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Could sudden sensorineural hearing loss be the sole manifestation of COVID-19? An investigation into SARS-COV-2 in the etiology of sudden sensorineural hearing loss

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ABSTRACT

Objective: The aim of this study is to investigate the presence of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) in patients presenting with only sudden sensorineural hearing loss (SSNHL) during the pandemic.

Methods: The study included 5 male patients who presented with the sole complaint of unilateral SSNHL to the otolaryngology outpatient clinic between April 3 and April 12, 2020. The patients were referred to the infectious diseases clinic to be evaluated for SARS-CoV-2 by using real time polymerase chain reaction (RT-PCR) testing.

Results: RT-PCR testing for SARS-CoV-2 were positive in one of the patient and negative in rest four patients. We also noted positive response to Coronavirus Disease-19 (COVID-19) specific treatment in SARS-CoV-2 positive SSNHL patient.

Conclusion: It should be kept in mind that non-specific symptoms such as SSNHL could be the only sign to recognize a COVID-19 case. Awareness of such a non-specific presentation of COVID-19 patients is crucial during this pandemic period for the prevention of infectious spread through isolation and early initiation of COVID-19 targeted treatment.

Keywords: COVID-19; Sudden Sensorineural Hearing Loss, Pandemic, Severe Acute Respiratory Syndrome Coronavirus 2

Highlights

- During the COVID-19 pandemic, it would be important to recognize every possible symptom of the infection to break the chain transmission.
- COVID-19 patients could present with nonspecific symptoms other than the commonly known.
- Sudden sensorineural hearing loss may be one of the symptoms of COVID-19.
- Up to now, there have been no reports of COVID-19 patients diagnosed with isolated sudden sensorineural hearing loss.

INTRODUCTION

Emerged in Wuhan of China, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus responsible for coronavirus disease (COVID-19) has been causing deaths from pneumonia and respiratory
failure, eventually becoming a pandemic. It was identified as a clade of the family of coronaviruses, isolated from human airway epithelial cells (Zhu et al. 2020) and reported as transmitted through droplets and direct contact, with an incubation period of 2-7 days extending up to 14 days (Rubin et al., 2020; Gralinski and Menachery 2020; Duarte et al., 2020; Carlos et al., 2020; Morse et al., 2020). The disease may be asymptomatic in about a third of the cases, accelerating the spread of the disease (Lai et al., 2020; Cao et al., 2020; Wu et al., 2020). The most common symptoms that accompany COVID-19 include fever, cough, sore throat, headache, muscle pain, diarrhea, and dyspnea. During the spread of the infection, nonspecific taste and smell disturbances have also been included in the spectrum of the symptoms (Viara et al., 2020; Mao et al., 2020).

Viruses are known to cause neurological manifestations, such as anosmia, facial paralysis, and sudden sensorineural hearing loss (SSNHL) (Kennedy 2010; Cohen et al., 2014; Mateer et al., 2018). During the previous SARS outbreak, coronaviruses were reported be associated with loss of sense of smell and taste due to neural injury (Haro-Licer et al., 2013; Suzuki et al., 2007). However, to our knowledge, no reports of SSNHL have appeared in the literature associated with the COVID-19 pandemic. Identification of patients presenting with non-specific symptoms during the pandemic may play an important role in breaking the infection chain and reducing the transmission. Given the previous literature data on coronavirus-associated SSNHL, we aimed to investigate the presence of SARS-CoV-2 in patients presenting with only SSNHL during this pandemic.
MATERIALS and METHODS

The study protocol was approved by the Clinical Research Ethics Committee of xxx University (April 9, 2020/0188).

The subjects were eligible for the study if presented with the sole complaint of unilateral sudden hearing loss to the otolaryngology outpatient clinic between April 3 and April 12, 2020.

SSNHL was defined as a hearing loss of more than 30 dB at three consecutive frequencies at least over a period of less than three days (Weiss et al., 2017). Audiological tests confirmed SSNHL in all the patients. The patients were then referred to the infectious diseases clinic to be assessed for SARS-CoV-2. Taking strict precautions in a safety cabinet with disposable isolation gown, N95 masks, gloves, and shields, pharyngeal secretion samples were collected from the oropharynx and then the nasopharynx through direct contact of the synthetic fiber swabs with plastic shafts. The samples were sent to the laboratory for real-time polymerase chain reaction (RT-PCR) test.

