

PREVALENCE OF SENSORINEURAL HEARING LOSS AND EVALUATION OF HEARING THRESHOLD IN PATIENTS WITH COPD IN A TERTIARY CARE HOSPITAL

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ABSTRACT

AIM: To evaluate the prevalence of sensorineural hearing loss (SNHL), mean hearing threshold and the frequencies affected in patients with chronic obstructive pulmonary disease (COPD). **METHODOLOGY:** A cross sectional study to evaluate the hearing threshold was conducted on 40 patients within the age group of 35-60 years who were diagnosed with COPD after undergoing Pulmonary Function Test (PFT). Patients who were meeting the inclusion and exclusion criteria and willing to give written informed consent were considered for the study. Thorough history and otological examination was done and these patients were subjected to Pure Tone Audiometry (PTA) for hearing evaluation. They were compared with 40 normal individuals who underwent similar evaluation to compare their audiology profile. **RESULTS:** Sensorineural hearing loss was prevalent in 57.5% of cases and 25% of controls. Mean hearing threshold in COPD patients was found to be 34.5 dB and in controls was 26.8 dB. The most affected frequencies in COPD patients were the high frequencies (2000-8000 Hz). **CONCLUSION:** The study concluded that chronic hypoxemia and inflammatory mechanisms occurs in COPD leading to cochlear dysfunction and the prevalence of SNHL increases with severity of COPD. The study also concluded that higher frequencies (2000 Hz - 8000 Hz) were more affected due to COPD and necessary measures should be taken in the early stages of COPD to prevent the effect of chronic hypoxemia on the auditory system.

KEYWORDS

Chronic Obstructive Pulmonary Disease (COPD), Sensorineural hearing loss (SNHL), Pure Tone Audiometry (PTA), Pulmonary Function Test (PFT), Chronic hypoxemia.

INTRODUCTION:

Chronic obstructive pulmonary disease (COPD) is currently defined as “a preventable and treatable disease with some significant extra pulmonary effects that may contribute to the severity in individual patients. Its pulmonary component is distinguished by an incompletely reversible airflow restriction. Usually progressive, the airflow restriction is linked to noxious inflammatory reaction of the lungs to harmful particles or gases”.¹ Among individuals with chronic illnesses, COPD is currently one of the leading causes of morbidity and mortality.²

According to research from the Global Burden of Disease (GBD), the prevalence of COPD varies from 2% to 5% throughout time.³ The central nervous system is one of the organ systems that can be directly impacted by COPD. Significant deterioration of general cognitive function, particularly verbal memory, is seen in patients with severe COPD.⁴

Hearing loss is a common condition with complex pathophysiology. Hypoxia, a condition in which there is insufficient oxygen available at the tissue level to sustain proper homeostasis, is one of the pertinent pathways for the genesis of sensorineural hearing loss. Numerous animal studies have assessed several pathways demonstrating how hypoxemia can impact the inner ear, and the cochlea needs a high oxygen supply to sustain its function.⁵

COPD is a most common condition seen in daily practice which is proved to have an impact on sensorineural hearing loss. Therefore this study is undertaken to know the prevalence of sensorineural hearing loss in COPD patients, hearing threshold of various stages of COPD, mean hearing threshold of patients with COPD and the common frequencies affected in COPD using PTA.

OBJECTIVES OF THE STUDY:

1. To study the prevalence of sensorineural hearing loss in patients with COPD.
2. To evaluate the hearing threshold in patients with various stages of COPD using PTA.
3. To evaluate the mean hearing threshold in patients diagnosed as COPD compared to controls using PTA.
4. To evaluate the frequencies affected in COPD.

MATERIALS AND METHODS:

With the institutional scientific and ethics board approval, a cross sectional comparative study was carried out on 80 patients (40 cases

and 40 controls) between the age group of 35-60 years, for a duration of 6 months from July 2025 - December 2025, who were willing to give written informed consent and were clinically confirmed cases of COPD. They were further referred to ENT OPD at KVG Medical College and Hospital, Sullia, Dakshina Kannada, Karnataka for evaluation of hearing loss.

