

Tinnitus in COVID-19 Patients: Our Experiences at an Eastern Indian Tertiary Care Teaching Hospital

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Abstract

Background: Tinnitus is a common otologic symptom found in the outpatient department of otolaryngology. Patients with COVID-19 infection have complained of tinnitus. However, in the present COVID-19 epidemic, it has received little attention. **Objective:** The goal of this study was to see how common tinnitus was among COVID-19 patients in a tertiary care teaching hospital. **Materials and Methods:** This is a prospective study that looked at 28 COVID-19 participants who had tinnitus. COVID-19 infection was confirmed in all of them using a nasopharyngeal swab reverse transcription-polymerase chain reaction (RT-PCR). The detailed history-taking clinical examination of the ear was done for the assessment of tinnitus and its outcome was analyzed. **Results:** There were 28 COVID-19 patients presented with tinnitus out of 212 patients infected with severe acute respiratory syndrome coronavirus-2. There were 16 (57.14%) men and 12 (42.85%) women out of 28 COVID-19 patients with tinnitus, with a male-to-female ratio of 1.33:1. Seven (25%) of the 28 patients had hearing loss, whereas 4 (14.28%) had balance issues. Out of 28 patients, 5 (17.85%) had symptoms of migraine. **Conclusion:** This study shows that COVID-19 patients may be affected by subjective otoneurological symptoms like tinnitus. Tinnitus is more common in male COVID-19 patients than in female. The associated symptoms of hearing impairment and balance issues should be anticipated along with tinnitus. More research is needed to figure out the specific pathophysiological process that causes this subjective ringing sensation in COVID-19 patients.

Keywords: Cochleovestibular symptoms, COVID-19, severe acute respiratory syndrome coronavirus-2, tinnitus

INTRODUCTION

COVID-19 infection is a highly contagious disease caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2).^[1] COVID-19 patients' clinical manifestations include fever, body soreness, cough, loss of smell, and taste abnormalities, as well as moderate respiratory symptoms to acute respiratory distress syndrome.^[1] COVID-19 patients may also present with neurological manifestations along with respiratory problems. The neurological symptoms may be found in approximately 30% of COVID-19 patients.^[2] The neurotropic nature of SARS-CoV-2 is still being investigated. Neurologic manifestations such as headache, impaired consciousness, and dizziness have been reported in COVID-19 patients.^[3] Olfactory and taste disturbances are two neurological manifestations found in COVID-19 patients.^[4] In addition to the variety of clinical symptoms, some COVID-19 patients present neuro-otological manifestations such as dizziness, tinnitus, and otalgia.^[5] Although tinnitus is a common clinical

symptom encountered in the outpatient department of otorhinolaryngology and often is due to otological etiology, also reported in a few cases of COVID-19 patients.^[6] Persistent tinnitus in patient results in a disturbing quality of life and often hinders the routine work of an individual.^[7] Although there is increasing evidence of neurological manifestations in COVID-19 infection, a neuro-otological symptom like tinnitus has been only partially investigated in the present pandemic. The aim of this study was to evaluate tinnitus among COVID-19 patients in a tertiary care teaching hospital.

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MATERIALS AND METHODS

This is a prospective study conducted at a tertiary care teaching hospital between November 2020 and December 2021. This study was approved by the Institutional Ethical Committee (IEC) with reference number IEC/IMS/SOAU//26/12.04.2020. The patients who recovered from proven COVID-19 infection and complaining of tinnitus were enrolled in this study. Patients having a positive nasopharyngeal swab for SARS-CoV-2, independent of illness severity or need for oxygen support during therapy, were included in this research. The recovery was defined as a negative report of RT-PCR. The patients who participated in this study were above the age of 18 years. COVID-19 patients with subjective hearing loss in at least one ear, hospitalization in an intensive care unit due to severe SARS-CoV-2 infection, history of acoustic trauma or prolonged noise exposure, presence of known audiological diseases before the diagnosis of COVID-19 infection or previous surgery, psychiatric disorder, cardiovascular diseases, or circulatory comorbidities were all excluded from the study. All the enrolled patients have signed their written informed consent for this study. All participants had a thorough medical examination, with pertinent information such as age, sex, duration, the severity of COVID-19 infection, and isolation/treatment location being recorded. All participants gave their informed consent to participate in this study and to the use of anonymized data from their survey replies [Table 1]. The risk factors such as diabetes mellitus, hypertension, and any steroid taken by the patient during the treatment period were documented. All participants were also asked about any loss of smell and taste sensation during or after treatment of COVID-19 infections. Otoscopic examinations and tuning fork tests for hearing assessment of the participants were done with the use of appropriate protective measures. Magnetic resonance imaging (MRI) was done in all cases with unilateral tinnitus to rule out any cerebellopontine angle lesions.

