ORIGINAL RESEARCH

A Study of Effect of Noise Exposure on the Hearing Level of Traffic Personnel

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ABSTRACT

Introduction. Noise has become very important "stress factor" in the environment of people. Noise induced hearing loss (NIHL) is a type of sensorineural hearing loss that is second only to age induced hearing loss (presbycusis). Traffic personnel are most vulnerable group for NIHL. **Material & Methods**. 150 volunteered traffic personnel were studied for the effect of continuous exposure of noise on their hearing over a period of one year. **Results**. Noise induced hearing loss was observed in 22% subjects. Bilateral involvement was seen in 32%. Majority (69.69%) of the subjects had mild hearing loss. Noise induced hearing loss was more prevalent in subjects exposed to noise pollution for more than 3 years. **Conclusion.** Significant association was observed between noise induced hearing loss and duration of exposure to noise. So, traffic policeman should be periodically checked both clinically and audiologically at frequent intervals of time. Moreover, they should be provided with hearing protective devices such as ear plugs and ear muffs.

KEYWORDS: Presbycusis, Sensorineural hearing loss

INTRODUCTION

Sound is produced by compression and rarefaction of particles in an elastic medium such as air and water. Frequency of sound is measured in cycles/second or Hertz (Hz). Sound of frequencies less than 20Hz are called infrasonics and greater than 20,000 Hz are ultrasonics. Normally, human ear can hear sounds of frequencies between 20 to 20,000 Hz. The amplitude of a sound is expressed in decibel (dB). A range of 120 to 160 dB is classified as painful; 90 to 110 dB is classified as extremely high; 60 to 80 dB is classified as very loud; 40 to 50 dB is moderate; and 30 dB is faint.[1] Practically, there is no difference between sound and noise. Sound is a sensory perception and noise corresponds to the undesired sound. By extension, noise is any unwanted disturbance within a useful frequency band.[2] Noise has become very important "stress factor" in the environment of people. Noise has multiple adverse effects making noise pollution a public health concern although it has not been well addressed. Some of them are elevated blood pressure, noise-induced hearing loss (NIHL), sleep disorders, and irritability.[3] Noise-induced hearing loss (NIHL) is second only to age induced hearing loss or presbycusis. It occurs as a result of exposure to recreational and occupational noise that results in damage to hair cells of the cochlea in the inner ear. These hair cells are indispensable components of the inner ear that are responsible for conversion of sound energy to electrical signals transmitted to the brain. The damage is irreversible once it occurs. Usually, prolonged noise exposure causes NIHL. However, sudden exposure to an intense sound such as an explosion, sometimes referred to as an acoustic trauma, heard at one instance can cause NIHL. In general, the amount of noise required to cause permanent damage from chronic exposure is anything equivalent to 10 years or more at a level of 85 dB for more than 8 hours a day.[4,5] The maximum hearing loss due to noise exposure is 40 dB at low frequency and 75 dB at high frequencies but when the effects of presbycusis are added, the thresholds may become greater.[6,7] Noise-induced hearing loss generally occurs slowly over time, and the full effects are usually not realized until after 10-15 years of chronic noise exposure.[8,9] However, some NIHL may be evident after a single exposure to loud noise.[10] Noise related hearing changes can be categorized into three groups: acute acoustic trauma, noise-induced temporary threshold shift (NITTS), and noise-induced permanent threshold shift (NIPTS). There are only minimal studies carried out regarding the estimation of noise levels and auditory effects of noise generated by automobiles among traffic policeman in India. Moreover, the insidious nature of noise induced hearing loss keep the majority of them unaware of the effects of noise pollution. The present study was undertaken to study the effect of noise pollution on the persons most exposed to its vagaries, the traffic personnel.

MATERIALS AND METHODS

The present cross-sectional study was undertaken in the Department of ENT and Head & Neck Surgery, SMGS Hospital, Government Medical College, Jammu in collaboration with the Department of Physiology,

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Santosh Medical College, Ghaziabad from 2012 to 2013 to assess the magnitude and effect of noise exposure on the hearing level of traffic personnel. Healthy traffic policemen working in different parts of Jammu city were included as subjects. They had been discharging their duties in the traffic department for a period of a minimum of one year and a maximum of five years at a stretch. After detailing the purpose and methodology of the study, all the subjects found eligible were requested to participate in the study. A pre-enrolment examination was conducted on them to ensure that they had a normal hearing. 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 the job in years and working hours were recorded by the investigator. All the subjects suffering from pre-existing diseases 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 below labelled tests were carried out on the recruited subjects to assess the degree of hearing loss among the participants:

1. **Otoscopy**
2. **Tuning fork tests**
   a.) Rinne's test
   b.) Weber's test
   c.) Absolute bone conduction test
   d.) Schwabach's test
3. **Pure Tone Audiometry** (PTA): Sound Pressure Level (SPL) was measured with the help of instrument called Sound Level Meter (SLM)-100 manufactured by Envirotech Instruments Pvt Ltd, New Delhi with Acoustic Calibrator, Model-2000, Type-2 with accuracy of ± 0.5 dB at 25 degree Celsius. The SPL was mounted on a tripod stand to avoid any effect due to body shaking and the measurements were taken at different crossings and places during the peak hours of the traffic, where traffic policemen were discharging their duties for about 8 to 12 hours per day.

OBSERVATIONS

The subjects, who volunteered for our study, consisted of 150 healthy traffic policemen deputed in different parts of Jammu city and who had been working for a period of minimum one to maximum five years.