Inclusion Criteria:

1. All patients who were diagnosed as COPD after PFT as per “GOLD criteria for severity of airflow obstruction in COPD” in Respiratory medicine and General Medicine department.
2. Patients who were willing to undergo PTA.
3. Both males and females of 35-60 years of age.

Exclusion Criteria:

1. Bedridden patients and patients unable to give their consent (eg, patients with dementia).
2. Patients on ototoxic drugs.
3. Diabetic patients.
4. Patients with pre-existing, long standing pathologies like chronic otitis media (COM), otosclerosis, tympanosclerosis and acoustic neuroma.
5. Patients above 60 years of age as they can have hearing loss due to presbycusis.⁶
6. Patients with occupational noise exposure (equal or above 85 decibels averaged over 8 working hours, or an 8-hour time-weighted average (TWA)).⁷
7. Patients who had undergone prior ear surgeries.
8. Patients not willing to give consent to undergo PFT and PTA.

Patients visiting the Respiratory Medicine and General Medicine OPD in the hospital who were diagnosed as COPD after PFT as per the “GOLD criteria for severity of air flow obstruction in COPD” which is based on forced expiratory volume (FEV1) and post-bronchodilator FEV1/forced vital capacity (FVC) ratio which is < 0.7 were taken into the study meeting the inclusion and exclusion criteria.⁸ The comparable controls included patients according to age and sex without COPD i.e. whose PFT showed FEV1/(FVC) ratio > 0.7 .

GOLD stage	Severity	FEV1/FVC	FEV1% of predicated
GOLD I	Mild COPD	< 0.7	> 80
GOLD II	Moderate COPD	< 0.7	50-80
GOLD III	Severe COPD	< 0.7	30-50
GOLD IV	Very severe COPD	< 0.7	< 30

GOLD: Global initiative for chronic obstructive lung disease,
FEV1: Forced expiratory volume in 1 second, FVC: Forced vital capacity

Detailed history of the patient was taken with respect to age, gender, presenting complaints with duration, associated complaints, past history, family history, personal history and detailed clinical examination was done which included otoscopic examination, tuning fork tests and systemic examinations. PTA was conducted for both the ears and the severity of hearing loss was assessed based on “Hearing loss grades and the International classification of functioning, disability and health”.⁹

Hearing loss	Values in decibel
Normal hearing	0-25 dB HL
Mild hearing loss	26–40 dB HL
Moderate hearing loss	41–55 dB HL
Moderate to severe hearing loss	56–70 dB HL
Severe hearing loss	71–90 dB HL
Profound hearing loss	> 90 dB HL

RESULTS

Total number of patients included in the study was 80 and were equally divided into cases (40) and controls(40).

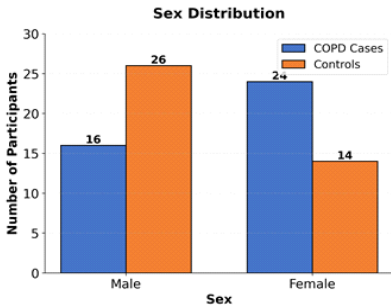


Figure 1: Gender distribution of the study

Among the total number of patients included in the study, there were 16 males and 24 females in the cases group and 26 males and 14 females in the controls group (Figure 1).

