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Effect of road traffic noise on auditory threshold in traffic policemen

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Abstract

Background: Modern day living and increasing urbanisation has resulted in increased incidence of noise pollution. Traffic policemen manning traffic are at an increased risk of suffering from hazards of noise and air pollution. With this background, the study aimed to assess the auditory threshold of traffic policemen working on roads.
Methods: Study included thirty traffic policemen and 30 age matched participants involved in administrative work as controls. Sound pressure level was measured at various traffic junctions during peak traffic hours. All subjects were subjected to pure tone audiometry.
Results: The mean age of study population was 42.46+6.78yrs. Audiometric test revealed that out of 30 traffic policemen in the test group, 8(26.66%)had NIHL of which, 5 had mild degree of hearing loss and 3 had moderate degree of hearing loss and there were no subjects with NIHL in control group. The average hearing threshold at frequencies 4Khz (AC and BC), 6Khz(AC) and 8Khz(AC) are significantly increased in the test group compared to that in the controls and showed significant dip at frequency of 4Khz and recovery at 6Khz and 8Khz in the test group which is typical of noise induced hearing loss (sensorineural).
Conclusion: NIHL is major avoidable cause of permanent hearing impairment and the most effective way to prevent NIHL from hazardous noise at the workplace is by use of safety equipments, periodic check-ups and duty scheduling for exposure limitation and awareness programs.

Keywords: Audiometry, Auditory threshold, Noise induced hearing loss, Road traffic noise

Introduction

Modern day living and increasing urbanisation has resulted in increased incidence of noise pollution and thereby it has deleterious effects on the human body especially the delicate sense of hearing[1].

Noise is an unwanted or undesirable sound which can be either environmental or occupational. Worldwide, 16% of the disabling hearing loss in adults (over four million disability-adjusted life years) is attributed to occupational noise[2].

Noise induced hearing loss (NIHL) is a sensory-neural hearing loss occurring in people who are exposed to noise for a long period with other reasons for hearing loss being excluded[3]. Long-term exposure to daily noise levels of more than 80 dB may eventually result in NIHL.

Traffic policemen are at an increased risk of suffering from hazards of noise and air pollution because they are engaged in controlling traffic noise, particularly at heavy traffic junctions. The effect is more in this subgroup because they are continuously exposed to noise. Majority of them remain unaware about the health effects of noise on their hearing ability as this is an insidious process and takes a long time to become overt[4].With this background the present study was undertaken to assess the auditory threshold in traffic policemen.

Materials and Methods

Study included thirty traffic policemen (test group) and 30 age matched subjects who were involved in administrative work in medical college (controls) aged between 25 and 55 years. Place of study was Department of Physiology, Sri Devaraj Urs Medical College, Kolar, Karnataka, India. Institutional Ethical Clearance was obtained. Informed written consent was taken from the subjects. The self structured questionnaire assessed information on socio-demographic characteristics, history of exposure to noise, years of experience/service etc. Subjects with history of chronic medical illness like diabetes, hypertension etc and history of use of ototoxic drugs were excluded from the study.

Sound pressure level was measured at various traffic junctions of Kolar city and within medical college campus using sound level meter, taken during peak traffic hours.

All subjects were subjected to pure tone audiometry. The method is based on American Society for Speech and Hearing Association [ASHA] 1978 guidelines for manual pure tone audiometry (PTA)[5].

Interpretation of an audiogram:

Conductive deafness- is indicated by raised air conduction thresholds (25dB) and a normal bone conduction threshold with a wide air-bone gap of 15 dB or more.

Sensorineural deafness-is indicated by raised air and bone conduction thresholds (both>25dB) and the air bone gap does not exceed 10dB.

Mixed deafness- air and bone conduction thresholds are raised with air bone gap of > 15dB.