RESULTS

We identified five male patients, with a mean age of 40.8 years (range: 29-54 years). Three patients (60%) had SSNHL in the left ear, and two (40%) in the right ear. SSNHL was the only symptom present in all the patients. None of the patients had any other symptoms than SSNHL or any risk factors such as metabolic diseases, ototoxic drug usage, history of trauma, history of upper respiratory tract infections, etc.

On audiologic examination with a tuning fork at a frequency of 512 Hz, the Weber test showed lateralization to the right in patients with left-sided hearing loss and to the left in those with right-sided hearing loss. Tympanometry results were type A for all patients, indicating normal middle ear condition. RT-PCR testing for SARS-CoV-2 were positive in one of the patients (20.0%) and negative in the remaining four patients. Pure tone audiometry findings at 250-500-1000-2000-4000-8000 Hz and RT-PCR results were presented at Table 1.

Due to suspicion of COVID-19, no specific treatment for SSNHL was initiated until RT-PCR test results were acquired. After getting the results, four patients negative for COVID-19 received oral prednisolone 1 mg/kg/day tapered till 16 mg at every three days and oral vitamin B-folic acid complex and proton pump inhibitor daily. The patient positive for COVID-19 received oral hydroxychloroquine 200 mg twice daily for five days in accordance with the republic of Turkey's health ministry COVID-19 guidelines.
Due to home-isolation of patients, early audiologic evaluation after treatment started could not be performed. The hearing status of the patients was inquired by phone. Patient #2 with a positive test result for COVID-19 reported complete resolution of hearing complaints on day 11 of the treatment. Patients #1, #4, and #5 with negative results for COVID-19 reported complete recovery of hearing on day 10, day 11, and day 3 of the treatment, respectively. Patient #3 with a negative test result for COVID-19 reported persistence of his hearing problem on day 11 of the treatment. Control audiologic tests were performed at least 1 month after the treatment and the results were given in the Table 1.

**DISCUSSION**

SARS-CoV-2 emerged in December 2019 and causes a pandemic already with more than one hundred thousand of deaths from acute respiratory failure across the world in a couple of months. While most patients present with the predominant symptoms of fever, cough, sore throat, muscle pain, and respiratory failure, anosmia and taste disorders alone or in combination with the common symptoms were further added to the clinical spectrum of COVID-19 (Vaira et al., 2020; Mao et al., 2020).

Viral infections may involve cranial nerves, leading to SSNHL, peripheral facial paralysis, or smell and taste disorders Kennedy 2010; Cohen et al., 2014; Mateer et al., 2018). The etiological factor for SSNHL was reported to cover many viruses such as herpes simplex virus, human immunodeficiency virus, hepatitis virus, measles virus, rubella virus, mumps virus, Lassa virus, and enteroviruses (Cohen et al., 2014; Mateer et al., 2018).

Three mechanisms have been implicated in the occurrence of SSNHL associated with viral infections: neuritis caused by viral involvement of the cochlear nerves, cochleitis due to viral involvement of the cochlea and perilymphatic tissues, and the stress response resulting from the cross-reaction of the inner ear antigens to viral infections (Wilson 1986). Animal studies of a variety of viruses reported induction hearing loss by direct involvement of the inner ear structures or indirectly via cerebrospinal fluid (Nomura et al., 1985; Esaki et al., 2011; Yun et al., 2015; Cashman et al., 2018).

Our findings suggest the need for RT-PCR testing for SARS-CoV-2 due to high suspicion of neurological involvement of COVID-19 in patients who are presented to otorhinolaryngology outpatient clinics with the sole manifestation of SSNHL during the COVID-19 pandemic. Given the speed at which the infection spreads, it is of paramount that every possible symptom suggestive of the infection needs to be taken into consideration. In our study, one of the patients had a positive RT-PCR test result.
An important consequence of identification of COVID-19 in the aetiology of SSNHL is choosing the right treatment strategy to maximize the clinical recovery and minimise the side effects and complications. Corticosteroids play a key role in the treatment of SSNHL (Hara et al., 2018). On the other hand, for the infection caused by this novel virus, like many other viral infections, the use of corticosteroids could present a risk of increasing the severity of the infection and cause delayed viral clearance (World Health Organization, 2020). Investigating the presence of SARS-CoV-2 in patients with SSNHL complaints and using other alternative treatment methods in COVID-19 positive cases could prevent such undesirable consequences. In our small series, the patient who was diagnosed with COVID-19 was treated with oral hydroxychloroquine 200 mg twice daily for five days and had a complete recovery from SSNHL. The rest of the cases with negative SARS-CoV-2 RT-PCR results were treated using routine therapy that includes corticosteroids. According to the results at least one month after treatment, the patient who had COVID-19, totally recovered. One of the patients with SARS-CoV-2 negative had a complete recovery, while one had a partial recovery. No significant improvement on hearing was observed in two patients (Table 1).

