

## PREVALENCE OF NOISE-INDUCED HEARING LOSS POLICE PERSONNEL COMING FOR HEALTH CHECKUP AT GOVERNMENT THENI MEDICAL COLLEGE AND HOSPITALS

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### ABSTRACT

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#### BACKGROUND

Occupational settings and transport is the prominent sources of noise that affect health. Noise-Induced Hearing Loss (NIHL) is sensory neural hearing loss due to exposure to intense impulse or continuous sound. Exposure to noise can be occupational or non-occupational. The audiologic profile of NIHL is the presence of sensorineural hearing loss that is most pronounced in the high-frequency region between 3,000 Hz and 6,000 Hz of the audiogram and the greatest amount of hearing loss is typically around the 4,000-Hz region (i.e. 4,000 Hz dip).<sup>1</sup> The main causes of hearing loss resulting in deafness in adults in India are excessive noise, age and ear infection. Although, occupational hearing loss is a well-recognized occupational condition arising from industries or occupations with exposure to high noise levels (e.g., airline crew),<sup>2</sup> it has not been fully evaluated in occupations where the risk is not so overt such as the police force. Police officers are potentially exposed to multiple sources of noise including vehicle horns, gunfire, barking from police dog and traffic noise.<sup>3</sup>

The aim of the study is to study the incidence of noise-induced hearing loss amongst traffic police personnel who came for master health checkup.

#### MATERIALS AND METHODS

A total of 812 constables were examined. All individuals underwent a complete general, systemic and ENT examination to detect any obvious pathology, which may result in hearing loss. A detailed history was taken regarding the number of years of service in traffic branch, place of duty, past history of ear disease or intake of ototoxic drugs. Subjects suffering from preexisting ear disease such as CSO, OME, otosclerosis and suffering from URI has been excluded. Policemen suffering from hypertension and diabetes were also excluded. Remaining 774 was included in the study. This study was approved by the institutional ethical committee, Government Theni Medical College. Written consent was obtained from all the policemen participating in study. All the individuals were subjected to pure tone audiometry to detect the degree and type of hearing loss. The subjects in the study had undergone pre-enrolment medical examination and had normal hearing at the time of enrolment.

Settings and Design- A study was undertaken by the Department of ENT, Government Theni Medical College, Theni, during June 3, 2015, to July 21, 2015. The subjects for this study were the police personnel who came for master health checkup.

#### RESULTS

A significant number of personnel were detected to be suffering from NIHL. No significant relationships was found between hearing loss and the age group of the individuals. There was an even distribution of hearing impaired individuals in all age groups. Those personnel who had less than 2 years' service in the traffic branch had slightly less (60.3%) incidence of hearing loss as compared to others who had a higher incidence of approximately 85%. The hearing loss was mild in case of inspectors and more than 40 dB in constables. It was unilateral in (30.8%) individuals and bilateral in (69.2%) individuals. These types of audiometric pattern were encountered- 1) Descending curve; 2) Hearing loss in frequency beyond 4000 Hz; 3) A pattern of audiometric notching was seen at 4000 Hz or 6000 Hz.

#### CONCLUSION

A significantly large number of subjects in this study showed sensorineural hearing loss, which was of moderate-to-severe intensity in as many as of the individuals. It was bilateral in majority of the subjects and was directly related to the duration of exposure. In view of the high incidence of acoustic damage, a number of preventive measures were suggested like rotation of beat of traffic personnel between high- and low-noise intensity areas, use of personal ear protectors like ear defenders or ear muffs and creation of awareness among exposed individuals about the hazards of noise pollution.

#### KEYWORDS

NIHL, ISO, Population Studies, Vibration, Cardiovascular Risk Factors, Mechanisms.

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## BACKGROUND

Noise-Induced Hearing Loss (NIHL) is sensory neural hearing loss due to exposure to intense impulse or continuous sound. Exposure to noise can be occupational or non-occupational. The audiologic profile of NIHL is the presence of sensorineural hearing loss that is most pronounced in the high-frequency region between 3,000 Hz and 6,000 Hz of the audiogram and the greatest amount of hearing loss is typically around the 4,000-Hz region (i.e. 4,000 Hz dip).<sup>1</sup> The main causes of hearing loss resulting in deafness in adults in India are excessive noise, age and ear infection. Although, occupational hearing loss is a well-recognised occupational condition arising from industries or occupations with exposure to high noise levels (e.g., airline crew),<sup>2</sup> it has not been fully evaluated in occupations where the risk is not so overt such as the police force. Police officers are potentially exposed to multiple sources of noise including vehicle horns, gunfire, barking from police dog and traffic noise.<sup>3</sup> Specifically, for police motorcyclists, the noise exposure can range from 63 dBA to 90 dBA and up to 105 dBA in open roads.<sup>4,5</sup>

