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Chronic Otitis Media and Hearing Loss in Covid Pandemic

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Abstract: ***Introduction: Chronic otitis media (COM) is an inflammatory condition of the middle ear, that commonly leads to some degree of conductive hearing loss. However sensorineural hearing loss (SNHL) is also seen in some cases. Corona Virus-2019 (nCoV-19) is the cause of the recent "COVID-19" pandemic. We planned to determine whether the frequency of sensorineural hearing loss in chronic otitis media patients has shown an increasing trend in the pandemic era. Methods: This is Cross sectional Observational study which included 200 patients who presented to ENT department; Bharati Hospital Pune, India. A detailed history of COM patients was taken, specifically asking for a positive COVID RTPCR test. A pure tone audiogram of all patients was obtained. All data was analysed identifying cases with disproportionate conductive, mixed or SNHL to look for statistical correlation between COVID 19 positivity. Results: Of 124 cases without any H/O COVID-19 infection, 87 (70.2%) had conductive, 33 (26.6%) had mixed and 4 (3.2%) had sensorineural hearing loss. Of 76 cases with the H/O COVID-19 infection, 22 (28.9%) had conductive, 30 (39.5%) had mixed and 24 (31.6%) had sensorineural hearing loss. (P-value<0.05). Conclusion: a) Significantly higher proportion of cases with the H/O COVID-19 infection had higher prevalence of mixed hearing loss (39.5%) compared to group of cases without the H/O COVID-19 infection. b) Significantly higher proportion of cases with the H/O COVID-19 infection had higher prevalence of sensorineural hearing loss (31.6%) compared to group of cases without the H/O COVID-19 infection***

Keywords: Chronic otitis media (COM), Sensorineural hearing loss (SNHL), Covid-19 pandemic, Covid RTPCR

1. Introduction

Chronic otitis media (COM) is an inflammatory condition of the middle ear, characterized usually by chronic otorrhea (i.e., lasting > 6-12 weeks) through a perforation in the tympanic membrane. COM most commonly leads to some degree of conductive hearing loss. However, recurrent ear infections result in diffusion and absorption of toxins and macromolecules into the inner ear and this can lead to sensorineural hearing loss (SNHL)

Corona Virus-2019 (nCoV-19) is the cause of the recent "COVID-19" pandemic. The outbreak emanated from Wuhan, China, in December 2019. The World Health Organization declared the outbreak as a Public Health Emergency of International Concern on January 30 and a pandemic on March 11. The statistics till 10th August 2020 show 2.2 million confirmed cases in Indian Subcontinent with a recovery of 1.5 million patients (68.18%) and demise of 44500 patients (0.02%).The clinical symptoms of this disease may appear upto 2–14 days after exposure (based on the incubation period of COVID-19 virus). These symptoms are numerous and may include fever, sore throat, cough and myalgia. Some patients have reported gastrointestinal symptoms as well. The elderly people with comorbidities are more susceptible to infection and prone to guarded outcomes, due to the development of acute respiratory distress syndrome (ARDS). In some cases neurological symptoms such as sudden loss of smell and taste also was reported.

Sensorineural Hearing Loss (SNHL) is defined as loss of 20 dB or greater in bone conduction values in at least three consecutive frequencies. Some viral infections can cause SNHL that can be congenital or acquired, unilateral or bilateral. COM patients are more vulnerable to entry of viruses into the middle ear cleft through the EAC as well as through the nasopharynx. Viral infections has been proposed as a cause of SNHL through damage of inner ear structures or by precipitating inflammatory responses which then cause this damage. The aim of this study was to determine the frequency of sensorineural hearing loss in chronic otitis media and whether that frequency has shown an increasing trend in the pandemic era.

Aim

To evaluate degree and type of hearing loss in chronic otitis media patients during a pandemic era

Objectives

1) To identify cases with sensorineural or mixed hearing loss by analyzing the data collected from pure tone audiograms
2) To look for statistical correlation between COVID 19 positivity and the hearing loss.
3) To establish, if any, sensorineural toxicity of the virus in COM patients.

2. Materials and Methods

This is Cross sectional Observational study which included the patients who presented to ENT department; Bharati Hospital Pune, India

Study Design: - Cross sectional Observational study

Study Area: -Pune, India

Study Subjects: - The study was conducted on patients of both sex of all age groups presenting to ENT outpatient department; Bharati Hospital Pune after taking a written consent that fulfilled the inclusion criteria.

