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Original Article

Ear, Nose and Throat Section

Audiological Profile of Heavy Vehicle Drivers: A Cross-sectional Study from Southern India

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ABSTRACT

Introduction: Noise-Induced Hearing Loss (NIHL), a permanent sensorineural hearing loss that usually develops undetected until it becomes functionally significant, can result from ongoing exposure over time.

Aim: To ascertain the prevalence of hearing loss and the audiological profile among heavy vehicle drivers in South India.

Materials and Methods: A cross-sectional study was conducted at the Department of ENT, Chettinad Hospital and Research Institute (a tertiary care centre), Chettinad Academy of Research and Education, Kelambakkam, Chennai, Tamil Nadu, India, from September 2024 to February 2025 among 90 participants. The study population consisted of heavy vehicle drivers (e.g., truck, bus, or lorry drivers) aged 18 to 60 years with a minimum of five years of occupational exposure, attending the Ear, Nose and Throat (ENT) Outpatient Department (OPD). Demographic details, local examinations and pure tone audiometry were conducted for all eligible participants and the findings were documented. A paired t-test was applied to find the difference in hearing loss between the left and right ears. A p-value of <0.05 was considered statistically significant.

Results: The overall percentage of hearing loss among the 90 drivers was 26 (28.9%) in their better ear (right ear) and 30 (33.3%) in their left ear. However, at higher frequencies (3000 Hz to 8000 Hz), the mean hearing loss was consistently greater in the left ear compared to the right ear. The differences were statistically significant at 3000 Hz, left ear (30.5 dB) vs. right ear (28.9 dB) (p=0.041); at 4000 Hz, left ear (37.8 dB) vs. right ear (35.2 dB) (p=0.028); at 6000 Hz, left ear (45.1 dB) vs. right ear (42.7 dB) (p=0.015); and at 8000 Hz, left ear (43.9 dB) vs. right ear (40.6 dB) (p=0.008).

Conclusion: There is a significant increase in hearing loss in the left ear compared to the right ear at higher frequencies (≥3000 Hz), indicating that high-frequency hearing may be more affected in the left ear among the study population.

Keywords: Noise-induced hearing loss, Pure tone audiometry, Screening, Sensorineural hearing loss, Truck drivers

INTRODUCTION

A common occupational health concern for people exposed to high levels of industrial and ambient noise is hearing loss [1]. Drivers of heavy vehicles are especially at risk because of extended exposure to engine vibrations, honking, traffic noise and inadequate cabin insulation [2]. One of the most prevalent occupational disorders in this category is Noise-Induced Hearing Loss (NIHL), which is usually bilateral, irreversible and sensorineural, with high frequencies (3000–6000 Hz) being impacted first. This condition is often exacerbated by prolonged exposure to vehicle noise [3]. Among these, the risk of permanent sensorineural hearing impairment is greatly increased by extended exposure to high noise levels, often surpassing 85 dB [4].

The NIHL, a permanent sensorineural hearing loss that usually develops undetected until it becomes functionally significant, can result from this ongoing exposure over time. Long work hours, poor use of hearing protection and restricted access to routine health tests all increase the risk [5]. Cumulative noise exposure is also influenced by work-related factors such as traffic congestion, extended driving hours and lack of sleep. Studies indicate that NIHL impairs the detection of horns and environmental cues, which not only affects communication but also lowers job performance and increases the risk of accidents [6-9].

Given the importance of heavy vehicle transportation to the Indian economy, drivers often operate in hazardous and ergonomically unfavourable environments [10,11]. There is little information available on the prevalence of hearing loss in this occupational category, particularly in South India, despite the high risks involved. Understanding the prevalence of hearing impairment in this population is essential for designing effective workplace interventions, public health policies and preventive measures [12]. Hence, the purpose of the present cross-sectional study is to ascertain the prevalence of hearing loss among heavy vehicle drivers in South India.

MATERIALS AND METHODS

A cross-sectional study was conducted at the Department of ENT, Chettinad Hospital and Research Institute (a tertiary care centre), Chettinad Academy of Research and Education, Kelambakkam, Chennai, Tamil Nadu, India, from September 2024 to February 2025. Institutional Human Ethics Committee approval (IHEC-11/0268/22) was obtained.

Sample size calculation: The required sample size of 90 participants was calculated using Dobson's formula at a 95% confidence interval, with an absolute error of 9% and a 41% prevalence of hearing loss based on the study by Fuente A and Hickson L [13].

Inclusion and Exclusion criteria: The study population comprised heavy vehicle drivers (e.g., truck, bus, or lorry drivers) aged between 18 and 60 years, with a minimum of five years of occupational exposure, attending the ENT Outpatient Department (OPD) at CHRI, Chennai, Tamil Nadu and who were willing to participate in the study. Patients attending the OPD who had a history of recent ear trauma or surgery, a history of ototoxic medication usage, those with neurological and psychiatric disorders, individuals with uncontrolled chronic conditions affecting the ears and pregnant women were excluded from the study.

