

Audiological Evaluation of Early Noise Induced Hearing Loss in Traffic Police Personnel in a Second Tier City a Community Based One Year Cross Sectional Study

Priyanka Kumari¹, Kishan Kumar², Jay Vardhan³, Rizwan Ahmad⁴, MD. Ozair⁵

¹Senior Resident, Department of ENT, DMCH, Laheriasarai

²Junior Resident, Department of ENT, DMCH, Laheriasarai

³Senior Resident, Department of ENT, DMCH, Laheriasarai

⁴Associate Professor, Department of ENT, DMCH, Laheriasarai

⁵Associate Professor, Department of ENT, DMCH, Laheriasarai

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Corresponding Author: Dr. Kishan Kumar

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Abstract:

Background: Prolonged exposure to high-intensity traffic noise is a major occupational hazard for traffic police personnel, especially in rapidly urbanizing second-tier cities where noise regulation is often inadequate. Chronic exposure may result in noise-induced hearing loss (NIHL), leading to significant morbidity and reduced quality of life.

Objectives: To evaluate the prevalence and pattern of noise-induced hearing loss among traffic police personnel in a second-tier city using standardized audiological assessments, and to identify associated risk factors.

Methods: A community-based, one-year cross-sectional study was conducted among traffic police personnel posted at high-traffic junctions. After obtaining informed consent, participants underwent detailed history-taking, otoscopic examination, and pure tone audiometry (PTA) using a calibrated audiometer in a sound-treated environment. Hearing thresholds were assessed at frequencies ranging from 250 Hz to 8 kHz, with special emphasis on the 3–6 kHz range, typically affected in NIHL. Total 120 traffic police personnel participated in the study. Use of protective measures, comorbidities, and lifestyle habits were collected through a structured questionnaire. Statistical analysis was performed to determine prevalence, severity, and correlates of NIHL.

Conclusion: Noise-induced hearing loss is a significant occupational health issue among traffic police personnel in second-tier cities. Early audiological screening, mandatory use of personal protective devices, and implementation of effective noise-control policies are essential to reduce the burden of NIHL in this high-risk group.

Keywords: Noise-Induced Hearing Loss, Traffic Police, Audiological Evaluation, Occupational Health, Cross-Sectional Study.

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Introduction

Noise-induced hearing loss (NIHL) is one of the most prevalent occupational health hazards worldwide, accounting for a significant proportion of preventable sensorineural hearing impairments. According to the World Health Organization (WHO), exposure to noise levels above 85 dB for prolonged durations can cause irreversible damage to the auditory system. Urban environments, particularly in developing countries, are characterized by increasing vehicular density and poor enforcement of noise regulations, placing traffic police personnel at high risk of NIHL due to continuous exposure to elevated sound levels.

Traffic police are occupationally vulnerable as they are stationed at busy road intersections for

prolonged periods, often without access to protective hearing devices. The noise exposure in these settings frequently exceeds safe limits, with horn use, engine sounds, and heavy vehicular movement contributing to sound levels between 90–110 dB. Chronic exposure to such levels may cause early cochlear damage, particularly affecting the high-frequency range (3–6 kHz), leading to progressive hearing loss if not identified and managed early.

Previous studies have documented a considerable prevalence of NIHL among traffic police in metropolitan cities. However, limited research exists in second-tier cities, where urban growth, traffic congestion, and inadequate occupational safety

measures create a similar yet under-recognized risk environment. Moreover, awareness of NIHL and the consistent use of protective measures remain low among this occupational group, further compounding the problem.

Given the rising urban noise burden and the lack of preventive screening in smaller urban centers, it becomes essential to assess the prevalence and early audiological changes in this high-risk group. This study aims to evaluate noise-induced hearing loss among traffic police personnel in a second-tier city through audiological assessments and to analyze associated risk factors such as duration of service, use of protective devices, and lifestyle variables. Findings from this study will help in formulating targeted preventive strategies and policy recommendations for occupational hearing conservation in this vulnerable workforce.

Materials and Methods

Study Design and Setting: A community-based cross-sectional study was conducted over a period of one year. Department of ENT, DMCH, Darbhanga Bihar. Total 120 among traffic police personnel posted at major road junctions in a second-tier city in India.

