SHORT ARTICLE

Pattern of Noise Induced Hearing Loss and its Relation with Duration of Exposure in Traffic Police Personnel

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Abstract | Introduction | Methodology | Results | Conclusion | References | Citation | Tables / Figures

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Abstract

Background: Occupational noise exposure is a major and preventable cause of hearing loss. Traffic policemen are constantly exposed to noise pollution. Noise induced hearing loss (NIHL) denotes a selective 4000 Hz hearing loss (unilateral or bilateral). **Objective:** To assess the prevalence pattern of NIHL and its relation with duration of exposure to noise in traffic policemen. **Material and methods:** Otoscopy, tuning fork tests and Pure Tone Audiometry (PTA) were performed in 150 apparently healthy police personnel. **Results:** Rinne's and Weber's test were normal in all the subjects. Schwabach's test showed normal bone conduction in normal subjects as well as those with NIHL. PTA revealed that 33 (22% of sample) subjects were suffering from NIHL; 8 (5.3%) had sensorineural hearing loss whereas 109 (72.7%) performed normally in the test. None of the subjects with sensorineural hearing loss showed the characteristic notch at 4 kHz. Majority of the subjects (69.7%) with NIHL had mild to moderate grades of hearing loss in both ears. No subject had profound hearing loss. **Conclusion:** Significant association was observed between NIHL and duration of exposure. Steps need to be taken at the level of employers as well as individuals to counter occupational noise threat.

Key Words

Noise Induced Hearing Loss; Pure tone audiometry; traffic police

Introduction

Noise is any unwanted disturbance within a useful frequency band (1). It is an important "stress factor" in the environment that has numerous adverse health effects of public health concern. The hazards of noise pollution include elevated blood pressure, noise-induced hearing loss (NIHL), sleep disorders, and irritability (2).

NIHL denotes a cumulative and permanent loss of hearing that develops gradually after months or years of exposure to high levels of sound (3). Selective 4000 Hz hearing loss is characteristic audiometric sign of its onset (4). Modern day living and urbanization have resulted in increased incidence of noise pollution. Traffic policemen standing in the midst of vehicular noise are constantly exposed to this occupational hazard during their duty hours averaging 10 to 12 hours per day.

There are only a few studies (5,6,7,8,9) originating from India that have estimated noise levels and auditory effects caused by automobile sounds on traffic policemen. However, to the best of our knowledge, there is no study from North India. We report findings from Jammu and Kashmir, the

farthest northern state of India. Ever since the last two decades, the population of Jammu city has increased manifold. Coupled with constant migration from other parts of the state into the city it has resulted in increased number of automobiles on roads.

Aims & Objectives

So, present study was undertaken to assess the effect of noise exposure on the hearing level of the persons most exposed to its vagaries viz. the personnel of traffic police and to relate the duration of exposure to the hearing level of traffic personnel on duty in Jammu city.

Material and Methods

The present cross-sectional study was undertaken in the Department of Physiology in collaboration with the Department of ENT and Head and Neck Surgery, Government Medical College, Jammu from December 2012 to November 2013.

Inclusion criteria: Apparently healthy traffic policemen working in different parts of Jammu city; for a period of minimum one year to maximum six years at a stretch.

Exclusion criteria: Subjects suffering from pre-existing ear disease such as chronic suppurative otitis media, otitis media with effusion, otosclerosis, throat infection, those on ototoxic drugs, suffering from any systemic disease such as hypertension or diabetes mellitus were excluded.

The study was approved by the Institutional Ethics Committee, Government Medical College, Jammu vide number IEC/Pharma/Thesis/Research/556/2012/2741 dated 1-11-2012. Inspector General Police (Traffic), Jammu was informed about the study and a permission was obtained to allow the personnel on duty in Jammu city to undergo tests for this study in batches.

A written consent was obtained from all the subjects. They underwent systemic and ENT examination to detect any obvious pathology which might result in hearing loss. Their age, sex, duration of job in years and working hours were recorded.

158 subjects were screened and out of these 150 who fulfilled the inclusion criteria were selected for the study. The tests carried out on the selected subjects (in the Department of ENT and Head and Neck Surgery) were: otoscopy, tuning fork tests and pure tone audiometry (PTA).

