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THE EFFECT OF NOISE ON THE WORKERS OF BASRAH PETRO-CHEMICAL FACTORY

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Abstract

This is a prospective study done in Basra Petro–Chemical Factory Health Center, from the period of Jan. 2001 to Des. 2001. Eighty workers aged 20-50 years were included in this study; they were subjected to a questionnaire including history of noise exposure, drug and medical history, full ENT and audiological examinations.

They were divided into two groups (control and noise exposed workers). The majority of noise exposed workers fell in the age group 31-40 years (20.5%). Twenty three workers of this group (57.5%) exposed to noise more than eight hours per day. The main complaint were bilateral deafness (22.5%) and aural fullness (20.5%).The audiological results were 18 workers (45%) had bilateral high frequency sensorineural hearing loss (SNHL), 10 workers (25%) of the high frequency SNHL have mild hearing loss with 20-35 dBA. Only two workers (engineers) using ear protection have no aural complaint. We conclude from this study that noise induced hearing loss is preventable disease by ear protection and decrease daily exposure.

Introduction

Hearing loss caused by exposure to a noise has been well recognized since the industrial revolution. An early term for this condition was (boiler maker's disease) because so many workers who made steam boilers developed hearing loss[1]. The site and the nature of the lesion in the ear produced by noise was first described by Haberman (1890), in 75 years old blacksmith. Partial disappearance of the organ of Corti was found with destruction of the hair cells, the extensive damage being in the lower basal coil[2]. Soon after the introduction of audiometer, Fowler (1929) observed dip at 4KHz and Bunch (1939) published the 1st audiometric data demonstrating the typical high frequency loss acquired by those exposed to noise[2].

Exposure to hazardous sounds can damage the inner ear hair cells, resulting in noise induce threshold shift (NITS) which is the hearing threshold level shift attributable to noise alone[3,4]. Depending on the loudness and duration of the hazardous sound, NITS can be temporary or permanent[3,4]. The first audiometric sign of NITS is usually a threshold loss at 3,4 or 6 KHz[1-3,5],with continued harmful noise exposure , the threshold loss at 3,4 or 6 KHz increases in severity and NITS can extent to include lower and higher frequencies[2,3,5]. Potentially hazardous sound levels may make it difficult for a person to hear conversation and cause the affected person to hear ringing in the ears or muffled sounds after the sound exposure has ended[3]. NITS can be resulted from exposure to acute or chronic noise, acute exposure such as an explosion or gunfire, can produce immediate, permanent, severe NITS[1,3]. Chronic exposure to less intense sounds, such as loud music, machine sounds power tools and wood working may produce sounds more than 85 dBA[6] which cause painlessly accumulate over a lifetime to gradually produce irreversible damage to the inner ear hair cells[1-3]. Noise induced hearing loss (NIHL) is a significant social and public health problem which tend to

increase with the remarkable progress of heavy industries, moreover occupational deafness is one of the most difficult cases in prevention and treatment. This needs grave concern from the viewpoint of both industrial and otorhinolaryngological practitioners[7]. An objective hearing screening tests can detect hearing loss in an earlier stage can prevent NIHL. Occupational NIHL is generally detected by pure tone audiometry, in the Netherlands, all employees who exposed to daily noise levels exceeding 85 dBA have to test at least once every four years voluntary[8].Since hearing loss damage is irreversible so early recognition is important to provide precautionary measures to prevent more damage[9,10].

Patients and methods

Eighty workers from Basra Petro-Chemical Factory were involved in this study which conducted for the period from January 2001 to December 2001 at the Health Center of the same factory. All the participants answered a special designed questionnaire paper which directed towards age, gender, place of work, date of employment, date of exposure to loud noises, family history of deafness, past history of using ototoxic drugs, the use of ear protection (ear plugs and/or muff) and any complaint (deafness, aural fullness, vertigo, ear discharge, itching and tinnitus). All the participants were subjected to full ENT examinations including 512Hz tuning fork tests and pure tone audiometric examination. Pure tone audiometry was done in a sound proof room using G.N. Otometrics AS audiometer (DA65R, DK-263OT astrup, Denmark) and the results are blotted on an audiogram for interpretation. Sound level meter (CEL-254 Digital impulse sound level meter, Casella Cell Limited, UK) was used to measure the level of noise at each department of the factory. The participants were divided into two groups, the 1st control group (40 workers) who subjected to low level of noise, they work in the fire department, administration department, health center and drivers, they subjected to noise of sound level (65 dBA, 67 dBA, 64.4 dBA and 65 dBA) respectively. The 2nd group (noise exposed workers) in the department of Ethylene production, high density polymers, boilers and electricity generators in which the sound level was (90 dBA, 91.7 dBA, 95 dBA and 97 dBA) respectively.

In this prospective study, workers above 50 years were excluded to avoid bias due to presbycusis and anyone who had middle ear disease like chronic suppurative otitis media were also excluded.

Results

This study was carried on 80 workers, the majority of them are falling in the age group of 31-40 years in a percentage of 60% and50percent for both control and noise exposed worker respectively as it shown in table I.

