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A Prospective Study of Assessment of Occupational Noise Induced Hearing Loss in Industrial Workers

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Abstract
Introduction: *Occupational noise induced hearing loss (ONIHL) is a major cause of disability throughout the world. Occupational noise exposure is likely to contribute in very high proportion of cases of sensorineural hearing loss (SNHL) in workers who are continuously exposed to high frequency noise being emitted from industrial machines.*
Materials and Methods:*This study was conducted to evaluate the effect of noise pollution at work place and different noise scale in two industries, that is, textile and hard strip rolling at Jamshedpur, India. This study was conducted in 100 male industrial workers in age group of 19-55 years, which includes office workers, machine operators, and helpers. All underwent ENT examination and audiometery. The patients suffering from chronic suppurative otitis media, wax, deviated nasal septum, sinusitis, diabetes, and hypertension and on drugs known to affect hearing were excluded from the study. Audiometric testing was conducted in a sound free room in the office and calibrated digital audiometer ALPS AD 2100 was used. Hearing threshold were obtained for each ear at 250-8 kHz and a threshold above the 25 dB was considered to be hearing loss in any of the above frequencies. Patient details were charted on the Performa.*
Results: *A total number of 100 male industrial workers were examined by audiometery in the age group of 19-55 years. In the age group 19-25 years, there were 16 (16%), 26-30 years 16 (16%), 31-35 years 20 (20%), 36-40 years 18 (18%), 41-45 years 10 (10%), 46-50 years 10 (10%) and >50 years 10 (10%). Number of noise induced hearing loss (NIHL) was 02 (12.5%) in 16-25 years, 01 (6.25%) in 16-30 years, 10 (50%) in 31-35 years, 14 (77.7%) in 36-40 years, 02 (20%) in 41-45 years, 06 (60%) in 46-50 years, whereas it was 3 (30%) in age group of >50 years [Table 1]. We have included office workers, machinery operator, and helper group that include gardeners, sweepers, and peons. The total duration of service was 1-10 years in 24 workers, 10-20 years in 54 workers, whereas >20 years in 22 workers. There were no significant ear differences (right vs. left) across the age group.*
Conclusion: *Chronic exposure to noise is common hazard in industrial workers that affect bilateral cochlea and causes high frequency SNHL with 4 kHz notch. We observed 39% industrial workers who were exposed to noise level >87.3 dBA, for 8-12 h/day in textile and hard strip rolling mills in spite of noise free machine are recommended suffered from SNHL.*
Key Words: *SNHL, Noise, dBA, industrial workers.*

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I. Introduction

Occupational noise induced hearing loss (ONIHL) is a major cause of disability throughout the world. Occupational noise exposure is likely to contribute in very high proportion of cases of sensorineural hearing loss (SNHL) in workers who are continuously exposed to high frequency noise being emitted from industrial machines.[1]Exposure to sound above a level of approximately 85 dB initially manifest as a temporary hearing loss or dullness of hearing that is known as temporary threshold shift (TTS), which may have fast resolution within first 10-15 days of the exposure.[2]However, a repeated or sustained exposure of noise to the hair cells and associated nerve fibers leads on to degenerative changes and the TTS becomes permanent threshold shift (PTS). The effect of excessive noise could be so devastating that it can cause permanent memory loss or psychiatric disorder.[3]

With the rapid development of industries and automobiles the noise hazard is increasing by many folds. According to American Academy of Ophthalmology and Otolaryngology excessive noise pollution can lead onto difficulty in communication, while at work and ringing sound in the ear for several hours even after work.[4]Further some noxious agents also affect the workers in the industries. It is identified among the textile plant workers, basic metal industries, chemical industries, beverages, and nonmetallic mineral product

industries.In this study, we conducted a survey of textile and metal rolling industries in our region to assess hearing loss in the industrial worker in relation to noise level, duration of exposure, age, and type of work in the factory.[5]

II. Materials And Methods

This study was conducted to evaluate the effect of noise pollution at work place and different noise scale in two industries, that is, textile and hard strip rolling at Jamshedpur, India. This study was conducted in 100 male industrial workers in age group of 19-55 years, which includes office workers, machine operators, and helpers. All underwent ENT examination and audiometery. The patients suffering from chronic suppurative otitis media, wax, deviated nasal septum, sinusitis, diabetes, and hypertension and on drugs known to affect hearing were excluded from the study. Audiometric testing was conducted in a sound free room in the office and calibrated digital audiometer ALPS AD 2100 was used. Hearing threshold were obtained for each ear at 250-8 kHz and a threshold above the 25 dB was considered to be hearing loss in any of the above frequencies. Patient details were charted on the Performa.

Noise survey was carried out with the help of a sound level meter or decibel meter. This was a portable type and had "ABC" (GU) frequencies. It is battery operated and has range from 50 dBA to 120 dBA. We also measured various sound levels at office and machinery operated area. All data were analyzed statistically.