Otoscopy was done to rule out any external and/or middle ear disease. Tuning fork tests viz. Rinne's test, Weber's test, Absolute bone conduction (ABC) test and Schwabach's test were done using a tuning fork (512 Hz) in accordance with the procedure described by Ghai (10) and Jain (11).

PTA was performed in a sound-proof room. The test was conducted as per the method detailed by Jain (11), in morning hours before joining the duty hours in order to minimize the effect of temporary threshold shift (TTS). The audiometer used was Elkon EDA-3 Multi.

Data concerning the average noise levels at different places of Jammu city for the last 6 years was obtained from the J&K State Pollution Control Board (SPCB), Jammu.

Statistical analysis: The data obtained was analyzed by using computer software MS Excel and SPSS 20.

Results

Mean age of the study group was 36.65 ± 6.61 years, with a range from 25 to 56 years. Mean duration of exposure to noise was 2.7 ± 0.97 years. Maximum number of subjects (59; 39.33%) were exposed to noise pollution for a period ranging from 2 to 3 years (Table 1).

Maximum subjects had no clinical problem related to ENT while 13 had tinnitus and 6 had vertigo as a clinical complaint.

PTA was normal in 109 subjects. 33 subjects had NIHL while rest 8 had sensorineural loss (without loss at 4 kHz).

A significantly higher number (24) of those detected with NIHL had history of exposure to noise for more than three years while only nine had exposure duration of less than or equal to 3 years.

Discussion

Occupational noise is a widespread risk factor, with a strong evidence base linking it to hearing loss (12). NIHL is an outcome of damage to the outer hair cells of cochlea in the inner ear. It is a permanent hearing impairment resulting from prolonged exposure to high levels of noise (13). Traffic police personnel are highly vulnerable to NIHL as they are continuously exposed to loud sounds during their duties.

Situation in Jammu city is no way better than others as the data provided by the State Pollution Control Board, Jammu shows much higher levels of noise in various places of Jammu region. Noise levels for the last 6 years at various places ranged from 80.1 dB to 69.2 dB(A). The data for year 2013 showed the highest average day time noise level i.e. 86.5 dB(A) at Gole Market of Gandhinagar area of Jammu city

whereas the minimum value of 71.1 dB(A) was reported from Narwal Chowk. These values are much above the prescribed upper limit of 65 dB(A). In the present study, Rinne's test was positive in all 150 subjects i.e., their air conduction was better than bone conduction (AC>BC). As per standards, this test was performed with tuning fork having frequency of 512 Hz. The same is unable to detect the higher frequency loss which is the hallmark of NIHL i.e., 4000 Hz. Therefore, this test cannot be relied upon to differentiate between normal persons and those having high frequency hearing loss. Similarly, the Weber's test was centralized in both the normal subjects as well as those having sensorineural hearing loss and NIHL for the same reason. Schwabach's test showed slight decrease in bone conduction in the subjects having sensorineural hearing loss but it was normal in those with no impairment as well as those having NIHL. Therefore, this test too cannot be relied on to differentiate between normal persons and those having NIHL for the same reasons as with Rinne's test. Absolute bone conduction (ABC) test was normal in case of normal subjects as well as in those having NIHL. Therefore, this test also cannot be relied upon to differentiate between normal persons and those having NIHL.

PTA is the accepted standard for measuring hearing levels (14). In our study, 33 (22%) subjects were found to have NIHL; 8 subjects had sensorineural hearing loss whereas 109 traffic personnel performed normally in PTA test. None of the subjects with sensorineural hearing loss showed a notch at 4 kHz, which is characteristic of noise induced hearing loss.

Results of the present study are in accordance with the study of Sharif *et al*. (15), that demonstrated that 24% of the traffic policemen of Dhaka had mild to moderate sensorineural hearing loss due to noise exposure and the same was related to the duration of exposure. Similarly, one Indian study Rajender Kumar (5) observed the incidence of NIHL to be 21% in traffic policemen. Lesage *et al*. (16) also investigated the NIHL in French police officers and found that 28% of the police department staff had NIHL compared to 16% civil servants.