Most of the subjects were in the age group of 30 to 39 years (85; 56.67%), while minimum number of subjects were in the age group of ≥50 years (12; 8%), with mean age of the study being 36.65 (±6.61) years and a range from 25 to 56 years [Table 1].

Maximum numbers of subjects (59; 39.33%) were exposed to noise pollution for a period ranging 2 to 3 years. Number of subjects exposed to ≥4 years of noise pollution were 21 (14%). There were 5 subjects who had pollution exposure of 5 years [Table 2].

Out of 150 subjects, Noise induced hearing loss, which was defined as selective 4000Hz hearing loss >30 dB was observed in 33 cases (22%) subjects and sensorineural hearing loss was observed in 8 (5.33%) subjects, whereas 109 traffic personnel were having normal hearing [Table 3].

Age group (in years)	Number of subjects	Percentage (%)
<30	18	12
30-39	85	56.67
40-49	35	23.33
≥50	12	8
Total	150	100

Table 1. Age distribution of study group (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	5	3.33
Total	150	100

Table 2. Distribution of study group according to duration of exposure (n=150)

Audiometric tests	Number of subjects	Percentage (%)
Normal	109	72.67
Noise induced hearing loss	33	22
Sensorineural hearing loss	8	5.33
Total	150	100

Table 3. Distribution of study group according to degree of hearing loss by audiometric tests (n=150)

Amongst all the 33 NIHL cases, most of the subjects had a mild impairment (26-40 dB) followed by moderate impairment (41-55dB) [Table 4].

In our study, subjects with ≤40 years age have more number of noise induced hearing loss cases as compared to the subjects in > 40 years of age [Table 5].

Noise induced hearing loss is seen more in subjects who were exposed to the traffic noise for a period of more than 3 years as compared to those exposed for a period up to 3 years [Table 6].

Grades	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
Total	33(100.00)	33(100.00)

Table 4. Distribution of study group according to grades of noise induced hearing loss (NIHL) in each ear (n=33)

Age group	NIHL Present	NIHL absent	Total
≤40	26	91	117
>40	7	26	33
Total	33	117	150

Table 5. Comparison of noise induced hearing loss with age

Duration of exposure (in years)	NIHL Present	NIHL Absent	Total
≤3	9	102	111
>3	24	15	39
Total	33	117	150

Table 6. Comparison of NIHL with duration of exposure

Table 7 shows mean hearing threshold at 4 kHz according to age showing most of the subjects with mild to moderate hearing loss (more in right as compared to left).

Table 8 shows mean hearing threshold at 4 kHz according to the duration of exposure.

Age group (in years)	Right ear mean (dB)	Left ear mean (dB)
30-39	44.05	40.5
40-49	46.66	38.5
≥50	46.66	35

Table 7. Mean hearing threshold at 4 kHz according to age (in dB)

Duration of exposure (years)	Right ear mean (dB)	Left ear mean (dB)
1-2	56.5	30
2-3	48.85	42.71
3-4	41	37.18
4-5	47.75	42.75

Table 8. Mean hearing threshold at 4 kHz according to duration of exposure (in dB)

DISCUSSION

Noise is defined as unpleasant sound that the listener does not want to hear.[11] Noise induced hearing loss (NIHL) is one of the causes of Sensorineural hearing loss (SNHL) which occurs as a result of damage to the outer hair cells of the cochlea in the inner ear. It is a permanent hearing impairment resulting from prolonged exposure to high levels of noise.[12] It is the most common cause of sensorineural hearing loss which is preventable. High frequencies are affected first, typically at 4 kHz, followed by middle and lower frequencies.[13] The problem needs to be addressed as there is no medical therapy for hearing loss caused by noise. Once established, the hearing loss is irreversible.[14] Internationally, the contribution of occupational noise exposure to total deafness rates is approximately 7% in the most developed nations and 21% in developing countries.[15] This study was conducted on 150 healthy traffic policeman to detect noise induced hearing loss in them with duration of 1 to 5 years.

Out of 150 subjects, Noise induced hearing loss was observed in 33 (22%) subjects and sensorineural hearing loss was observed in 8 (5.33%) subjects, whereas 109 traffic personnel were having normal hearing. The results are in accordance with some studies done earlier who assessed the traffic noise and its impact on traffic policeman and observed a high incidence of noise induced hearing loss (21%) and of sensorineural hearing loss (18%) in these persons[16], whereas incidence of noise induced hearing loss of 22.9% was found among the air force personnel.[17] Our study is not in agreement with a study conducted in Malaysia, who studied noise exposure and noise induced hearing loss among Kuala Lumpur traffic point duty personnel and found that 80% were positive for noise induced hearing loss.[18]

Amongst all the 33 NIHL cases, most of the subjects had mild impairment (26-40 dB) followed by moderate impairment (41-55dB) which is consistent with a study who concluded that 24% of the traffic policeman of Dhaka had mild to moderate sensorineural hearing loss due to noise exposure which was related to duration of exposure.[19]

Our study showed right sided predominance, which is in consonance with a study who also reported right sided hearing loss.[17]

CONCLUSION

1. A significant association was observed between noise induced hearing loss and duration of exposure to noise. So, the duration of exposure of traffic persons to noise pollution must be less than three continuous years for exposure limitation.
2. Periodic checking of traffic policeman (clinically and audiologically) should be done regularly at frequent intervals of time.
3. Traffic policemen should be provided with hearing protective devices such as ear muffs, ear plugs and ear canal caps free of cost.
4. Awareness should be created among traffic policemen about the auditory and non-auditory effects of noise by implementing education and training programs.

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