Sample Size: - 200 cases

Sampling Methods: - Patients above age of 5 years were selected

Study Period: - September 2020 to September 2022

Selection of Patients

Inclusion criteria:

1) All patients aged more than 5 years with COM

Exclusion criteria:

1) History of head trauma or meningitis.
2) H/O previous tympanomastoid surgeries
3) H/O systemic ototoxic drug therapy. (except Hydroxychloroquine)
4) No family history of congenital SNHL.
5) Incomplete Clinical records and Missing audiograms
6) COM with any clinical or Radiological Complication

3. Methodology of Study

A detailed history of the patient was taken, specifically asking for a positive COVID RTPCR test, duration and type of discharge. A thorough ENT examination was carried out.

Following this, the patients' respective pure tone audiograms were obtained. Pure tone audiometry was performed in a soundproof booth by a trained and experienced audiologist.

We will compare the bone conduction values of the diseased ear(s) of all COM patients with standard bone conduction values. Any reduction in Bone Conduction below 20dB in any frequency will be considered as a sensorineural deafness.

All data collected from pure tone audiograms were analyzed identifying cases with disproportionate conductive, mixed or SNHL to look for statistical correlation between COVID 19 positivity and the hearing loss.

Data Analysis: -

Data analysis included following steps.

Step I:

- All responses were tabulated by the investigator using Microsoft-Excel 2017 Software. Graphical representations were made wherever necessary.

Step II:

- Data analysed by using SPSS software version 25.0
- Statistical tools were used were proportions & percentages & other appropriate Statistical tests of significance

4. Observations and Results

The present research was conducted with patients with COM who presented to ENT OPD during Covid pandemic era, to evaluate the degree and type of hearing loss in these patients.

This cross-sectional observational study included a total of two hundred cases and satisfying inclusion/exclusion criteria (mean age 38.50 years, min age-7 years, max age- 75 years) of either genders, who had chronic otitis media (COM) on presentation. Following section shows the detailed statistical analysis along with interpretation and graphical representation of the statistical results on the available data.

Table 1: Distribution of type of hearing loss among the cases studied.

Type of hearing loss	No. of cases	% of cases
Conductive	109	54.5
Mixed	63	31.5
Sensorineural	28	14.0
Total	200	100.0

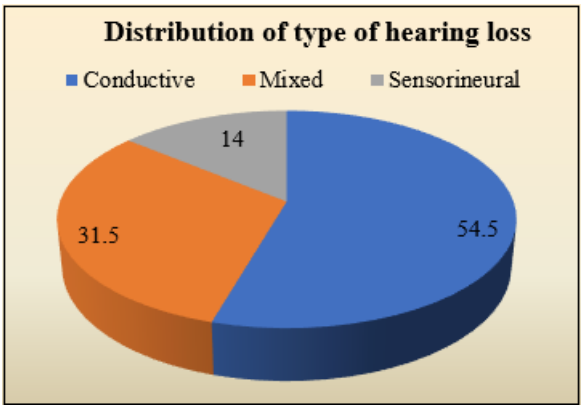

Figure 1: Distribution of type of hearing loss among the cases studied.

1) Distribution of type of hearing loss (Table 1, Figure 1)

Of 200 cases studied, 109 cases (54.5%) had Conductive hearing loss, 63 cases (31.5%) had mixed hearing loss and 28 cases (14.0%) had sensorineural hearing loss in the study group.

Table 2: Distribution of degree hearing loss among the cases studied.

Type of hearing loss	Degree of hearing loss	No. of cases	% of cases
Conductive (n=109)	Mild	60	55.0
	Moderate	45	41.3
	Severe	4	3.7
Mixed (n=63)	Mild	39	61.9
	Moderate	23	36.5
	Severe	1	1.6
Sensorineural (n=28)	Mild	12	42.9
	Moderate	16	57.1
	Severe	0	0.0
Total		200	100.0