Degree of Hearing Loss [WHO Classification 1980] [6]

Normal	0-25 dB
Mild	26-40 dB
Moderate	41-55 dB
Moderately severe	56-70 dB
Severe	71-91 dB
Profound	>91 dB

Hearing threshold levels obtained by pure tone audiometry were compared between traffic policemen and control group. The data was analysed by SPSS version 16. Unpaired t-test was computed to determine the significance of difference ($p<0.05$) between hearing threshold of traffic policemen and age matched controls. Results were expressed as mean $\pm$ standard deviation (SD).

Results

The mean age of study population was 42.46+6.78yrs. Mean$\pm$ Standard deviation of sound pressure level measured at various traffic junctions was 83.12+4.23 dB(A) compared to 65.10+0.47 dB(A) ($p <0.001$) measured in and around medical college campus . Number of years of exposure to noise among traffic policemen was 8.77±4.25years.

Table 1 depicts that in the test group, eight (26.66%) had sensorineural hearing loss and there were none in the control group. Among 8, five (16.66%) had mild degree hearing loss and 3 (0.1%) had moderate degree hearing loss.

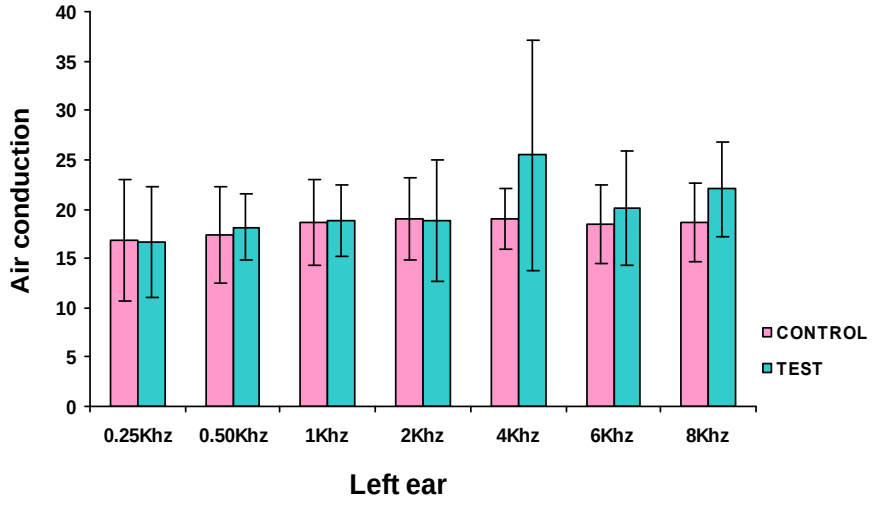
Graph 1 to 4 shows the comparison of auditory thresholds between control and test group in both the ears. It is evident that in the test group, the mean thresholds at frequencies 4Khz (AC and BC), 6Khz(AC) and 8Khz(AC) are increased compared to that in the controls with the significant p value of <0.001 at frequency of 4Khz (AC &BC), 0.04 at 6Khz(AC) and 0.001 at 8Khz(AC) in the left ear and also in the right ear the auditory acuity was statistically significant with a p value of <0.001 at 4Khz(AC &BC) , 0.015 at 6Khz(AC) and <0.001 at 8Khz(AC) respectively.

There is a significant dip (increased hearing threshold) at frequency of 4Khz and recovery at 6Khz and 8Khz in the test group which is typical of noise induced hearing loss (sensorineural).