## MATERIALS AND METHODS

The Occupational Health Division (OHD) conducts periodic medical examinations for police personnel hold posts of different ranks such as police constable, special sub-inspector, inspector and head constable, yearly. In this study, the medical examinations included obtaining a detailed occupational history, significant medical history, past and current noise exposure history as well as compliance with usage of hearing protective devices and physical examination, otoscopic examination for external ear conditions such as eardrum perforation, earwax impaction or external ear infections, audiometry test were also carried out to complete the medical examination. Audiometric testing at the OHD is conducted using an audiometer. Recent ear infection, history of head and/or neck injury, exposure to chemicals and ototoxic medications or a family history of hearing loss. Severity of NIHL is based on the WHO grading. Hearing within 0-25 dBA or less (better ear) is classified as normal hearing, 26-40 dBA as mild impairment, 41-60 dBA as moderate impairment, 61-80 dBA as severe impairment and >80 dBA as profound impairment. These ranges of levels are

categorised as such by averaging the hearing level at frequencies 500 Hz, 1,000 Hz, 2,000 Hz and 4,000 Hz in the better ear.

## Study Design and Study Population

A cross-sectional study was conducted on police personnel who were seen for periodic medical examination at the OHD during the period of June 2015 until August 2015. Each person had to have been in service for at least 3 years and a maximum of 30 years. Diagnosis of NIHL was based on history of occupational noise exposure. Hearing loss of >25 dBA at 4,000 Hz frequency in two consecutive audiograms and no significant medical history affecting hearing. Other causes of hearing loss needed to be excluded such as non-occupational noise exposure, ototoxic medications, family history of hearing loss, recent or chronic ear infections, head and neck injury, radiotherapy to the head and neck and history of mumps. Of note, part of the selection criteria to join the police force was absence of any hearing impairment.

## Ethical Consideration

The study protocol was approved by the institutional ethical committee, Government Theni Medical College, Theni.

## Data Collection and Statistical Analysis

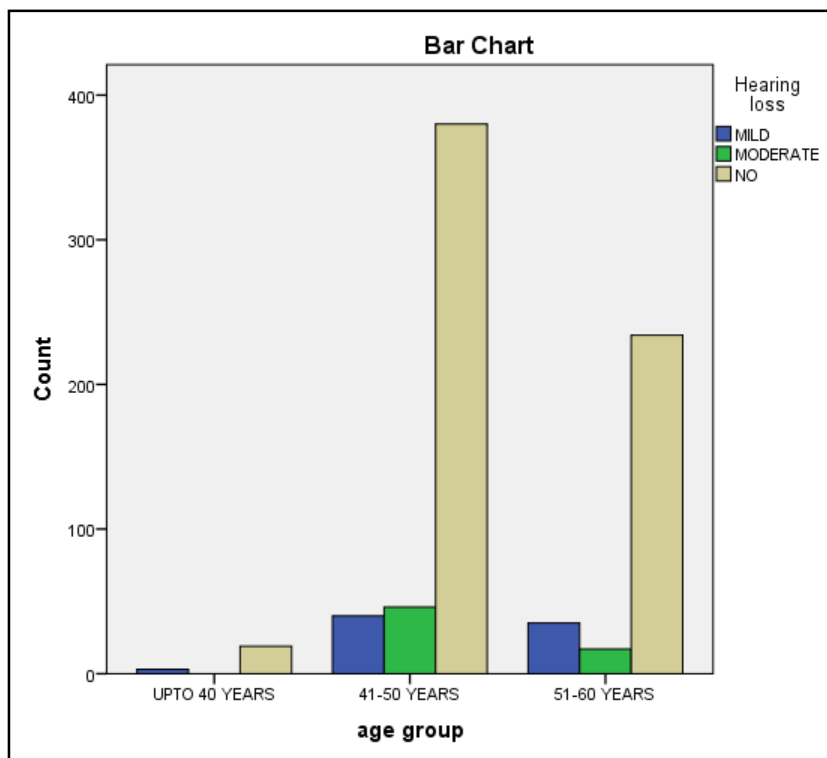
Collection of data was performed by the study team by reviewing the clinical records. Relevant information was collected from the findings of routine periodic medical examination that police personnel undergo at the OHD. The information was entered into a database for study analysis.