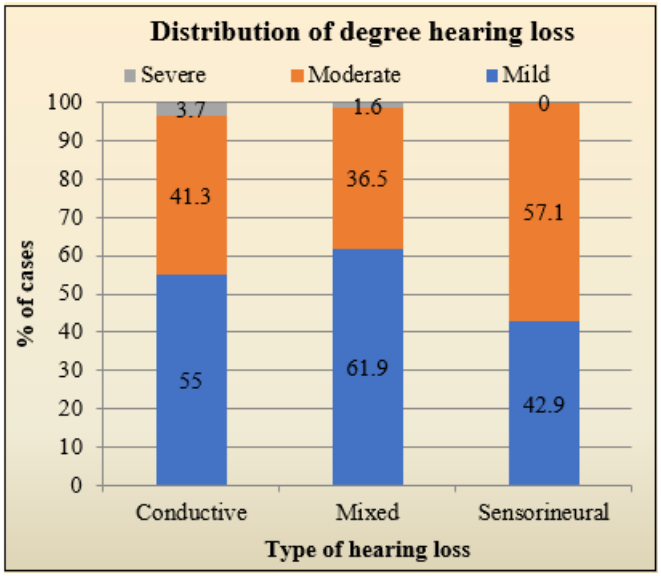

Figure 2: Distribution of degree hearing loss among the cases studied

2) Distribution of degree of hearing loss in each type of hearing loss (Table 2, Figure 2)

Of 109 cases with conductive hearing loss, 60 (55.0%) had mild, 45 (41.3%) had moderate and 4 (3.7%) had severe degree of hearing loss.

Of 63 cases with mixed hearing loss, 39 (61.9%) had mild, 23 (36.5%) had moderate and 1 (1.6%) had severe degree of hearing loss.

Of 63 cases with sensorineural hearing loss, 12 (42.9%) had mild, 16 (57.1%) had moderate and none had severe degree of hearing loss.

Table 3: Distribution of type of hearing loss according to age groups of cases studied.

	Type of hearing loss								
	Conductive (n=109)		Mixed (n=63)		Sensorineural (n=28)		Total (n=200)		P-value
Age group (years)	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	
≤18	7	70.0	3	30.0	0	0.0	10	100.0	0.777^{NS}
19 – 29	21	47.7	17	38.6	6	13.6	44	100.0	
30 – 39	34	57.6	19	32.2	6	10.2	59	100.0	
40 – 49	25	52.1	15	31.3	8	16.7	48	100.0	
50 – 59	15	60.0	5	20.0	5	20.0	25	100.0	
>60	7	50.0	4	28.6	3	21.4	14	100.0	
Total	**109**	**54.5**	**63**	**31.5**	**28**	**14.0**	**200**	**100.0**	
P-value by Chi-square test. P-value<0.05 is considered to be statistically significant. NS –Statistically non-significant.									

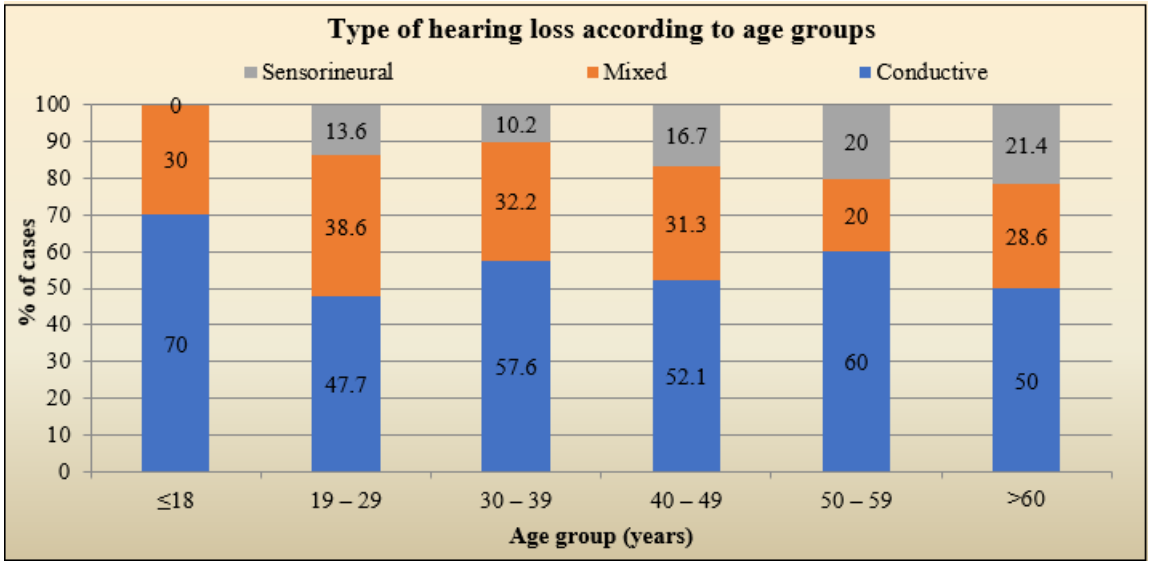

Figure 3: Distribution of type of hearing loss according to age groups of cases studied.

