

Prevalence of Noise Induced Hearing Loss in Industrial Workers of Taxila

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ABSTRACT

Background: Occupational hazards and risks are a common public health issue, especially when healthcare workers safety is concerned; Noise induced hearing loss is a common preventable occupational hazard which affects millions of people globally¹. It is the hearing loss that is caused by prolonged exposure of the ear to the noise².

Aim: To identify prevalence of Noise induced hearing loss in industrial workers from July 1, till December 31st, 2021

Study design: Descriptive, cross-sectional study

Place and duration of study: The current study was conducted at Taxila at HITEC-Institute of Medical sciences from July 1, till December 31st, 2021.

Methodology: A total number of 314 workers working in industrial area with noisy surroundings according to the selection criteria were included in the study. A questionnaire about past medical history of all participants in regard to ear and hearing disorders was obtained. Prevalence of NIHL was assessed in all workers with or without hearing loss.

Results: The total numbers of workers included in the study were 314. The total number of patients having NIHL was 42. Prevalence of NIHL was 13. NIHL is a global health problem and is the second most important cause of hearing loss. It is a preventable disorder that affects a large proportion of workers. In our setup the NIHL was lower than expected due to better control of Noise and proper use of noise protective equipment.

Keywords: NIHL = Noise-induced Hearing Loss, sensorineural hearing loss, Hearing loss.

INTRODUCTION

Noise induced hearing loss is a common preventable occupational hazard which affects millions of people globally¹. It is the hearing loss that is caused by prolonged exposure of the ear to the noise². It is considered to be a reversible symptom if the person leaves the noisy environment early but permanent hearing loss can occur if we continue to live in the noisy surroundings of a considerable loudness. There is growing evidence that there is also a relationship that exists between noise in the environment and tinnitus. Long-term exposure to noise leads to pathology of the inner ear leading to NIHL and often tinnitus. This hearing loss which is increasingly becoming prevalent in industrial workers and now new evidence shows its existence in young adults due to the prevalence of high noise equipment in household and recreational tools³. It mostly affects both ears. It is usually diagnosed by pure tone audiometry and is characterized by formation of a notch at high frequencies of 3000, 4000, 6000 or 8000 KHz⁴. As far as the industrial noise induced deafness is concerned it is preventable by decreasing the noise exposure by decreasing the time to stay at noisy environment and secondly and most importantly by wearing personal protective equipment⁴. According to one study, the noise induced hearing loss is the second most common cause of hearing loss second only to the age related hearing loss which also accompanies tinnitus⁵. This may lead to communication problems during working hours. Similarly, other medical conditions may result from hearing loss namely Hypertension and IHD. So, there should be a proper screening of all individuals with ages greater than 60 years. There are estimated cases of over 4 million suffering by occupational noise exposure (Nelson et al)⁶.

An important factor is the detailed history of the patient to rule previous history of any noise exposure and to rule out other causes of hearing losses. Similarly, hearing loss also accompanies other conditions of the external and middle ear so they should be properly diagnosed to distinguish them from noise induced hearing loss which is the result of insult of the inner ear. So, this study will include the screening results of patients with NIHL as well as it will exclude hearing loss resulting from conditions of external and middle ear.

It is to be considered at this point that the NIHL is although preventable but very difficult to be treated on medical grounds. There has been no evidence that the hearing loss diminishes or subsides once the individual has left the noisy surroundings^{7,8,9}. However, further aggravation of the hearing loss will continue if the individual does not use protective equipment or is not moved from the loud noise. By far the first most important measure to avoid this type of hearing loss is by reduction of noise exposure by means of decreasing the noise intensity or by reducing the duration of exposure. The second most important measure is to use ear protection device. This means that early prevention and regular follow up will make the hallmark in the future research. Recent surveys conducted in developed countries have shown better control of hearing loss with advancing technology and awareness of workers with disabling effects of noise at work and even at home and has led to better control of hearing in old age but still numbers of hearing impaired continue to rise due to the fact that more people living longer.