## RESULTS

A total of 812 police personnel were identified for the period of June 2015 to August 2015. Since, there was a mixed exposure of traffic noise with period of regular posting, of this total, 774 were eligible for the study, i.e. there was a presence of occupational noise exposure in the shooting range and traffic noise.

Demographic details from this group indicated that there were 747 males and 27 females with a mean age of 36.2 years and a mean duration of service of 15.8 years. The reasons for their exclusion were as follows- listening to loud music, use of ototoxic medications, history of head injury, family history of hearing loss and history of chronic ear infection.

The descriptive characteristics of the study population and presence of NIHL are presented in Table 1.



**Age Group**

	Cases					
	Valid		Missing		Total	
	N	Percentage	N	Percentage	N	Percentage
Sex * hearing loss	774	100%	0	0%	774	100%
Age group * hearing loss	774	100%	0	0%	774	100%

**Table 1. Case Processing Summary**

Sex \* Hearing loss.

Crosstab						
			Hearing Loss			Total
			Mild	Moderate	No	
Sex	Female	Count	3	1	23	27
		% within hearing loss	3.8%	1.6%	3.6%	3.5%
		% of total	0.4%	0.1%	3%	3.5%
	Male	Count	75	62	610	747
		% within hearing loss	96.2%	98.4%	96.4%	96.5%
		% of total	9.7%	8%	78.8%	96.5%
Total		Count	78	63	633	774
		% within hearing loss	100%	100%	100%	100%
		% of total	10.1%	8.1%	81.8%	100%

**Table 2. Crosstab**

Chi-Square Tests			
	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-square	0.746 <sup>a</sup>	2	0.689
Likelihood ratio	0.912	2	0.634
Number of valid cases	774		

**Table 3. Chi-Square Tests**

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 2.20.  
Age group \* hearing loss.

<b>Crosstab</b>						
		<b>Hearing loss</b>				
		<b>Mild</b>	<b>Moderate</b>	<b>No</b>		
Age group	Up to 40 years	<b>Count</b>	<b>3</b>	<b>0</b>	<b>19</b>	
		% within hearing loss	3.8%	0%	3%	
		% of total	0.4%	0%	2.5%	
	41-50 years	<b>Count</b>	40	46	380	
		% within hearing loss	51.3%	73%	60%	
		% of total	5.2%	5.9%	49.1%	
	51-60 years	<b>Count</b>	35	17	234	
		% within hearing loss	44.9%	27%	37%	
		% of total	4.5%	2.2%	30.2%	
<b>Total</b>		<b>Count</b>	<b>78</b>	<b>63</b>	<b>633</b>	
		<b>% within hearing loss</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	
		<b>% of total</b>	<b>10.1%</b>	<b>8.1%</b>	<b>81.8%</b>	

**Table 4. Crosstab**

<b>Crosstab</b>			<b>Total</b>
Age Group	Up to 40 years	<b>Count</b>	<b>22</b>
		% within hearing loss	2.8%
		% of total	2.8%
	41-50 years	<b>Count</b>	466
		% within hearing loss	60.2%
		% of total	60.2%
	51-60 years	<b>Count</b>	286
		% within hearing loss	37%
		% of total	37%
<b>Total</b>		<b>Count</b>	<b>774</b>
		<b>% within hearing loss</b>	<b>100%</b>
		<b>% of total</b>	<b>100%</b>

**Table 5**

<b>Chi-Square Tests</b>			
	<b>Value</b>	<b>df</b>	<b>Asymp. Sig. (2-sided)</b>
Pearson Chi-square	7.894 <sup>a</sup>	4	0.096
Likelihood ratio	9.692	4	0.046
Linear-by-linear association	0.450	1	0.502
No. of valid cases	774		

**Table 6. Chi-Square Tests**

A 2 cells (22.2%) have expected count less than 5. The minimum expected count is 1.79.