3) Distribution of type of hearing loss according to age groups (Table 3, Figure 3)

Distribution of type of hearing loss did not differ significantly across various age groups of cases studied (P-value>0.05). The mean ± SD of age of cases studied was 38.50 ± 13.36 years and minimum - maximum age range was 7 – 75 years.

Table 4: Distribution of type of hearing loss according to duration of disease among the cases studied.

	Type of hearing loss								
	Conductive (n=109)		Mixed (n=63)		Sensorineural (n=28)		Total (n=200)		P-value
Duration of disease	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	
1 – 5 years	102	54.2	58	30.9	28	14.9	188	100.0	0.326^{NS}
6 – 10 years	7	58.3	5	41.7	0	0.0	12	100.0	
Total	**109**	**54.5**	**63**	**31.5**	**28**	**14.0**	**200**	**100.0**	
P-value by Chi-square test. P-value<0.05 is considered to be statistically significant. NS –Statistically non-significant.									

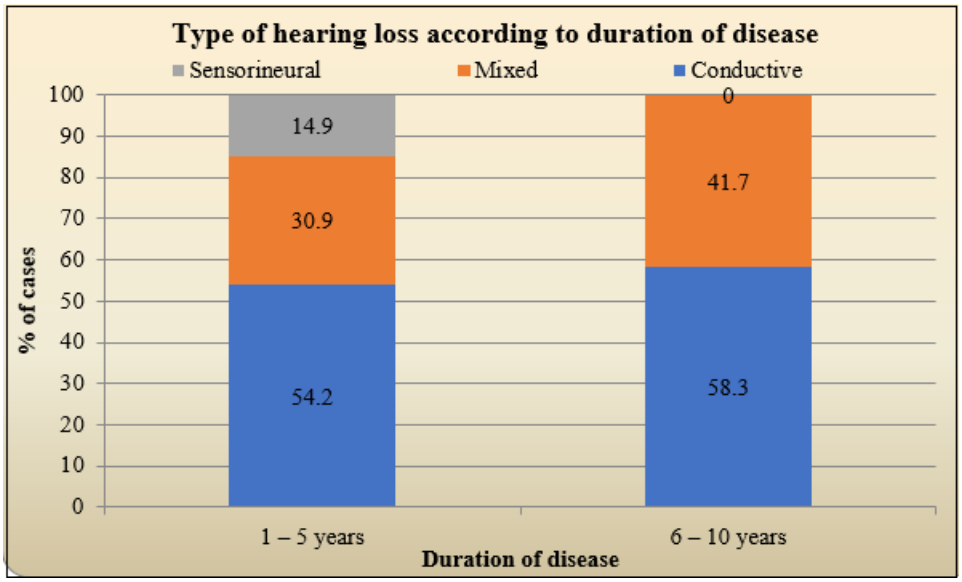

Figure 4: Distribution of type of hearing loss according to duration of disease among the cases studied

4) Distribution of type of hearing loss according to duration of disease (Table 4, Figure 4)

Of 188 cases with duration of disease between 1 – 5 years, 102 (54.2%) had conductive, 58 (30.9%) had mixed and 28 (14.9%) had sensorineural hearing loss.

Of 12 cases with duration of disease between 6 – 10 years, 7 (58.3%) had conductive, 5 (41.7%) had mixed and none had sensorineural hearing loss.

Table 5: Distribution of type of hearing loss according to H/O COVID-19 infection among the cases studied.