Study Procedure

Through a simple random sampling technique, the eligible participants were recruited into the study. Demographic details,

local examinations and pure tone audiometry (conducted using the Harp Basic-Plus advanced diagnostic audiometer) were performed by the investigator at the time of enrolment for all eligible participants and the findings were documented. Hearing loss was determined by taking the mean threshold of pure tone in each ear at frequencies of 500, 1000, 2000, 3000, 4000, 6000 and 8000 Hz.

Participants were categorised into four groups according to their level of hearing loss: those with healthy ears (HL <25 dB), those with mild hearing loss (HL >25 dB and ≤40 dB), those with moderate hearing loss (HL >40 dB and ≤60 dB) and those with severe hearing loss (HL >60 dB) [14].

STATISTICAL ANALYSIS

The data collected were entered into a Microsoft Excel spreadsheet and analysed using IBM Statistical Package for Social Sciences (SPSS) version 21.0. Descriptive statistics for categorical variables were expressed in terms of frequency and percentages, while continuous variables were expressed as mean and standard deviation. A paired t-test was applied to determine the difference in hearing loss between the left and right ears. A p-value of <0.05 was considered statistically significant.

RESULTS

The mean age of the study participants was 39.9±8.7 years and the mean duration of occupational exposure was 9.6±3.7 years [Table/Fig-1]. The majority of the study participants did not have hearing loss, whereas only three to four percent of the study population had severe hearing loss [Table/Fig-2]. The difference in mean hearing loss between the right and left ears was statistically significant at 3000 Hz, 4000 Hz, 6000 Hz and 8000 Hz [Table/Fig-3].

Characteristics	n (%)
Age	
18-40 years	56 (62.2)
41-60 years	34 (37.8)
Duration of exposure	
5-10 years	51 (56.7)
≥10 years	39 (43.3)

[Table/Fig-1]: Basic demographic characteristics of the study participants.

Degree of hearing loss	Right ear n (%)	Left ear n (%)
Without hearing loss	64 (71.1)	60 (66.7)
Mild hearing loss	16 (17.8)	19 (21.1)
Moderate hearing loss	6 (6.7)	8 (8.9)
Severe hearing loss	4 (4.4)	3 (3.3)

[Table/Fig-2]: Prevalence of various degrees of hearing loss in right and left ear.

Frequency (Hz)	Hearing loss in right ear (Mean±SD)	Hearing loss in left ear (Mean±SD)	p-value
500	15.4±5.2	16.1±5.4	0.214
1000	18.7±6.1	19.2±6.0	0.345
2000	22.3±7.4	23.0±7.1	0.290
3000	28.9±8.0	30.5±7.8	0.041*
4000	35.2±9.3	37.8±9.1	0.028*
6000	42.7±10.5	45.1±10.1	0.015*
8000	40.6±11.0	43.9±10.8	0.008*

[Table/Fig-3]: Comparison of mean hearing loss (in dB) between right and left ears at different frequencies.
Paired t-test, p<0.05 is statistically significant

DISCUSSION

One known risk factor for sensorineural hearing loss is prolonged exposure to high levels of traffic and vehicle noise, particularly when preventative measures are not regularly employed [14-16]. This statement is supported by the findings of the present study, in which over half of the participants had been exposed to such conditions for more than five years.

A significant percentage of participants had mild to moderate hearing loss and 3-4% had severe hearing impairment; however, the majority (71.1% in the right ear and 66.7% in the left ear) had no detectable hearing loss. These results are consistent with earlier research, which found that different commercial drivers experienced varying prevalence rates of Noise-Induced Hearing Loss (NIHL) (29% to 49%), often influenced by exposure time and the lack of hearing conservation techniques [17-19].

A study by Agarwal S et al., conducted among industrial workers in India showed a 49% prevalence of NIHL [20]. Similarly, studies conducted among public transport drivers in Bengaluru and Chennai reported prevalence rates of 40% and 76.7%, respectively [21]. A global meta-analysis involving 69 studies revealed an overall prevalence of NIHL of 28.8% [22].

Asymmetric exposure patterns, such as drivers being positioned closer to open windows or experiencing traffic noise from specific roads, may explain the greater damage observed in the left ear, as noted in comparable occupational settings [23].

The present findings underscore the necessity of early identification of threshold shifts, regular hearing evaluations for drivers and the implementation of hearing conservation initiatives. Preventing lifelong disability requires actions such as enforcing rest periods, conducting periodic audiometric screening, limiting prolonged exposure, promoting awareness and supporting the use of ear protection along with cabin noise insulation.

The present study paves the way for conducting a prospective cohort study with a larger sample size and a control group of non noise-exposed individuals to track the progression of hearing loss over time and strengthen causal interpretations.

Limitation(s)

The absence of data on the duration of daily noise exposure and the usage of earphones or headphones was not taken into account. As a cross-sectional snapshot, the study does not allow for the assessment of progressive hearing deterioration over time.

CONCLUSION(S)

Heavy vehicle drivers face a serious but little-known occupational risk of hearing loss, particularly at high frequencies. Additionally, collaboration between audiologists, occupational health specialists and transport authorities is essential in developing practical and sustainable interventions.

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