Table 1: Percentage distribution of study subjects with sensorineural hearing loss

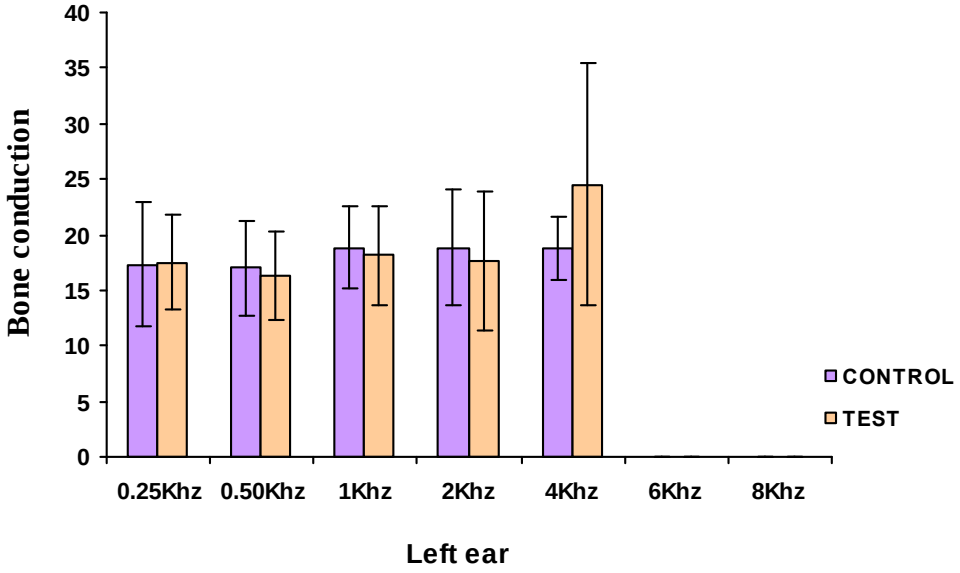
Study Group	Sensorineural Hearing Loss				Total
	YES		NO		
	Number	Percentage	Number	Percentage	
TEST group (traffic policemen)	8	26.66	22	73.33	30
Controls	0	0	30	100	30

Graph 1: Auditory threshold (air conduction) of left ear

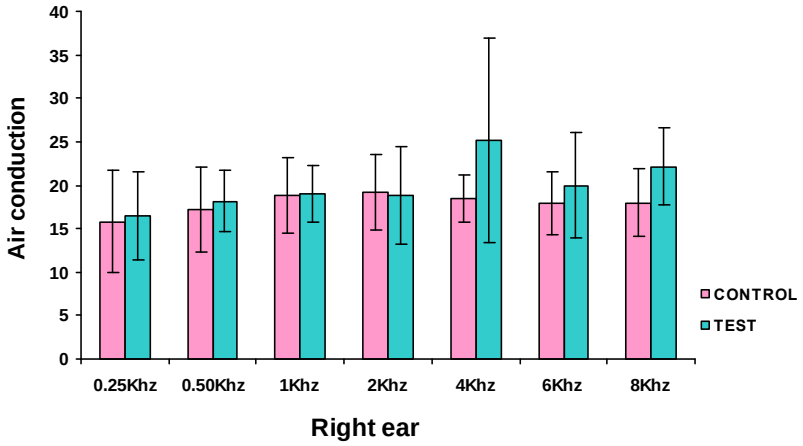


KHz: kilohertz

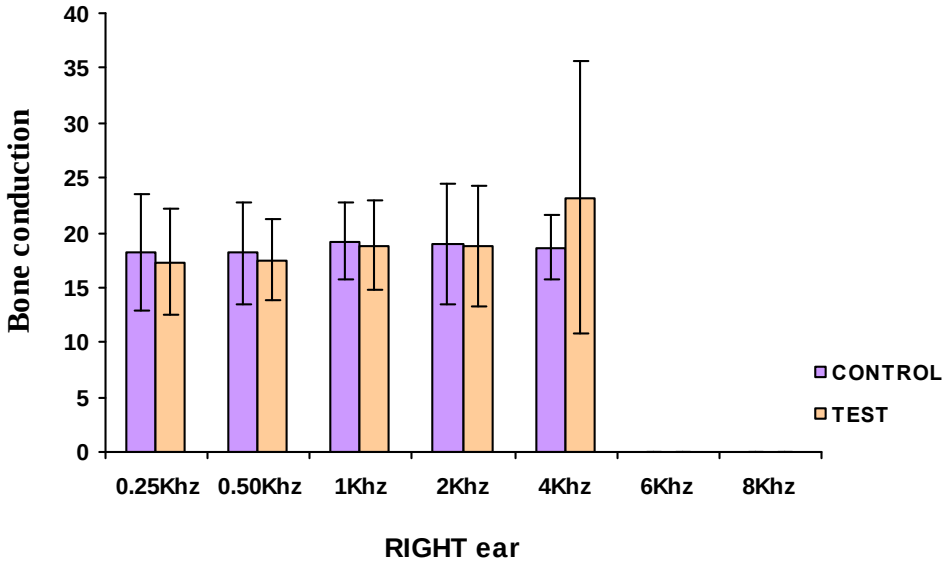
Graph 2: Auditory threshold (bone conduction) of left ear