	Type of hearing loss								
	Conductive (n=109)		Mixed (n=63)		Sensorineural (n=28)		Total (n=200)		P-value
COVID-19 infection	n	%	n	%	n	%	n	%	
No	87	70.2	33	26.6	4	3.2	124	100.0	0.001***
Yes	22	28.9	30	39.5	24	31.6	76	100.0	
Total	**109**	**54.5**	**63**	**31.5**	**28**	**14.0**	**200**	**100.0**	
P-value by Chi-square test. P-value<0.05 is considered to be statistically significant. ***P-value<0.001.									

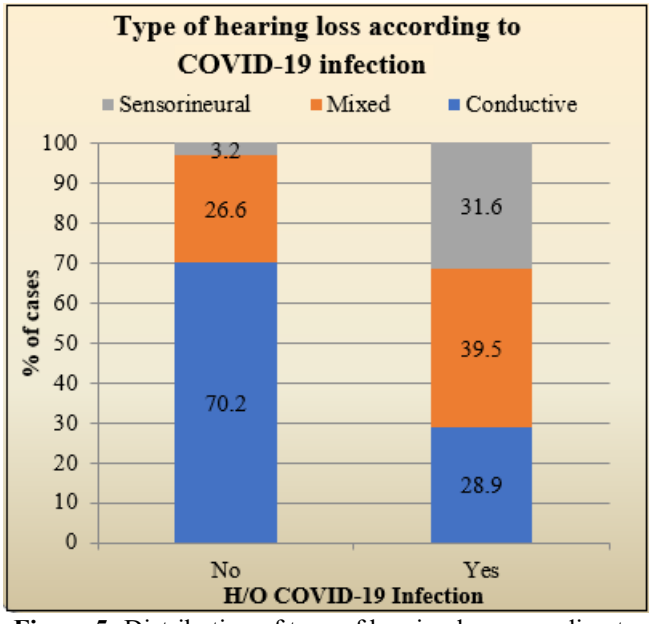

Figure 5: Distribution of type of hearing loss according to H/O COVID-19 infection among the cases studied.

5) Distribution of type of hearing loss according to H/O COVID-19 infection (Table 5, Figure 5)

Of 124 cases without any H/O COVID-19 infection, 87 (70.2%) had conductive, 33 (26.6%) had mixed and 4 (3.2%) had sensorineural hearing loss.

Of 76 cases with the H/O COVID-19 infection, 22 (28.9%) had conductive, 30 (39.5%) had mixed and 24 (31.6%) had sensorineural hearing loss. (P-value<0.05).

5. Discussion

Distribution of type of hearing loss

Of 200 cases studied, 109 cases (54.5%) had Conductive hearing loss, 63 cases (31.5%) had mixed hearing loss and 28 cases (14.0%) had sensorineural hearing loss in the study group. **(Table 1, Figure 1)**

In a similar study by **Paparella et al** in 1984, 607 patients with unilateral CSOM from six centres in different countries across the world were studied and it showed bone conduction impairment of 30db or greater at two frequencies incidences being 11% in Minnesota, 23% in Italy,12% in Finland, 30% in New York and 18% in Sweden. These values are roughly similar to the 31.5% of SNHL among the 200 patients in our study. (1)

Distribution of degree of hearing loss in each type of hearing loss

In the present study, out of 109 cases with conductive hearing loss, 60 (55.0%) had mild, 45 (41.3%) had moderate and 4 (3.7%) had severe degree of hearing loss.

Out of 63 cases with mixed hearing loss, 39 (61.9%) had mild, 23 (36.5%) had moderate and 01 (1.6%) had severe degree of hearing loss.

Out of 28 cases with sensorineural hearing loss, 12 (42.9%) had mild, 16 (57.1%) had moderate and none had severe degree of hearing loss. **(Table 2, Figure 2)**

Distribution of type of hearing loss according to age groups

Distribution of type of hearing loss did not differ significantly across various age groups of cases studied (P-value>0.05). The conductive hearing loss was the most common type of hearing loss across all the age groups of cases studied, though the difference did not reach statistical significance all age groups.

