

PATTERN OF HEARING LOSS ON PURE TONE AUDIOGRAM IN HEAVY INDUSTRIAL WORKERS

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ABSTRACT

Background: Hearing loss in industrial worker may be devastating for the workers, with poor quality of life. **Objective:** This study was conducted to find out the degree of hearing loss and audiometric pattern of hearing loss in local industrial workers. **Patients & method:** This cross sectional study was conducted at department of ENT, head & neck surgery, Kulsoom Bai Valika Social Security Hospital, SITE, affiliated hospital of Hamdard University, Karachi, from 1st January, 2010 to 31st December, 2010. A total of 100 persons were included in this study who were industrial workers for more than 15 years and came to hospital for some reasons other than hearing loss or any ENT problem. The data was entered and analyzed by using SPSS version 15. **Results:** Majority of the subjects were male (96%) while only 4% were females. 18 patients were below the age of 35 years, 29 were between 36-45 years, 32 were between 46-55 years and 21 were above the age of 55 years. 74% of the workers were not using any protective device or method against loud machinery noises. Mean hearing threshold of all the subjects was above 25 dB in all frequencies tested i.e. from 250 to 8000 Hz. Mean hearing loss was maximum at the frequency of 4000 Hz. **Conclusion:** All of the workers included in this study has some degree of hearing loss atleast in some frequencies (more pronounced at 4000 Hz), although majority were not aware of this hearing loss.

Key words: Noise induced hearing loss, Occupational hazards, Sensori-neural hearing loss, Pure tone audiometry

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INTRODUCTION

Noise is unwanted, nonharmonic, unpleasant and very high amplitude sounds. From the ancient time, the hammer of professional black smith was believed to cause and start noise induced hearing loss. Noise is known to be one of the environmental and occupational hazard listed in the Factory and Machinery Act 1967.¹ Hearing loss that is caused by noise exposure due to recreational or non-occupational activities is termed as sociocusis. Hearing loss due to injurious noise at workplace is called occupational noise induced hearing loss. Occupational noise-induced hearing loss is a worldwide problem and contributes 16% of hearing loss among adults ranging from 7% to 21% in various regions being higher in developing countries.² Furthermore hearing loss may lead to abnormal behavior like anxiety, mood disorders, personality disorders, schizophrenia and communication breakdown. The classical audiometric pattern is of a high-tone hearing loss with a notched appearance centered on 4 or 6 kHz, with some recovery at 8 kHz.³ However, the notch is often absent but significant

audiometric loss at frequencies below 2 kHz is uncommon. With the passage of time and continued exposure to loud sound, lower frequencies are also affected.^{4,5} There is limited scientific data available in Pakistan regarding the incidence, prevalence and type of hearing loss due to occupational noise exposure. So this study was conducted to find out the degree of hearing loss and audiometric pattern of hearing loss in industrial workers of Karachi, who otherwise have no complaint regarding hearing loss.

PATIENTS AND METHODS

This cross sectional study was conducted at the department of ENT, head & neck surgery, Kulsoom Bai Valika Social Security Hospital, which is the affiliated hospital of Hamdard College of Medicine & Dentistry, Hamdard University, Karachi, from 1st January, 2010 to 31st December, 2010. Inclusion criteria for this study were as follows: Any patient or attendant coming to hospital with no apparent complaint of hearing loss or any other ENT problem and who had history of working in any industry on heavy machines for more than 15 years continuously without gap other than normal holidays and vacations. On examination his tympanic membrane must be normal looking with normal mobility on Valsalva's maneuver, no other gross and apparent pathology related with nose and throat. The exclusion criteria for this study were as follows: Patients with previous history of discharge from the ears or perforation or any ear surgery.

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Patients having marked air-bone gap on pure tone audiogram. Patients having abnormal tympanogram (other than type A). Patients with unilateral sensori-neural deafness or marked asymmetry in hearing threshold in two ears, and Patients having diabetes mellitus or abnormal blood glucose levels.