Study Population: All traffic police personnel employed in the city and actively engaged in field duties during the study period were considered eligible.

Inclusion criteria:

- Traffic police personnel with at least 1 year of continuous field duty.
- Age between 20–55 years.
- Willingness to provide informed consent.

Exclusion criteria:

- History of pre-existing ear disease (chronic otitis media, otosclerosis, ear surgery).
- Known systemic diseases affecting hearing (e.g., uncontrolled diabetes, hypertension).
- History of ototoxic drug use.
- Recent upper respiratory tract infection at the time of examination.

Data Collection Tools

1. **Structured Questionnaire:** Designed to collect demographic details (age, sex), occupational history (years of service, duty hours), lifestyle factors (smoking, alcohol), and use of protective measures (earplugs, earmuffs).

2. Clinical Examination:

- Otoscopic examination was done to rule out wax, infections, or tympanic membrane abnormalities.
- General health assessment was recorded.

3. Audiological Assessment:

- Pure Tone Audiometry (PTA) was conducted using a calibrated diagnostic audiometer (make/model) in a sound-treated room.
- Air conduction and bone conduction thresholds were measured at frequencies 250 Hz–8 kHz, with special attention to 3, 4, and 6 kHz to identify the “noise notch.”
- Hearing loss was classified based on WHO criteria:
 - Normal: 0–25 dB HL
 - Mild: 26–40 dB HL
 - Moderate: 41–60 dB HL
 - Severe: 61–80 dB HL
 - Profound: >80 dB HL

Outcome Measures: The primary outcome was the prevalence of noise-induced hearing loss among traffic police personnel. Secondary outcomes included severity of hearing loss, laterality (unilateral/bilateral), and associated risk factors.

Ethical Considerations: Approval was obtained from the Institutional Ethics Committee prior to the study. Written informed consent was taken from all participants. Confidentiality and anonymity of the data were ensured. Personnel found to have significant hearing loss were counseled and referred for further management.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using SPSS version. Descriptive statistics (mean, standard deviation, proportions) were used to summarize demographic and clinical data. Chi-square test and Student’s t-test were applied to assess associations between risk factors and hearing loss. Logistic regression was used to identify independent predictors of NIHL. A p-value <0.05 was considered statistically significant.

Results

Study Population: A total of 120 traffic police personnel participated in the study. The mean age of participants was 38.4 ± 7.2 years (range: 24–54 years). The majority were male (92.5%) with a small proportion of female participants (7.5%). The average duration of service was 11.6 ± 5.8 years.

Table 1: Demographic and occupational characteristics of study participants (n = 120)

Variable	Number (%)
Age (years)	
20–30	28 (23.3)
31–40	44 (36.7)
41–50	37 (30.8)
>50	11 (9.2)
Sex	
Male	111 (92.5)
Female	9 (7.5)
Duration of service (years)	
1–5	22 (18.3)
6–10	39 (32.5)
11–15	31 (25.8)
>15	28 (23.4)
Use of protective devices	19 (15.8)

Prevalence of Hearing Loss: Out of 120 participants, 54 (45%) were found to have hearing loss in at least one ear. The majority had bilateral

sensorineural hearing loss (38 cases, 70.4%), while 16 cases (29.6%) showed unilateral involvement.

Table 2: Distribution of hearing status among participants

Hearing Status	Number (%)
Normal hearing	66 (55.0)
Unilateral sensorineural hearing loss	16 (13.3)
Bilateral sensorineural hearing loss	38 (31.7)

Pattern of Hearing Loss: The audiometric pattern most commonly observed was a 4 kHz notch, characteristic of noise-induced hearing loss. The

severity of hearing loss varied from mild to moderate, with no cases of profound loss.

Table 3: Severity of hearing loss (n = 54)

Severity (WHO classification)	Number (%)
Mild (26–40 dB HL)	32 (59.3)
Moderate (41–60 dB HL)	18 (33.3)
Severe (61–80 dB HL)	4 (7.4)
Profound (>80 dB HL)	0 (0.0)

Association with Risk Factors

- **Duration of service:** Hearing loss prevalence increased significantly with longer service duration ($p < 0.05$).
- **Protective device use:** Only 15.8% of participants reported using ear protection; those

without protection had significantly higher prevalence of NIHL ($p < 0.01$).