Statistical Packages for the Social Sciences (SPSS), version 20, SPSS Inc., Chicago, IL, USA, was used for the statistical analysis.

RESULTS

In this study, 212 patients with positive nasopharyngeal/oropharyngeal swabs for SARS-CoV-2 were included in the study. Out of 212 patients, 28 (13.20%) presented with subjective tinnitus. The age range of the COVID-19 patients with tinnitus was 18–72 years with a mean age of 48.16 years (standard deviation [SD] ± 12 ; median 49). Out of 28 COVID-19 patients with tinnitus, 16 (57.14%) males and 12 (42.85%) females with a male-to-female ratio of 1.33:1. Out of 28 COVID-19 patients with tinnitus, 9 (32.14%) had diabetes mellitus and 5 (17.85%) had hypertension. Out of 28 COVID-19 patients with tinnitus, 11 (39.28%) had taken steroids during the treatment period of COVID-19 infection [Table 2]. There were 13 (46.42%) patients who developed the decreased sensation of smell and 12 (42.85%) had decreased taste sensation out of 28 COVID-19 patients

Table 1: Questionnaire for evaluation tinnitus among COVID-19 patients

Questionnaire	Response
Have you ever experienced tinnitus before COVID-19 diagnosis?	Yes/no
Have you started experiencing tinnitus after diagnosis of COVID-19 infection	Yes/no
Specify the characteristic of your tinnitus	Occasional/continuous floating/persistent, pulsatile/continuous
Along with tinnitus, you have hearing loss?	Yes/no
Along with tinnitus, you have balance problem?	Yes/no
Do you suffer from migraine?	Yes/no
Indicate the severity of your tinnitus?	0-10 score

Table 2: Clinical profile of COVID-19 patients with tinnitus

Clinical profile	n=28, n (%)
Male patients	16 (57.14)
Female patient	12 (42.85)
Recurrent tinnitus	18 (64.28)
Occasional/sporadic tinnitus	10 (35.71)
Tinnitus with hearing loss	7 (25)
Tinnitus with balance disorder	4 (14.28)
Tinnitus with migraine	5 (17.85)
Patients taking steroids during treatment	11 (39.28)
Patients with diabetes mellitus	9 (32.14)
Patient with hypertension	5 (17.85)
Smell disorder	13 (46.42)
Taste disorder	12 (42.85)
Anxiety and depression	6 (21.42)
Characteristic of tinnitus	
Tinnitus of fluctuating intensity	12 (42.85)
Persistent but with changing intensity	10 (35.71)
Persistent with the same tinnitus	4 (14.28)
Pulsatile tinnitus	2 (7.14)
Tinnitus in both ears	25 (89.28)
Tinnitus in one ear	3 (10.71)

with tinnitus. There were 18 (64.28%) patients who described tinnitus as recurrent, whereas 10 (35.71%) patients presented with occasional or sporadic [Table 2]. There were 25 (89.28%) patients presented with tinnitus in both ears, whereas 3 (10.71%) of them presented with tinnitus in one ear. MRI scan of the brain was done in three patients those presented with unilateral tinnitus and showed normal findings. Out of 28 patients, 12 (42.85%) described tinnitus of fluctuating intensity in nature, 10 (35.71%) described persistently but with changing intensity in nature, 4 (14.28%) described continuous with the same intensity, and 2 (7.14%) described the pulsatile type of tinnitus [Table 2]. Out of 28 patients, 7 (25%) presented with hearing loss confirmed by pure-tone audiometry and 4 (14.28%) with a balance disorder. Out of 28 patients, 5 (17.85%) had symptoms of migraine. Out of 28 patients with COVID-19 infections, 6 (21.42%) had developed anxiety and depression during isolation at the time of treatment.