Graph 3: Auditory threshold (air conduction) of right ear



Graph 4: Auditory threshold (bone conduction) of right ear



Discussion

Average acceptable noise level of human ear is 50 dBA. In India, occupational permissible exposure limit for 8 hour time weighted average is 90 dBA.[7] In the present study, the mean sound pressure level (dBA) measured where test group were involved was significantly high compared to controls. In a study done in Cairo traffic policemen , noise level ranged from 72-110 dBA.[8] A study done in thirty-two points in Kaula Lumpur recorded a maximum sound of 108.2 dBA.[9]

In our study, number of years of exposure to noise among traffic policemen was found to be 8.77±4.25years. Audiometric test revealed that out of 30 traffic policemen in the test group, 8(26.66%)had NIHL of which, 5 had mild degree of hearing loss and 3 had moderate degree of hearing loss and there were no subjects with NIHL in control group. The average hearing threshold at frequencies 4Khz (AC and BC), 6Khz(AC) and 8Khz(AC) are significantly increased in the test group compared to that in the controls and shows the significant dip at frequency of 4Khz and

recovery at 6Khz and 8Khz in the test group which is typical of noise induced hearing loss (sensorineural).

Study on traffic personnel done by Gupta M et al in 2015 revealed that 22% had NIHL and most of them had mild to moderate impairment.[10]In the study of prevalence of NIHL among traffic police in Dhaka Metropolitan City, 24% had mild to moderate high frequency sensorineural hearing loss and affected mainly frequencies of 4-6Khz. [11] A survey on the effects of noise pollution on traffic policemen in the city of Hyderabad, India, carried out by the Society to aid the hearing impaired, revealed that 76% had NIHL. Among those who had completed 5 years in the traffic wing had hearing loss in various degrees.[7]In a similar study conducted on hearing threshold of Cairo(Egypt) traffic policemen showed that the mean threshold of traffic policemen was significantly higher than that of controls.[8]

Sound damages the ear first at a frequency of about 4 kHz and one of the reasons for this is the acoustic resonance characteristics of the external ear. This hard walled tube, closed at one end, amplifies acoustic energy in the upper frequencies by about 10 decibels. In addition, individual variation in the acoustic transfer characteristics of the tube is a factor in the large variability in people's susceptibility to noise. Hair cells in the basal coil of the cochlea are the most sensitive to noise damage; they are responsible for transducing higher frequencies and this accounts for the high frequency hearing loss found in noise-damaged ears.[12]

In conclusion, these results suggest that continuous exposure to loud and chronic noise cause sensorineural hearing loss in long run.

Conclusion

The observations made from the present study showed that the traffic policemen manning traffic showed mild to moderate degree of hearing loss. NIHL is major avoidable cause of permanent hearing impairment and the most effective way to prevent NIHL from hazardous noise at the workplace is by use of safety equipments, periodic check-ups and duty scheduling for exposure limitation and awareness should be created among traffic policemen about the harmful effects of noise on hearing by implementing education and training programmes.

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