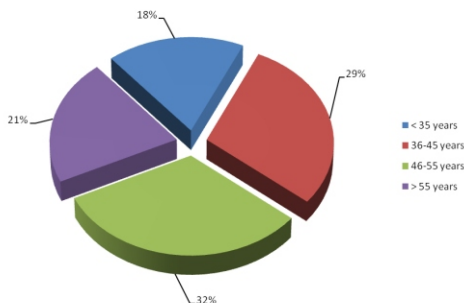
After selecting the person, thorough history and clinical examination of the ear, nose and throat were done in all patients. Random blood sugar, pure tone audiogram and tympanogram were done in all the patients. PTA was carried out in sound proof chamber at least 16 hours after last exposure to noise and frequency range used was 250 to 8000. At the end of this protocol, 100 consecutive persons following inclusion and exclusion criteria were included in this study. The data was entered and analyzed by using SPSS version 15.

RESULTS

A total of 100 patients were included in the study out of which 96 were male and 4 were female patients. Figure I shows the age wise distribution, where majority of the patients were between the age of 46 to 55 (32%), the mean age being 45.62 years (± 5.6). All the persons included in this study were factory worker on heavy machinery which were textile factory (32%), garment factory (18%), leather industry (9%) and others (41%). Working hours for all the workers were 8 to 10 hours per day, six days a week, some also doing overtime (extra hours) off and on.

Regarding the use of protective devices majority were not using any devices (74%), while improper use of devices by 26% and proper use of devices by none (0%). Table I shows the age wise mean duration of work.

Fig. I: Age group distribution (N = 100)



Over all mean duration of work was 23.3 years (table I). Fig II and III show the mean hearing threshold on pure tone audiogram at different frequencies in right and left ear in different groups according to age. Figure IV shows the mean hearing threshold of all patients in right and left ear, which shows almost equal and symmetrical hearing loss in two ears ($p < 0.01$).

Fig. II: Age wise mean hearing threshold of Right Ear (N = 100)

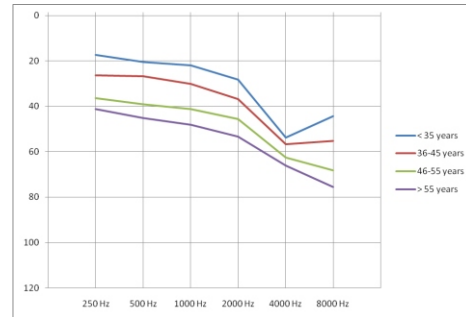


Fig. III: Age wise mean hearing threshold of Left Ear (N = 100)

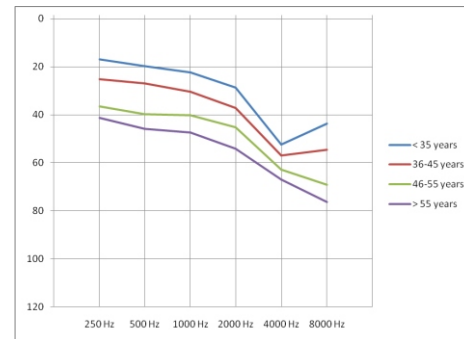


Fig. IV: Mean hearing threshold of Right and Left Ear (All patients, N = 100)

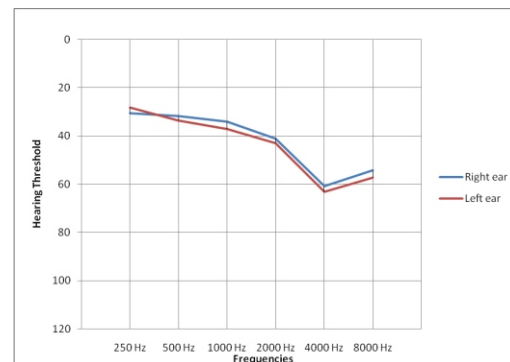


Table I: Age wise number of patients, duration of work and mean hearing threshold