DISCUSSION

Tinnitus has a major impact on the patient's quality of life.^[8] Viral infections often cause sensorineural hearing loss and tinnitus, majority of them typically involve/damage the hair cells of the inner ear; however, some of them can involve the auditory brainstem.^[9] COVID-19 infections are reported to be associated with otoneurological manifestations such as tinnitus and balance disorders.^[10] The neurotrophic and neuroinvasive nature are the typical features of SARS-CoV-2 [Figure 1].^[11] One study showed brain involvement by coronavirus infection results in possible neuro-auditory impairment.^[12] The SARS-CoV-2 infection may directly involve the central nervous system or result in vascular injury causing vasculitis similar to the mechanism for varicella-zoster virus and human immunodeficiency virus (HIV).^[12] The vasculopathy of the SARS-CoV-2 infection can be a direct feature of hypercoagulability.^[13] COVID-19 infection causes damage to the cochlear outer hair cells, according to a study.^[14,15] Direct viral damage of the organ of corti, stria vascularis, or spiral ganglion, injury mediated by the patient's immune system against virally expressed proteins (cytomegalovirus), and immunocompromise resulting in secondary bacterial infection of the ear are some of the mechanisms behind damage to the peripheral auditory system, such as the cochlea (measles and HIV).^[16]

The involvement of the cochleovestibular system by SARS-CoV-2 and stress in the current COVID-19 pandemic results in cochlear symptoms like tinnitus.^[17] Because the COVID-19 pandemic is predicted to last longer, the health, social, and emotional consequences are likely to persist. COVID-19 individuals who are socially isolated, lonely, and have poor sleep are at the greatest risk of acquiring tinnitus. Patients with tinnitus frequently complain that health-care providers ignore them because they do not comprehend the problems that come with tinnitus and hearing loss.^[18] Tinnitus

is substantially more troublesome for females and younger age groups under the age of 50 years during the COVID-19 pandemic.^[9] In this study, 57.14% of males and 42.85% of females with COVID-19 infections were suffered from tinnitus. The age range of the COVID-19 patients with tinnitus was 18–72 years with a mean age of 48.16 (SD $\pm$ 12; median 49) in this study.

Some COVID-19 patients present with olfactory dysfunction and taste dysfunction along with the presence of tinnitus due to the common mechanism of the neuroinvasive nature of SARS-CoV-2. In this study, 46.42% of COVID-19 patients with tinnitus presented with olfactory dysfunction, and 42.85% of COVID-19 patients with tinnitus presented with taste disorders. The factors which exacerbate tinnitus include self-isolation, experiencing loneliness, poor sleep, and reduced levels of physical exercise.^[19] Anxiety, depression, irritability, and financial worries during the pandemic period further contribute to more bothersome tinnitus.^[20] In this study, 21.42% of patients of COVID-19 patients with tinnitus had developed anxiety and depression during the isolation period. Although not always found, several patients manifested with tinnitus and deafness, with unilateral sensorineural hearing loss being the most commonly reported.^[9] The auditory symptoms in COVID-19 patients were documented to resolve in some patients and persisted for 6–7 months in COVID-19 patients by others.^[21] In this study, tinnitus of fluctuating intensity was found in 42.85% of COVID-19 patients with tinnitus, whereas persistent but changing intensity was found in 35.71% of cases.

The important diagnostic element of the patient with tinnitus is often medical history data.

As survivors of COVID-19 patients who were managed by ototoxic medicines such as chloroquine or hydroxychloroquine, a thorough history should be taken, as these treatments have been linked to an increased risk of deafness, tinnitus, and vertigo.^[22] Hearing difficulties, such as the onset or development of tinnitus, should be observed in COVID-19 patients. Detail audiological assessments are needed for patients with tinnitus which include tuning fork test, pure-tone audiometry, and tympanometry.^[23] Pure-tone audiometry testing and tympanometry by an audiologist in a soundproof room are helpful to rule out any hearing loss and tinnitus. In this study, 25% of COVID-19 patients with tinnitus presented with hearing loss. In the current pandemic, pure-tone audiometry and tympanometry should be performed with all safety measures for COVID-19. Tympanometry is done to assess the middle ear pathology and Eustachian tube function. Otoacoustic emissions (OAEs) are the kind of energy generated by cochlear outer hair cells. Spontaneous OAEs are usually recordable in the absence of deliberate external acoustic stimulation.^[23a] TEOAEs are noninvasive and simple to carry out. This test needs lesser time, lesser cost, and higher sensitivity.^[24] TEOAE may exhibit a reduction in amplitude, indicating a modest degradation of the cochlea's outer hair cell