One has to bear in mind that different individuals respond to the loud noise differently. This means that a loud noise of particular intensity can have different impact on 2 different individuals¹⁰. Similarly, different systemic diseases may also have a different impact when they are also associated with NIHL but their role is still unclear¹¹ and this needs to be evaluated in the future.

Rationale: There has been no such study in recent years in our setup. It will aid in prevention of noise induced hearing loss by introduction and awareness of workers by use of protective equipment.

Acronyms: NIHL = Noise-induced Hearing Loss

(A noise of 90 dB (A) SPL, 8 h a day for 5 days per week is the maximum safe limit).

Noise induced hearing loss is defined as the sensorineural hearing loss that results from prolonged exposure to noise and will be measured by appearance of dip at 4 KHz in pure tone audiogram. The fact that the noise induced hearing loss affects the frequencies of or around 4 KHz is due to the characteristic anatomical and physiological properties of the ear. Hearing loss was measured by Audiogram.

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METHODOLOGY

This cross sectional study was conducted at HIT Hospital attached to HITEC-Institute of Medical Sciences at Taxila from July 1st, till December 31st, 2021. By taking precision 5%, 95% confidence interval, anticipated population proportion for Noise induced hearing loss was 24.9% and estimated sample size was 288.

A total number of 314 workers working in industrial area with noisy surroundings according to the selection criteria were included in the study using simple random sampling. All the workers with or without hearing loss were included in the study. The hearing loss was labeled for only those workers having noise trauma. This means that the workers who had hearing loss due to diseases of the external or middle ear and those who have undergone previous ear surgery were not labeled as having hearing loss. A questionnaire about past medical history of all participants in regard to ear and hearing disorders and risk factors was obtained. The data was entered using a special Performa and finally interpreted using SPSS version 25.

The data will be collected from the factory / industry. Any patient reporting to OPD was also included in the study. After taking consent, detailed history was taken and a form was filled by the patient. The data was entered in Microsoft excel and all variables were added. These variables were added to the SPSS version 25. The incidence of each variable was calculated with 0.5% with 95% confidence interval. All variables were tabulated and chi square test was implemented. The frequency of each variable was also calculated. The minimum age was 22 and the maximum age was 74 years. The age group was categorized into 5 groups.

The objectives of the study were to identify prevalence of Noise induced hearing loss in industrial workers working at Taxila from July 1st, till December 31st, 2021 and to compare the noise related changes in hearing of different age groups.

RESULTS

The total numbers of workers included in the study were 314. The total number of patients having NIHL was 42. The Prevalence of NIHL was 13%. All patients were male. The minimum age was 22

and the maximum age was 71 years with mean age being 39.26 years. The age group was categorized into 5 groups.

A total number of 314 workers were included in the current study. All workers were male. The age group was categorized into 5 groups. 21-30 years old were 92(29.2%), 31-40 years old were 80(25.4%), 73(23.2%) were 41-50 years of age, 51-60 years old were 67(21.3%) and 2(0.6%) were above 60 years of age. The total number of patients having NIHL was 42 indicating 13% of the workers were having hearing loss due to noise trauma. Among the age groups having NIHL, most workers were affected in age group of 60 years or above i.e. 2(100%) and the age group that was least affected was 31-40 years having only 7(8.75%) cases of NIHL (Table 2).