**RESULTS**

Males with 747 members made up the majority of the police force while there were 27 females. The mean age for police personnel was 35.55 years with a mean duration of service of 14.75 years. A significant number of personnel were detected to be suffering from noise-induced sensorineural hearing loss were found to have raised hearing thresholds. The prevalence of NIHL in this study population was 16% with a higher prevalence in males than in females (3%). Overall, 55% were found to have mild NIHL, 45% had moderate to severe NIHL and no police personnel were found to have profound hearing loss.

The following observations were made-

- a. Age- No significant relationship was found between hearing loss and the age group of the individuals. There was an even distribution of hearing impaired individuals in all age groups.
- b. Duration of Exposure- Those personnel who had less than 2 years’ service in the traffic branch had slightly less (60.3%) incidence of hearing loss as compared to others who had a higher incidence of approximately.
- c. Degree of Hearing Loss- The hearing loss was mild in case of 78(55%) inspectors and more than 40 dB in 63(45%) constables.
- d. Audiometric Pattern - These types of audiometric pattern were encountered- A pattern of audiometric notching was seen at 4000 Hz.

Urbanisation has brought with it the hazards of noise pollution. The human ear is constantly being subjected to noise trauma. There are a number of mechanisms, which protect inner ear from damage from impulse noise. A significantly large number of subjects in this study showed sensorineural hearing loss, which was of moderate-to-severe intensity in as many as 37.7% of the individuals directly related to the duration of exposure. In view of the high incidence of acoustic damage, a number of preventive measures were suggested ear muffs and creation of awareness among exposed individuals about the hazards of noise pollution and characteristics of study population and presence of NIHL.

The study population was predominantly male. The mean age of police personnel was 35.55 years with a mean duration of service of 14.75 years. The majority of the personnel (43.3%) were police constables whose job scope included mainly operational duties, whereas the higher ranks handled more administrative duties. Moreover, 44.3% were smokers and only 7.7% consumed alcohol.

The results revealed that occupational NIHL was prevalent in 34.2% of police personnel. NIHL was found to be higher in males than in females. Male personnel holding the ranks of police constable and additional police officer recorded a high prevalence of NIHL (31.1% and 20.4%, respectively).

Table 2- Prevalence of NIHL by degree of severity and sex.

The degree of severity of NIHL was further categorised using the WHO grading where the average was taken for readings at the lower frequencies of 500 Hz, 1,000 Hz, 2,000 Hz and 4,000 Hz, in the better impaired ear.<sup>6,7</sup> Out of 141 police personnel with NIHL, (78/141) were found to have mild NIHL, (63/141) had moderate SN hearing loss, whereas no police personnel had profound NIHL. Further analyses showed that some of the factors studied have an association with NIHL.<sup>8</sup> Factors with a strong association are sex, age, duration of service, rank, diabetes mellitus and hypertension. Age, duration of service and rank were found to have a significant association with NIHL.

## DISCUSSION

Occupational NIHL is a well-recognised condition among police personnel particularly in motorcycle police officers. However,<sup>9,10</sup> only few studies worldwide have been conducted in this occupational group to evaluate the associated risk factors. In our study, NIHL was noted to be more prevalent among the male police personnel compared to females, this is similar to the findings of other studies. Worldwide, 16% of disabling hearing loss in adults is attributed to occupational noise exposure with the effect of exposure being greater in males. In the United Kingdom, it was estimated that there were 1,53,000 men and 26,000 women with severe hearing difficulty whose condition could be attributed to occupational noise exposure. Among United States Military Personnel, the prevalence of NIHL in males was found to be significantly higher. Our result is similar to that of other studies showing that the prevalence

of NIHL is directly proportional to increasing age and longer duration of service.

WHO estimates that globally 16% of individuals have a moderate to greater degree of hearing loss due to occupational noise exposure.<sup>11</sup> In our study population, males made up the majority of those who were found to have NIHL at the lower frequencies. Out of 141 police personnel with NIHL, 78 were found to have mild NIHL. 63 had moderate SN hearing loss, whereas no police personnel had profound NIHL. The study team recognises that there are several limitations to this study. We were unable to quantify the exact decibel of noise exposure at different sites.

## CONCLUSION

NIHL is an incurable, but preventable occupational condition. This study shows that increasing age, longer duration of service and presence of hypertension are significant associated factors for NIHL. Preventative strategies such as adequate provision of a hearing protective device, regular education and training for the employer and employees, implementation of a hearing conservation program at the workplace and regular health surveillance (audiometry) for police personnel with exposure to excessive noise can help address the problem.

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