.columbia.edu) (A. Khan).



Fig. 1.1. Etiology of depression in the context of COVID-19.

tinnitus has been reported amongst several COVID-19 survivors but that no intervention was required in his case. However, considering the debilitating impact his symptoms had upon his sleep, he was given a prescription for Zolpidem for insomnia by his primary care provider. He did not see a psychiatrist during this time. His-PASC and reemergent back pain ultimately led Mr. R to experience intermittent suicidal ideation without any actual plan or intent. He did not verbalize these thoughts to his family, nor seek any mental health treatment. Ultimately, his suicidal ideation persisted and likely increased in frequency and intensity.

On the day of his overdose (11/25/2021), he reported that his insomnia had resulted in significant sleep deprivation which contributed to him “impulsively” overdosing on Tramadol and Zolpidem. Though he was unable to remember the exact amount of medication he took; previous non-compliance had allowed him to accumulate medication. He traveled by train to his hometown 30 min away, went to a deserted park, and waited for the medication to end his life. The medication did not cause symptoms, and when he began to feel that the overdose would not be lethal, he stabbed himself multiple times in the chest and abdomen. He also mentioned that it was getting darker by this time and that he was hoping that the coyotes would “finish the job”.

Mr. R was found in the park and was brought into the hospital via an ambulance.

## 2.2. Clinical course during hospitalization

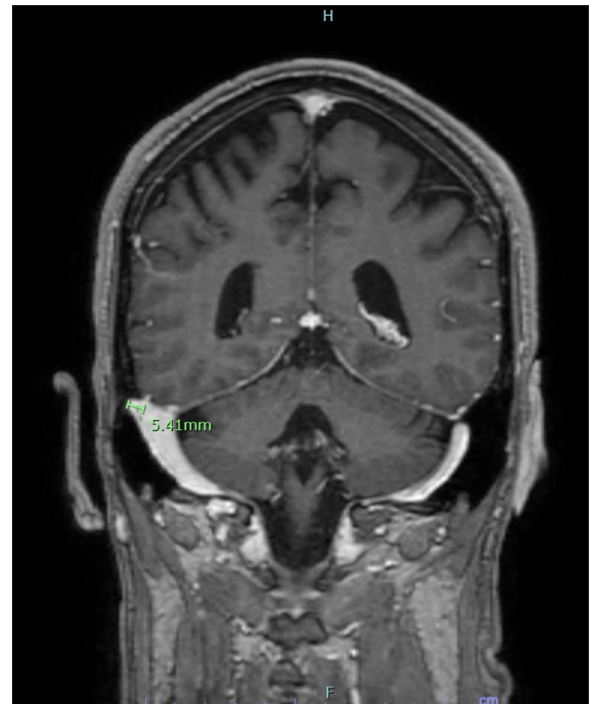
Mr. R presented to the ED with 5 thoraco-abdominal stab wounds ranging from 1.5 cm to 2.5 cm and multiple wrist lacerations. He underwent an exploratory laparotomy which did not demonstrate organ damage but required a pericardial window as a result of fluid identified on echocardiogram.

On psychiatric consultation, he expressed relief at having survived, and maintained that the suicide attempt was a “mistake” throughout his assessments. Evaluators noted that the patient had somewhat of a tendency to minimize his complaints. He admitted to experiencing some mood disturbance, loss of interest, chronic pain, insomnia and hopelessness but denied the persistence of suicidal thoughts after hospitalization. He was initially reluctant to consider medication for his mood symptoms.

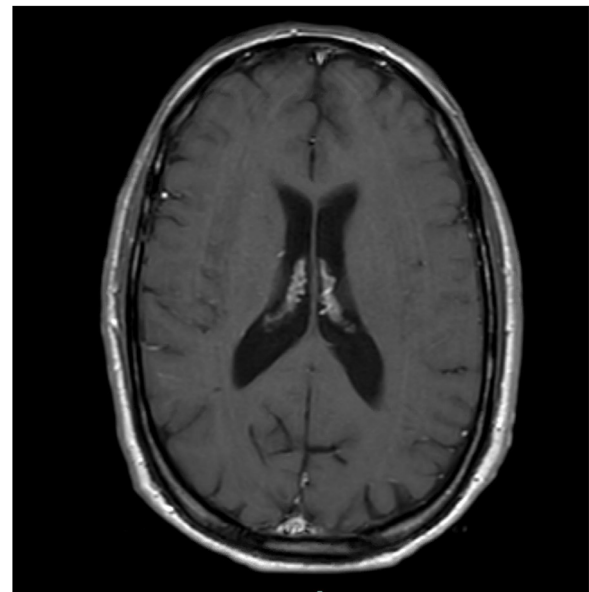
Otorhinolaryngology consult noted an isolated symptom of non-pulsatile tinnitus which was typically bilateral but occasionally localized to the right ear. Upon examination, the bilateral auditory canals were clear and the tympanic membranes were clear and intact in both ears. Weber’s test was midline, while Rinne  $A > B$ . As a result, a routine MRI brain with visualization for the internal auditory canal was recommended.