The hearing loss was tested first with tuning fork while filling the questionnaire and later on confirmed by Audiometry. Hearing impairment was considered only in those patients who had NIHL. Hearing impairment due to other conditions of external or middle ear was addressed to the patients and treatment offered. Among those, 31(9.8%) patients were having bilateral NIHL and 11(3.5%) patients were having unilateral NIHL with most workers in the 21-30 years age group [Unilateral hearing loss in 1.08% as compared to bilateral hearing loss in 9.7%]. The hearing loss was seen mostly in the 41-50 years age group [Unilateral hearing loss in 6.8% as compared to bilateral hearing loss in 12.3%]. Among these, Age group 1 had 1 case of unilateral hearing loss and 9 cases of bilateral hearing loss, Age group 2 had 4 cases of unilateral and 3 cases of bilateral hearing loss (P value <0.05), Age group 3 had 5 and 9 cases of unilateral and bilateral hearing loss respectively, Age group 4 had 1 case of unilateral and 8 cases of bilateral hearing loss and Age group 5 had only 2 cases of bilateral NIHL whereas no worker had unilateral hearing problem (P value <0.05) (Table 3).

The hearing loss was also associated to be linked with the duration of employment. The most workers having 15 years or more of experience were directly affected (Table 4). The employment duration was categorized in 5 groups. All groups showed a significant impact on their hearing with respect to duration of employment (P value <0.05) with most workers involved in the Group 5 with more than 15 years of experience.

Table 1:

Total patients (N)	Minimum age	Maximum age	Mean age	Standard deviation
314	22	71	39.26	11.328

Table 2: Age Group / Hearing Loss Cross tabulation:

Age Group	Hearing Loss				N	%
	No hearing loss	%	Hearing loss	%		
21-30 years old	82	89.1%	10	10.8%	92	29.2%
31-40 years old	73	91.2%	7	8.7%	80	25.4%
41-50 years old	59	80.8%	14	19.1%	73	23.2%
51-60 years old	58	86.5%	9	13.4%	67	21.3%
Above 60 years	0	0%	2	100.0%	2	0.6%
Total	272	86.6%	42	13.3%	314	

Table 3: Unilateral / Bilateral Hearing loss Cross tabulation:

Age Group	No Hearing Loss		Unilateral Hearing Loss		Bilateral Hearing Loss		Total	
	N1	%	N2	%	N3	%	N	%
21-30 years old	82	89.1	1	1.08	9	9.7	92	29.2
31-40 years old	73	91.2	4	5	3	3.7	80	25.4
41-50 years old	59	80.8	5	6.8	9	12.3	73	23.2
51-60 years old	58	86.5	1	1.4	8	11.9	67	21.3
Above 60 years	0	0	0	0	2	100	2	0.6
Total	272	86.6	11	3.5	31	9.8	314	

Table 4: Duration of Employment / Hearing loss Cross tabulation:

Employment duration	Hearing Loss					
	No Hearing Loss	%	Hearing Loss	%	Total (N)	%
1-2 years of experience	23	92%	2	8%	25	7.9%
3-5 years of experience	27	77.1%	8	22.8%	35	11.1%
6-10 years of experience	63	86.3%	10	13.69%	73	23.2%
11-15 years of experience	57	90.4%	6	9.52%	63	20.06%
More than 15 years of experience	99	83.8%	19	16.1%	118	37.5%
Total	269	85.6%	42	13.3%	314	

DISCUSSION

The current research was done to study the incidence of noise induced hearing loss in our setup and to have some idea about the risk factors leading to this disease which is among the most common occupational diseases in the world. The total number of workers included in the study was 314. The total number of patients having NIHL was 42. The minimum age was 22 and the maximum age was 71 years. The age group was categorized into 5 groups. Among the age groups, the maximum number of cases having NIHL was in the age group of 60 years or above and the minimum number of cases was in the age group falling between 31-40 years of age. This showed that the workers with age > 60 years had significant impact on their hearing due to noise trauma. Among these, 31 patients were having bilateral NIHL and 11 patients were having unilateral NIHL with most workers in the 21-30 years age group. The bilateral NIHL was seen affecting mostly the age group of 60 years or above and unilateral hearing loss was seen mostly in the age group of 41-50 years. The hearing loss was also associated to be linked with the duration of employment. The employment group was divided into 5 groups. The most workers having 15 years or more of experience were directly affected. The noise intensity was measured 104-105 dB by noise meter. The average exposure of workers was estimated to be 25 hours / week or 100 hours / month.