Amongst these cases, three showed complete recovery. No improvement has been observed in the fourth case to this day.

Considering neurological involvement of SARS-CoV-2, there have been several reports addressing many different neurological manifestations, but not SSNHL. Mao et al. (Mao et al., 2020) reported patients who were presented with only nonspecific neurological symptoms such as dizziness, ataxia or stroke without smell or taste disorders, and neuralgia due to peripheral cranial nerve involvement. They emphasized the need for high levels of vigilance and evaluation of neurological manifestations in the context of SARS-CoV-2 for early diagnosis and prevention of the spread of infection through isolation, particularly in super-spreading patients. Our data suggest that the same approach may also apply to those presenting with SSNHL as the sole symptom.

Autopsy seems to represent the only way to provide the definite evidence base for better understanding of the neural impairment caused by the virus. During the previous SARS-CoV and MERS-CoV outbreaks, the studies of cerebrospinal fluid showed the presence of viral nucleic acid and autopsy studies reported neurological involvement (Desforges et al., 2013; Arabi et al., 2017). Similarly, autopsy results of patients with SARS-CoV-2 showed hyperemic and edematous brain tissue with neuronal degeneration (National Health Commission of the People’s Republic of China, 2020).
In our study, we observed COVID-19 in 1 of 5 (20%) patients with SSNHL symptoms with no prior risk factors for hearing loss. This result is important in that it shows that infected patients can also present in clinics with symptoms different from the previously identified ones in the literature. During this pandemic that has been claiming hundreds of thousands of lives, it would be important to recognize every possible symptom of the infection to break the chain transmission. Therefore, even if the sample size is low, our results carry importance for the global public health. To our knowledge, there have been no reports of COVID-19 patients diagnosed with isolated SSNHL. Therefore, our study is the first to bring awareness to the practitioners and researchers to look for SARS-CoV-2 positivity in patients with SSNHL. We hope our study will contribute to the field of Epidemiology and the practice of Otorhinolaryngology by allowing the early detection of these patients, their isolation, the prevention of their infectiousness in the early period, and the early and targeted medical treatment.

**Conclusion**

It should be kept in mind that non-specific symptoms such as SSNHL could be the only sign to recognize COVID-19 cases. Awareness of such a non-specific presentation of COVID-19 patients is crucial during this pandemic period for the prevention of infectious spread through isolation and early initiation of COVID-19 targeted treatment and avoiding potentially harmful standard SSNHL treatment that includes prednisolone.

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Highlights

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Table 1: Pure tone audiometry findings and RT-PCR results in patients with SSNHL

| Case | Sex | Age | Affected side | Right Ear (dB) | Left Ear (dB) |
|------|-----|-----|---------------|----------------|---------------|
|      |     |     |               | Air/Bone       |               |
|      |     |     |               | 250 500 1000 2000 4000 8000 | 250 500 1000 |
| 1    | M   | 41  | Left          | B. T. 20/20- 15/15 15/15 25/20 20/20 10/10 60/60 75/75 60/60 |               |
|      |     |     |               | A. T. 15/15 10/10 10/10 15/10 15/10 10/10 20/20 15/15 15/15 |               |
| 2    | M   | 29  | Right         | B. T. 60/60 50/50 40/40 20/20 10/10 10/10 10/10 10/5 |               |
|      |     |     |               | A. T. 10/10 10/10 10/10 10/10 5/5 5/5 10/10 10/10 5/5 |               |
| 3    | M   | 54  | Right         | B. T. 40/40 35/35 35/35 50/50 80/80 95/95 20/20 15/15 10/10 |               |
|      |     |     |               | A. T. 30/30 35/35 35/35 45/40 70/65 85/85 15/15 15/15 10/10 |               |
| 4    | M   | 45  | Left          | B. T. 20/20 20/20 25/25 25/25 65/65 70/70 40/40 45/45 45/45 |               |
|      |     |     |               | A. T. 10/10 15/15 15/15 15/15 65/65 55/55 15/15 15/15 20/20 |               |
| 5    | M   | 35  | Left          | B. T. 15/10 10/10 5/5 5/5 5/5 10/10 20/20 50/50 75/75 |               |
|      |     |     |               | A. T. 20/20 15/15 5/5 5/5 5/5 10/10 40/40 55/55 60/60 |               |

M: Male; B.T.: before treatment; A.T.: After treatment