III. Results

A total number of 100 male industrial workers were examined by audiometery in the age group of 19-55 years. In the age group 19-25 years, there were 16 (16%), 26-30 years 16 (16%), 31-35 years 20 (20%), 36-40 years 18 (18%), 41-45 years 10 (10%), 46-50 years 10 (10%) and >50 years 10 (10%). Number of noise induced hearing loss (NIHL) was 02 (12.5%) in 16-25 years, 01 (6.25%) in 16-30 years, 10 (50%) in 31-35 years, 14 (77.7%) in 36-40 years, 02 (20%) in 41-45 years, 06 (60%) in 46-50 years, whereas it was 3 (30%) in age group of >50 years [Table 1]. We have included office workers, machinery operator, and helper group that include gardeners, sweepers, and peons. The total duration of service was 1-10 years in 24 workers, 10-20 years in 54 workers, whereas >20 years in 22 workers. There were no significant ear differences (right vs. left) across the age group.

S.No	Age Group (in years)	No of patients (%)	No of NIHL	Percentage
1	19-25	16 (16)	02	12.5
2	26-30	16 (16)	01	6.25
3	31-35	20 (20)	10	50
4	36-40	18 (18)	14	77.7
5	41-45	10 (10)	02	20
6	46-50	10 (10)	06	60
7	>50	10 (10)	03	30

Table 1:NIHL in industrial workers in relation to age

Total office workers examined were 22 who were working for 8 h, out of which 3 workers had mild 4 kHz notch, 1 moderate high frequency loss (HFL). Of a total of 46 machinery operators with 12 working hours, two had mild 4 kHz notch, 9 moderate 4 kHz notch, 3 moderate HFL, 04 severe 4 kHz notch, 4 severe HFL. Of 32 helpers with 12 working hours, 1 had mild 4 kHz notch, 2 moderate 4 kHz notch, 1 moderate HFL, 5 severe 4 kHz notch, and 3 severe HFL [Table 2].

S.No	Place of work	Total number of workers examined	Normal	Loss in dBA			
				Severity	Total	4K notch	HFL
1	8	22	18	Mild Moderate Severe	3 1 0	3 - -	- 1 -
2	12	46	24	Mild Moderate Severe	2 12 8	2 9 4	- 3 4
3	12	32	20	Mild Moderate Severe	1 3 8	1 2 5	- 1 3

Table 2: Hearing status of industrial workers in relation to type of work

Noise level at office was 64.8 dBA, at machinery area 87.3 dBA and at helpers area was 76.7 dBA at textile industry. The noise level in hard strip rolling was 69.4 dBA at office area, 90.3 dBA at machinery area, whereas 83 dBA at helpers area and was comparable in the two industries.

IV. Discussion

The noise originate from human activities especially the urbanization and development of transport and industries.[6] The word noise is derived from the Latin word "*nausea"* meaning impulsive, unwanted, unpleasant, or loud unexpected sound. The casual association between occupational noise exposure and hearing loss is well-documented.[7]In spite of various preventive measures in vogue to reduce the effect of noise, however, it still remains one of the most prevalent occupational health hazard. It has many adverse effects such as elevated blood pressure, agitation, disorientation, headache, reduced performance, sleeping difficulties, annoyance, stress, tinnitus, and last but not the least permanent irreversible SNHL.[8]

Noise as such is achieving dangerously alarming proportion and proving hazardous in all spheres of life more so industries workers. In our study all the workers either in office, machinery operator or helpers exposed to noise got hearing defects. It is due to fact that exposure of noise of >85 dB for >8 h daily over a long period of time cause shearing forces on stereocilia of the hair cell lining the basilar membrane of cochlea; leading on to wear and tear of delicate inner ear structures.[9]There are many hypothesis that include mechanical injury from basilar membrane motion, metabolic exhaustion, activity induced ischemia and ionic poisoning from breaks in cell membrane.In our study, overall noise exposure was 76.2 dBA in textile industry and 80.9 dBA in hard rolling strip industries. Ohrstrom *et al*.reported the subjective noise annoyance among workers in a textile mill and machine factory is common in the workers. The authors suggested the use of industrial noise exposure criteria based on annoyance, rather than hearing damage criteria. [10]

High noise level exposure presents a great challenge to auditory system; however, continuous exposure of sound to the ears causes progressive damage to auditory periphery, or cochlea. A maximum permissible level of occupational noise limit by the international standards organization is 85-90 dBA for 8 h/day. In India, model rules under Indian factories Act 1948 stipulate a limit of 90 dBA for 8 h of exposure for 6 days a week.Most of the workers employed in the industries as skilled or semi-skilled workers are illiterate or semi illiterate having no information about the noise regulation and adverse effects of noise on their performance and health. The study of general adverse effects of exposure to occupational noise has been a topic of active research and debate among researchers. We have recorded maximum noise levels at machinery operated area when compared to helpers and office area. That is the reason maximum hearing loss was observed in machinery operating workers than helpers and office workers

V. Conclusion

Chronic exposure to noise is common hazard in industrial workers that affect bilateral cochlea and causes high frequency SNHL with 4 kHz notch. We observed 39% industrial workers who were exposed to noise level >87.3 dBA, for 8-12 h/day in textile and hard strip rolling mills in spite of noise free machine are recommended suffered from SNHL.

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