Mr. R was transferred to the psychiatry service for further management. Serotonin and norepinephrine re-uptake inhibitor (SNRI) was considered in addition to other interventions. After continued psychoeducation and explanation of its positive effects on neuropathic pain, Mr. R consented to Duloxetine, which was started at 20 mg twice daily and eventually increased to three times per day.

MRI of the brain with an internal auditory canal protocol was performed on 12/2/2021. Internal auditory canal visualization did not show any masses suggestive of schwannoma but revealed a 4 to 5 mm laterally directed outpouching of the right sigmoid sinus, which was po-



a) MRI coronal section showing a 5 mm out-pouching of the right sigmoid sinus.



b) MRI C+ showing hypoattenuation of sulci suggestive of volume loss.

Fig. 1.2. a) MRI coronal section showing a 5 mm out-pouching of the right sigmoid sinus. b) MRI C+ showing hypoattenuation of sulci suggestive of volume loss.

tentially a small diverticulum. [Fig. 1.2a] The attenuation of sulci also indicated volume loss [Fig. 1.2b]

Self-report scales for depression and anxiety as well as a fatigue severity score were administered. The PHQ- 9 for depressive symptoms was reported as 4 (No self-reported depression as mild depression  $>5$  score) (Kroenke et al., 2001). The GAD-7 for anxiety was reported at 5 (mild anxiety) (Spitzer et al., 2006) and Fatigue Severity Scale was 34 (Borderline for fatigue) (Krupp et al., 1989).

MoCA scores were 28–29 out of 30 indicating no significant decline in cognitive functioning (Davis et al., 29).

As his psychiatric hospitalization progressed, Mr. R. continued to deny mood disturbance and reported a complete remission of his suicidal ideation, despite continued insomnia. He also felt Duloxetine was effective in the management of his tinnitus.

Based on a review of the available literature, Gabapentin was offered to the patient for COVID-19 associated tinnitus, and he agreed to consider it on an outpatient basis. (Chirakkal et al., 2021) Family supports were employed as there was concern for minimization of psychiatric symptoms considering his prior potentially lethal suicide attempt. He was also given the option of cognitive therapy which he agreed to consider.

Mr. R. was discharged to the community with outpatient psychiatric, neurological and ENT follow up.

### 3. Discussion

SARS-CoV has an established impact on the respiratory and circulatory system and there is an emergent focus on identifying long-term medical sequelae. However, the presence of neuropsychiatric symptoms and the impact of the prolonged cognitive sequelae may be overlooked on outpatient assessments. In the above case, we highlight how multifaceted experiences of the illness and its sequelae resulted in a cumulative impact on the quality of life of an individual to the extent that someone with no previous psychiatric illness and strong community support, developed severe major depressive disorder.

From an audiometric perspective, SARS-CoV has been implicated in direct invasion of the vestibulo-cochlear structures due to expression of ACE2 receptors and TMPRSS2 and FURIN co-factors by the hair cells of the vestibular and cochlear organoids (Jeong et al., 2021). Similarly, SARS-CoV has been identified within the mastoid cells and middle ear upon autopsy of patients who died of COVID-19 (Jeong et al., 2021). Mouse models have also suggested viral invasion of the olfactory bulb resulting in neuronal atrophy (Han et al., 2021; Li et al., 2020). There appears to be a need to recognize new onset vestibulo-cochlear symptoms in individuals recovering from COVID-19, in order to identify potential medical interventions.

It is useful to note that there are several complicated psychosocial nuances to the acute illness of COVID-19, especially when individuals suffer periods of isolation and other adverse life events. These factors may contribute to negative affectivity and anhedonia generated by post-traumatic symptoms. (Farooqi et al., 2022; Costanza et al., 13) From the neurological perspective, tinnitus itself has also been implicated in development of depression and consequentially suicidal thoughts in certain individuals (Lugo et al., 2019).

Taken together, there are multiple negative interactions, psychosocial factors and potentially chronic medical symptoms, which result in depressive syndromes and suicidal behavior. [Fig. 1.1]

### 4. Conclusion

SARS-CoV-2 has a multitude of potential neuropsychiatric sequelae that includes “brain fog”, insomnia, depression, headaches and vestibular symptoms. There is an emergent need for screening for psychiatric and cognitive co-morbidity on outpatient follow of COVID-19 survivors. Further research into the factors contributing to post-COVID-19 neuropsychiatric sequelae is needed in order to elucidate these mechanisms in the hope of establishing proper prevention and management of these symptoms. Antidepressants with a positive effect on neuropathic pain may be especially helpful in patients with co-morbid pain syndromes. In the above case, the use of Duloxetine, a serotonin and norepinephrine

re-uptake inhibitor led to remission of mood symptoms, as well as partial relief of pain and tinnitus. Future research utilizing randomized controlled trials with medications such as Duloxetine may have utility determining treatment recommendations.

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### Consent

Written informed consent was obtained from the patient for publication

### Declaration of Competing Interests

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