CONCLUSION

Since, the recognition of the NIHL, its effect on the potential employees has been studied at various intervals and is alarming. It is estimated to be the fourth leading cause of disability all over the world (Cunningham and Tucci, 2017). The employees working at high noise areas who may have normal audiological results still may have decrease speech perception¹. Similarly, one of the ears usually the left ear may be early affected as compared to the other one. Certain sources of sound may affect one of the ears more than the other like gunshot or sirens or where there is fixed placement of the individual during the work which can all be prevented by awareness sessions especially for the new recruiters⁴.

The current study showed that the incidence of NIHL is directly related to the age of the workers. It has been noticed that an active awareness program needs to be implemented in these industrial workers so that they may be able to prevent the future number of cases of NIHL. It is further noticed that noise protective equipment has been provided by the authorities but due to lack of awareness, an active implementation program associated with long-term regular follow up may be needed including;

- Frequent screening of employees by means of audiological investigations.
- Screening at the time of recruitment and follow up.

Furthermore, proper use of the protective equipment is also needed which requires frequent workshops and training sessions of the employees. Similarly, with advancing and evolving technology, the new and better more comfortable protective devices have been introduced, the use of which can ensure the comfort of employees while at work. More recently, new pharmaceutical agents (including steroids and certain Vitamins) have been identified that can minimize the ototoxic effects of acoustic trauma¹. In our setup the NIHL was lower than expected due to better control of Noise and proper use of noise protective equipment.

Conflict of interest: Nil

REFERENCES

1. Le TN, Straatman LV, Lea J, Westerberg B. Current insights in noise-induced hearing loss: a literature review of the underlying mechanism, pathophysiology, asymmetry, and management options. *J Otolaryngology Head Neck Surg.* 2017 May 23; 46(1):41. doi: 10.1186/s40463-017-0219-x. PMID: 28535812; PMCID: PMC5442866.
2. Ding T, Yan A, Liu K. What is noise-induced hearing loss? *Br J Hosp Med (Lond).* 2019 Sep 2; 80(9):525-529. doi: 10.12968/hmed.2019.80.9.525. PMID: 31498679.
3. Imam L, Hannan SA. Noise-induced hearing loss: a modern epidemic? *Br J Hosp Med (Lond).* 2017 May 2; 78(5):286-290. doi: 10.12968/hmed.2017.78.5.286. PMID: 28489444.
4. Mirza R, Kirchner DB, Dobie RA, Crawford J; ACOEM Task Force on Occupational Hearing Loss. Occupational Noise-Induced Hearing Loss. *J Occup Environ Med.* 2018 Sep; 60(9):e498-e501. doi: 10.1097/JOM.0000000000001423. PMID: 30095587.
5. Royster JD. Preventing Noise-Induced Hearing Loss. *N C Med J.* 2017 Mar-Apr; 78(2):113-117. doi: 10.18043/ncm.78.2.113. PMID: 28420774.
6. Addressing the rising prevalence of hearing loss. Geneva: World Health Organization; 2018. License: CC BY-NC-SA 3.0 IGO.
7. Dobie RA. *Medical-Legal Evaluation of Hearing Loss.* 3rd ed. San Diego, CA: Plural Publishing; 2015.
8. Durch JS, Joellenbeck LM, Humes LE, eds. *Noise and Military Service: Implications for Hearing Loss and Tinnitus.* Washington, DC: National Academies Press; 2005.
9. Lee FS, Matthews LJ, Dubno JR, Mills JH. Longitudinal study of pure-tone thresholds in older persons. *Ear Hear.* 2005; 26:1-11.
10. Stucken EZ, Hong RS. Noise-induced hearing loss: an occupational medicine perspective. *Curr Opin Otolaryngol Head Neck Surg.* 2014; 22:388-393.
11. Ward WD. Endogenous factors related to susceptibility to damage from noise. *OccupMed.* 1995; 10:561-575.