Age	No. of Pt.	Mean duration of work (Years)	Mean Hearing Threshold on pure tone audiogram											
			250 Hz		500 Hz		1000 Hz		2000 Hz		4000 Hz		8000 Hz	
			L (dB)	R (dB)	L (dB)	R (dB)	L (dB)	R (dB)	L (dB)	R (dB)	L (dB)	R (dB)	L (dB)	R (dB)
< 35 years	18	16.7	16.9	17.4	19.7	20.5	22.3	21.9	28.7	28.3	52.4	53.8	43.8	44.3
36-45 years	29	20.8	25.2	26.3	26.9	26.8	30.4	30.1	37.2	36.8	56.9	56.8	54.7	55.2
46-55 years	32	25.2	36.5	36.3	39.8	39.2	40.3	41.3	45.2	45.7	62.8	62.6	69.2	68.3
> 55 years	21	29.8	41.4	41.3	45.9	45.2	47.5	48.1	54.1	53.4	67.1	66.1	76.3	75.6
Mean	100	23.3	28.2	30.6	33.6	31.8	37.1	34.1	42.9	41.1	63.2	60.9	57.2	54.2

DISCUSSION

Noise induced hearing loss is the most prevalent and preventable occupational disease in most Asian countries.⁴ Secondly occupational noise is the most common cause of noise induced hearing loss in adults.⁵ Onset of occupational noise induced hearing loss may occur at any age. There is marked inter-subject variability, even when the exposure to sound is same. There is no clear cut difference in the susceptibility between young and older individuals. Some studies report that hearing deteriorates with age and noise induced hearing loss occurs in addition to this.^{6,7} On the other hand some workers believe that it is the young and tender ear of the young worker that is more susceptible to effects of loud noise.⁸ Our study showed that with increasing age the mean hearing threshold is also increased, which is probably due to associated age related hearing loss. Secondly, older person are more exposed to noise because of more duration of work, as the mean duration of work for age less than 35 years was 16.7 years compared to age more than 55 years was 29.8 years.

Exposure to high intensity sound may cause temporary or permanent hearing loss. Repeated exposure to noise trauma may change a temporary threshold shift (TTS) to a permanent threshold shift (PTS). Degree and configuration of hearing loss depends on time of exposure, sound intensity and upto some extent sound frequency. Noise induced hearing loss is typically greatest in the range of 4000 to 6000 Hz. This appears to be a consequence of several factors like human ear is more sensitive at 1000 to 5000 Hz, acoustic reflex attenuates loud noises below 2000 Hz and non-linear middle ear function as a result of increased intensities. In our study, the notch at 4000 Hz was more pronounced in younger patients and fading

out as the age increases. Again this finding is most probably because of age related changes and more duration of work.

Usually the hearing loss is equal and symmetrical in two ears but unilateral or marked asymmetrical loss may occur depending upon the side of noise exposure (e.g. firearms sound) and use of protecting devices. In our study, we have excluded persons with unilateral or asymmetrical hearing loss, so there was no difference in hearing loss between right and left ear. This is also because of work environment in indoor factories which produces essentially equal stimulation of both the ears.

Use of hearing protection methods during work is the most feasible mean to prevent noise induced hearing loss in industrial workers. In our study, use of protective devices was very poor, none of the patient was using proper hearing protection methods. Only 26 % of the workers used inconsistent and improper methods while majority (74%) did not used any protective method. In our country, this attitude is mainly because of non-availability of the devices and ignorance of the workers regarding their health issues. Inconsistent use of hearing protection is an issue not limited to developing countries only but it is also observed in the developed world as well.^{9,10}

In our study, almost all of the persons had some degree of hearing loss specially at higher frequencies (4000 Hz), although most of them were unaware of their hearing loss. This is mainly because the lower frequencies are less effected specially in younger age group. The similar results were reported in other studies from shipyard industries, shipping workers, aviation workers, textile workers and rickshaw drivers of Karachi.¹¹⁻¹⁵

The findings of this study can be used in alerting the authorities to the still-prevalent but preventable problem of noise induced hearing loss in different occupations.

CONCLUSION

Almost all of the worker in this study, who are working in different industries for more than 15 years showed some degree of hearing loss which was most pronounced at 4000 Hz. Most of the workers were un-aware of this hearing loss. Appropriate public health measures are suggested for prevention, timely diagnosis, treatment and rehabilitative measures for industrial workers.

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