However, a higher prevalence of NIHL was observed by Shrestha *et al*. (17), who found that 66.4% traffic police personnel of Kathmandu metropolitan city had NIHL and out of these 40.9% had bilateral involvement. Barbosa and Cardoso (18) report a prevalence of 28.5% in Sao Paulo while Thomas *et al*. (19) surveyed Kuala Lumpur traffic point duty personnel and found that 80% were positive for NIHL.

Moderately severe (56-70 dB) and profound (>90 dB) grades of NIHL were not observed in our study.

Out of 33 traffic police personnel having NIHL, only 9 had suffered an exposure to noise levels for <3 years, while 24 affected persons had exposure for more than 3 years. Our findings correlate the duration of exposure to noise with NIHL ($p < 0.001$).

Lack of acoustic reflex has been shown to predispose patients to NIHL (the protective effect of acoustic reflex is primarily at 2 kHz and below) (20).

Conclusion

Present study on traffic personnel revealed that 22% had NIHL and most of them had mild to moderate impairment. Significant association was also observed between NIHL and duration of exposure to noise.

Outcome of our study suggests that NIHL is a significant problem among traffic police. This calls for more attention to this group and they should be periodically checked and audiometry must form a part of hearing loss assessment. They need to be provided with protective devices such as ear muffs, ear plugs and ear canal caps.

Recommendation

Health authorities and NGOs must create awareness among traffic policemen about the auditory and non-auditory effects of noise. We suggest that these personnel must be regularly shifted from their road side duties to other engagements so that their exposure to noise is minimal.

Limitation of the study

A comparison with the subjects exposed to significantly less levels of noise, e.g. traffic policemen posted in rural areas having less vehicular density, will be a matter of future study

Authors Contribution

MG: Concept of study, VK: Preparation of manuscript, MM: Analysis of data, KLG & SO: Acquisition of data.

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Tables

TABLE 1 DISTRIBUTION OF STUDY GROUP ACCORDING TO DURATION OF EXPOSURE (N=150)

Duration of exposure (years)	Number of subjects	Percentage (%)
1 – 2	22	14.67
2 – 3	59	39.33
3 – 4	43	28.67
4 – 5	21	14
5 – 6	5	3.33
Total	**150**	**100.00**

TABLE 2 DISTRIBUTION OF STUDY GROUP ACCORDING TO CLINICAL PRESENTATION OF ENT DISEASES (N=150)

ENT diseases	Number of subjects (%)
Vertigo	6 (4.00)
Tinnitus	13 (8.67)
None	131 (87.33)
Total	**150 (100.00)**

ABC test was normal in 142 subjects.

TABLE 3 DISTRIBUTION OF STUDY GROUP ACCORDING TO DEGREE OF HEARING LOSS BY ABSOLUTE BONE CONDUCT TEST (N=150)

	Number of subjects	Percentage (%)
Decreased	8	5.33
Normal	142	94.67
Total	**150**	**100.00**

TABLE 4 DISTRIBUTION OF STUDY GROUP ACCORDING TO DEGREE OF HEARING LOSS BY PTA (N=150)

PTA	Number of subjects	Percentage (%)
Normal	109	72.67
NIHL	33	22.00
Sensorineural hearing loss	8	5.33
Total	**150**	**100.00**

TABLE 5 GRADES* OF NIHL IN EACH EAR

Grade	Right ear No. (%)	Left ear No. (%)
No impairment (≤25 dB)	0	1 (3.03)
Mild impairment (26 – 40 dB)	21 (63.64)	26 (78.79)
Moderate impairment (41 – 55 dB)	11 (33.33)	6 (18.18)
Moderately severe impairment (56 – 70 dB)	0	0
Severe impairment (71 – 90 dB)	1 (3.03)	0
Profound impairment (>90 dB)	0	0

*Grades of NIHL as per WHO International Classification of Impairment, Disabilities and Handicaps (1991).

TABLE 6 RELATION OF NIHL TO DURATION OF EXPOSURE

Duration of exposure (in years)	NIHL			
	Present No.	Absent No.	Total No.	Statistical inference
<3	9	102	111	$\chi^2=44.94$; $p<0.001$;
>3	24	15	39	
Total	33	117	150	