- **Lifestyle factors:** Smokers had a higher risk of hearing loss compared to non-smokers ($p < 0.05$).

Table 4: Association of risk factors with prevalence of NIHL

Risk Factor	Prevalence of NIHL (%)	p-value
Service ≤ 5 years	18.2	$<0.05^*$
Service 6–10 years	38.5	
Service 11–15 years	54.8	
Service >15 years	67.9	
Use of protection	15.8	$<0.01^*$
No protection	52.5	
Smokers	58.3	$<0.05^*$
Non-smokers	37.5	

*Statistically significant

Discussion

The present study evaluated the prevalence and pattern of noise-induced hearing loss (NIHL) among traffic police personnel in a second-tier city, with an overall prevalence of 45%. This finding is consistent with previous research from metropolitan areas, which has reported NIHL prevalence ranging between 30–60% in occupationally exposed traffic police [1–3]. The high prevalence observed highlights that not only metropolitan but also second-tier cities with rapidly increasing vehicular density and inadequate noise regulation present a significant occupational hazard.

Audiological Findings: The most common audiological pattern observed was a bilateral sensorineural hearing loss with a 4 kHz notch, which is considered the classical audiometric signature of NIHL. This is in agreement with studies by Saha et al. [4] and Singh et al. [5], who also demonstrated early high-frequency involvement at 3–6 kHz in traffic police personnel. Importantly, most cases in our study were mild to moderate in severity, suggesting that early screening and intervention could potentially prevent progression to disabling hearing loss.

Duration of Service: The prevalence of NIHL increased significantly with longer duration of service, with nearly two-thirds of personnel serving more than 15 years affected. This dose–response relationship has been well-established in occupational hearing studies [6,7], as cumulative noise exposure leads to irreversible cochlear damage, particularly affecting outer hair cells.

Protective Measures: Only 15.8% of participants in this study reported the use of protective devices, and lack of usage was strongly associated with higher prevalence of NIHL. Similar findings were reported by Patel et al. [8], who demonstrated that consistent use of earplugs reduced the risk of NIHL by nearly 40%. The low uptake of protective measures in our study could be attributed to poor awareness, discomfort in hot and humid conditions, and lack of enforcement by authorities.

Lifestyle Factors: Smoking was found to be a significant risk factor in our population, with smokers demonstrating higher prevalence of NIHL compared to non-smokers. Previous studies have suggested that smoking may potentiate cochlear hypoxia and oxidative stress, thereby increasing susceptibility to noise damage [9,10]. This emphasizes the importance of addressing modifiable lifestyle factors in hearing conservation programs.

Comparison with Literature from Metropolitan vs. Second-Tier Cities: While most existing literature has focused on metropolitan cities such as Delhi, Mumbai, and Bangalore [3–5], our findings show comparable prevalence in a smaller urban

setting. This suggests that urban noise exposure in second-tier cities has reached levels sufficient to cause significant auditory health concerns. With increasing motorization in these regions, the burden of NIHL is likely to rise further if preventive strategies are not implemented.

Public Health Implications: The study highlights NIHL as a neglected occupational health issue in traffic police. Regular audiological screening, provision of personal protective devices, and awareness campaigns are crucial. Moreover, urban planning interventions such as stricter enforcement of noise pollution control, restriction of unnecessary horn use, and creation of noise-free zones can play a significant role in mitigating risk.

Strengths and Limitations: A major strength of this study is its community-based design with direct audiological assessment of traffic police personnel in their occupational setting, providing robust data. However, limitations include the cross-sectional design, which restricts causal inference, reliance on self-reported protective device use and smoking habits, and absence of direct measurement of environmental noise levels during duty hours.

Future Directions: Further longitudinal studies are warranted to assess the progression of NIHL over time among traffic police. Interventional studies focusing on the effectiveness of protective measures and awareness programs in second-tier cities could provide valuable evidence for policymaking.

Conclusion

Noise-induced hearing loss is a significant occupational health issue among traffic police personnel in second-tier cities. Early audiological screening, mandatory use of personal protective devices, and implementation of effective noise-control policies are essential to reduce the burden of NIHL in this high-risk group.

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