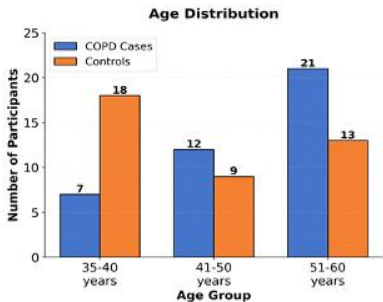


Figure 2: Age distribution of the study

Table 1: Prevalence of hearing loss

Parameter	Hearing Loss Present n (%)	No Hearing Loss n (%)	Total	P-value	95% CI
COPD Cases	23 (57.5%)	17 (42.5%)	40	0.045*	0.2 to 14.6
Controls	10 (25.0%)	30 (75.0%)	40		

Table 2: Prevalence of hearing loss in each severity of copd

Severity of COPD	No of patients	Hearing Loss Present n (%)	No Hearing Loss n (%)	p-value
Mild	16	6 (37.5%)	10 (62.5%)	0.024
Moderate	11	7 (63.6%)	4 (36.4%)	0.156
Severe	7	5 (71.4%)	2 (28.6%)	0.082
Very Severe	6	5 (83.3%)	1 (16.7%)	0.041
Total	40	23	17	

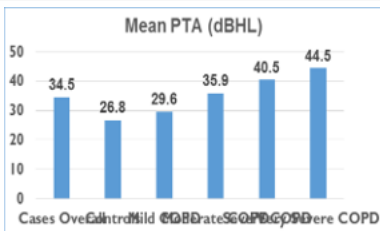


Figure 3: Mean PTA values

Table 3: Depiction of p-value of hearing threshold of each frequency

Frequency (Hz)	COPD Cases (n=40) Mean ± SD (dBHL)	p-value
250 Hz	20.8 ± 12.5	0.38
500 Hz	24.2 ± 13.8	0.29
1000 Hz	28.5 ± 15.2	0.21
2000 Hz	33.6 ± 16.8	0.042*
4000 Hz	40.2 ± 19.5	0.018*
8000 Hz	47.8 ± 21.6	0.008*

DISCUSSION

Upto 600 million individuals worldwide suffer with COPD, an irreversible or persistent airflow obstruction that frequently coexists with comorbidities.² It is widely believed that COPD will rank among the major health issues in the coming decades.¹

Since the transduction process of the cochlea and the transmission of impulses through the auditory conduit are known to depend on blood and tissue oxygenation, any significant oxygenation deficiency can impede the development of auditory nerve impulse generation and transmission at the level of the auditory system, thereby impairing the hearing process.⁶ COPD patients cochlear function is compromised by chronic hypoxaemia because the inner ear is highly dependent on oxygen.⁵

In addition to hypoxaemia, COPD related inflammatory processes have been found to impact hearing. A low-grade systemic inflammation linked to COPD may be connected to other systemic symptoms of the illness. Similarly, the worsening of hearing thresholds in COPD may be related to inflammatory cells or mediators.³

The present study found a significantly high prevalence of hearing loss in COPD patients with 57.5% hearing loss when compared to controls who showed 25% hearing loss with an Odds Ratio = 4.06 (95% CI: 1.63-10.14, p<0.001) which is consistent with similar studies done by Bayat et al., meta-analysis in 2019.²

The study also showed that the prevalence of SNHL increased with severity from mild (37.5%) → moderate (63.6%) → severe (71.4%) → very severe (83.3%) which is consistent with similar studies done by Demirel et al., in 2021.³

The mean threshold worsened with severity of the disease i.e mild (29.6 dBHL) → moderate (35.9 dBHL) → severe (40.5 dBHL) → very severe (44.5 dBHL) which is also congruent with the studies done by Demirel et al., in 2021.³

The most affected frequencies in COPD patients were the high frequencies (2000-8000 Hz), which is in line with the findings of Abdel Dayem et al.¹⁰

CONCLUSION

This study demonstrates a significantly higher prevalence (57.5%) of sensorineural hearing loss in COPD patients when compared to normal individuals and also concluded that the hearing loss worsens with severity of the disease, with the mean hearing threshold values of each severity being elevated. Since the hearing loss is observed at higher frequencies (2000Hz – 8000Hz), it often goes unnoticed by the patients and hence fail to be diagnosed and treated. Therefore routine audiological screening is recommended for COPD patients to identify hearing loss at early stages.

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