There was no statistical significance in the age distribution of Sensorineural or mixed hearing loss **(Table 3 , Figure 3)**

In a study conducted by Soni et al at a tertiary care hospital in New Delhi, with 60 patients suffering from unilateral mucosal chronic otitis media A statistically significant association between SNHL/Mixed HL was seen in the 40-50-year age group (p-0.004). (2)

Distribution of type of hearing loss according to duration of disease

Distribution of type of hearing loss did not differ significantly between group of cases with duration of disease between 1 – 5 years and group of cases with duration of disease between 6 – 10 years (P-value>0.05). **(Table 4, Figure 4)**

A study undertaken by Khurshid et al showed that duration of disease had no significant association with the type and degree of hearing loss. This correlates with the findings of our own study. (3)

However, in another study by Rana et al conducted with 840 cases of unilateral COM it was seen that comparatively more cases of mucosal disease showed SNHL when the duration of disease was more than 5 years whereas in squamosal disease progression to SNHL happened much quicker. (4)

Distribution of type of hearing loss according to H/O COVID-19 infection

Distribution of type of hearing loss differs significantly between group of cases with H/O COVID-19 infection and group of cases without H/O COVID-19 infection (P-value<0.05).

The Conductive hearing loss was more common (in higher proportion, 70.2%) among the cases without any H/O COVID-19 infection compared to group of cases with H/O COVID-19 infection. Significantly higher proportion of cases with the H/O COVID-19 infection had higher prevalence of mixed hearing loss (39.5%) as compared to group of cases without the H/O COVID-19 infection. Significantly higher proportion of cases with the H/O COVID-19 infection had higher prevalence of sensorineural hearing loss (31.6%) compared to group of cases without the H/O COVID-19 infection. **(Table 5, Figure 5)**

In the past studies association between viral infection sudden sensorineural hearing loss (SSNHL) has been noticed. Inflammation involving the cochlear nerve, cochlea, and perilymphatic tissue, and other components of the auditory pathway as well as cross-reaction between the antigens in the inner ear and virus have all been identified as probable culprit in causing SSNHL. Additionally, indirect transmission of the virus from cerebrospinal fluid to the inner ear structures can also be the cause behind SSNHL. (5)

In a systemic review and meta-analysis performed by **Zahra jafari et al** on 12 final selected articles, the Evidence Ratios (ERs) of hearing loss was collected from 4 of the 12 papers and a random meta analysis was performed with an extent of heterogeneity (i.e., $I^2 = 75.661$, $P = 0.006$). This study reported hearing loss in cases with COVID-19. The total study population was 560, with a varied sample size ranging between 50 and 239. The ER of hearing loss was calculated to 0.031 with a Confidence index (CI) which was between 0.01 and 0.09 (df range was 3, Z: −5.972, P Value ≤ 0.001). This meta-analysis performed on four studies shows that hearing loss has a prevalence rate of 3.10% (CIs: 0.010–0.090) or 3.1% among confirmed cases of COVID-19. This study however mentions that due to low level of evidence the statistical numbers, should be interpreted with utmost precaution (6). The results of our study are in line with the findings to this meta analysis as the prevalence of sensorineural and mixed hearing loss are observed to be higher in patients with history of Covid 19 infection.

6. Conclusion

The study revealed the following points:

- The mean ± SD of age of cases studied was 38.50 ± 13.36 years and minimum - maximum age range was 7 – 75 years.
- Of the 200 cases of COM studied majority had conductive hearing loss (51.5%) followed by mixed hearing loss (31.5%) and sensorineural loss (14%).
- It was observed among the cases with conductive hearing loss and mixed hearing loss majority (55% and 61.9% respectively) had mild hearing loss while among the cases with sensorineural hearing loss majority (57.1%) had moderate hearing loss.
- Distribution of type of hearing loss did not differ significantly across various age groups of cases studied, with conductive hearing loss being the most common across all age groups
- Distribution of type of hearing loss did not differ significantly between group of cases with duration of disease between 1 – 5 years and group of cases with duration of disease between 6 – 10 years
- The Conductive hearing loss was more common (70.2%) among the cases without any H/O COVID-19 infection compared to group of cases with H/O COVID-19 infection
- Significantly higher proportion of cases with the H/O COVID-19 infection had higher prevalence of mixed hearing loss (39.5%) compared to group of cases without the H/O COVID-19 infection.
- Significantly higher proportion of cases with the H/O COVID-19 infection had higher prevalence of sensorineural hearing loss (31.6%) compared to group of cases without the H/O COVID-19 infection

This study was carried out under the Code of Ethics of the World Medical Association (Declaration of Helsinki). Approval was granted by the Ethics Committee/IRB of Bharati Vidyapeeth Deemed to be University, Pune, India

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