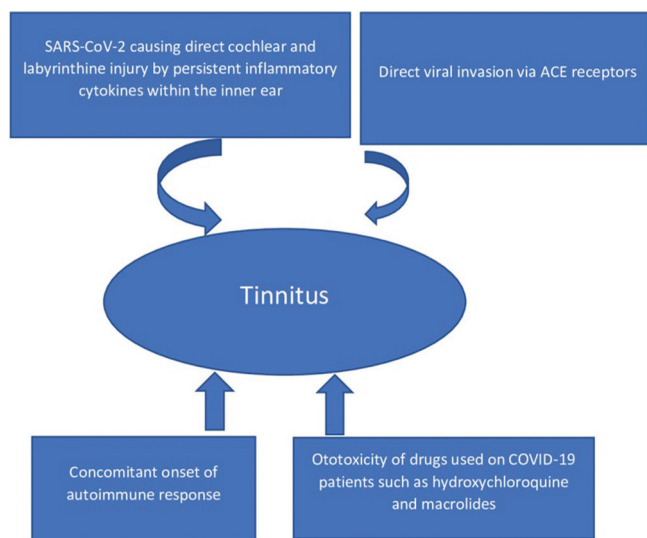


Figure 1: Mechanism of SARS-CoV-2-induced tinnitus. SARS-CoV-2: Severe acute respiratory syndrome coronavirus-2

functioning. COVID-19 infection has a negative impact on the outer hair cells of the cochlea, which affects the pure-tone audiogram low-frequency threshold as well as TEOAE and DPOAE low-frequency amplitudes. Decreased amplitude of TEOAEs and DPOAEs indicates damaged outer hair cells of the cochlea. To rule out any lesions in the brain and inner ear, MRI can be used. In this study, 10.71% of patients presented with tinnitus in one ear. MRI scan of the brain was done in these patients those presented with unilateral tinnitus and showed normal findings.

The most effective therapy for COVID-19 infections is still being researched urgently. It is always challenging for the clinician to identify the etiology of COVID-19 infections for cochleovestibular symptoms such as tinnitus and start appropriate treatment to get maximum clinical recovery. Evaluation for diabetes mellitus, hypertension, lipid profile, thyroid function tests, allergies, and variables that cause tinnitus, such as stress, coffee, aspirin, and nicotine use, must all be considered and controlled while treating tinnitus.^[25] In this study, 32.14% of patients with COVID-19 infections were associated with diabetes mellitus, and 17.85% of them were associated with hypertension. Pharmacological treatments such as lidocaine, antidepressants, benzodiazepines, and caroverine are tried and given some benefits for managing tinnitus. Ginkgo Biloba is also a common alternative medicine prescribed by several clinicians for the treatment of tinnitus.^[26] Tinnitus retraining therapy (TRT), masking, amplification, and minimizing triggering substances, as well as environmental variables, are among nonpharmacological therapeutic alternatives. Masking is a technique that uses an external sound to cover or partially conceal tinnitus. TRT is more successful than masking since it involves counseling and sound generator therapy.^[8]

CONCLUSION

There is growing evidence of otologic symptom disorders like tinnitus as part of clinical manifestations of COVID-19 infection. Tinnitus in COVID-19 infection has been described as neurotrophic and neuroinvasive capabilities of the SARS-CoV-2 virus. Recurrent tinnitus is more commonly found in this study. In many cases of COVID-19 patients with tinnitus, they were associated with comorbidities such as diabetes mellitus and hypertension. More research is needed to fully comprehend tinnitus in patients with SARS-CoV-2 infection and the persistence of this clinical entity long after infection, as well as a high-quality study with a large sample size to look at the impact of COVID-19 infections on the audiovestibular component.

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Conflicts of interest

There are no conflicts of interest.

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