Table I: Age distribution among the workers

Age (Y)	20-30 y	Percentage	31-40 years	Percentage	41-50 years	Percentage
Control	1	2.5	24	60	15	37.5
Noise Exposed	5	12.5	20	50	15	37.5

Table II shows that the control group has a daily exposure to noise less than 8 hour while the other group 17 workers 42.5% exposed to less than 8 hour while 23 workers (57.5%) exposed to noise more than 8 hour daily.

Table II: The daily noise exposure distribution among workers

Daily exposure	<8hours	Percentage	>8 hours	Percentage
control	40	100	0	0
Noise exposure	17	42.5	23	57.5

This study shows that 11 workers had deafness in noise expose group in frequency of 7.5% (3 workers) and 22.5% (9 workers) for unilateral and bilateral deafness respectively. In same group 8 workers (20%) complained from an aural fullness and bilateral tinnitus while 3 workers (7.5%) had unilateral tinnitus (Table III).

In the control group 3 workers (7.5%) had deafness and only one worker (2.5%) complained form tinnitus.

Table III: Distribution of the workers according to the complaint

Complaint		Deafness		Aural fullness	Tinnitus		Ear discharge	Itching
		RT.	LT.		RT.	LT.		
control	Unilateral	0	1	0	0	1	0	0
	bilateral	2			1			
Noise exposed	Unilateral	2	1	0	2	1	0	0
	bilateral	9		8	8			

Twenty workers (50%) of the noise exposed group don't use the ear protection, five of them (25%) had hearing problems while 18 (45%) use it irregularly, three of them (16.6%) had hearing problems and only two workers (5%) use the ear protection regularly who don't complain from ear problem.

In control group, no one use the ear protection. Pure tone audio metric findings display that 3 workers of the control group complain from high frequency mild hearing loss, one workers (2.5%) had unilateral hearing loss with hearing threshold of 20 dBA while 2 workers (5%) had bilateral hearing loss with hearing threshold of 20-30 dBA, all of them had exposed to noisy trauma during military services. In the other group, 10 workers (25%) had bilateral high frequency hearing loss with hearing threshold of 20-35 dBA, while 5 workers (12.5%) had unilateral high frequency hearing loss with hearing threshold of 70-80 dBA. 3 workers (7.5%) had bilateral moderate high frequency hearing loss with hearing threshold of 35-45 dBA and only 2 workers(5%) had severe bilateral high frequency hearing loss with hearing threshold of 20-30dBA (table IV). 13 worker (32.5%) had 4 KHz dip and 3 workers (7.5%) had 6 KHz dip.

Table IV: Type severity and percentage of sensory hearing loss

Severity		Unilateral				Bilateral			
		High frequency		Low frequency		High frequency		Low Frequency	
		No.	%	No.	%	No.	%	No.	%
mild	Control	1	2.5	0	0	2	5	0	0
	Noise Exposed	5	12.5	0	0	10	25	2	5
moderate	Control	0	0	0	0	0	0	0	0
	Noise exposed	0	0	0	0	3	7.5	0	0
severe	Control	0	0	0	0	0	0	0	0
	Noise exposed	0	0	0	0	5	12.5	0	0
Total noise exposed		5	12.5	0	0	18	45	2	5

Discussion

Relation between noise exposure and hearing loss has been dealt with in a considerable amount of literature, but there are few studies in which the effect of noise on Iraqi labor were investigated, hence the following study on this problem has been carried. most workers in the present study were in age group of 31-40 years in both control and noise exposed workers (60% and 50% respectively), although workers over 50 years old are excluded in this study to omit the cases of presbycusis. This result goes with Sandra et al[11], Mc Bride et al[12] and Topilla[13] whom started that noise independently, but causally related to the age where it's levels below 98 dBA. The present study shows that 8 (42.5%) of noise exposed workers complain from aural fullness, 9 (22.5%) workers had bilateral deafness while 8 workers (20%) complain from tinnitus, these finding in comparable with the result of Osowole[14], while Bary, et al[15] shows the majority of worker in their study complain from tinnitus in a percentage of 74%. Although no workers complain from vestibular symptoms in our study, 11.2% complain from vertigo and/or dizziness in the study of Golz, et al[16]. Noise inducing hearing loss is a preventable disease, in our study 50% of workers that was exposed to noise didn't use ear protection at all while 45% of workers used it in an irregular manner, the majority of them had hearing loss (62.5%), at the same group two engineers wear ear muffs regularly, they had no hearing abnormalities, this probably claimed to the use of ear muffs in preventing noise induced hearing loss. These results goes with other literature, Ahmed, et al[17], McBride[12], Daneill, et al[18] and lusk[19] who claim that elimination and isolation of noise sources are the best control method of choice in preventing noise induce hearing loss. In the present study 18 workers (45%) of the noise exposed group had bilateral high frequency sensorineural hearing loss. This goes with the result of Ahmed[17] and McBride[20] whom found the hearing loss is bilateral and symmetrical sensorineural hearing loss, hearing loss is proportional to the daily exposure to noise, so in this study 23 workers (57.5%) of the noise exposed group were exposed to noise more than 8 hour per day which is harmful to the ears[2]. This explains the above results for high percentage of hearing loss (62.5%) among the noise exposed group and comparable with the result of Solicki[21], Soilkwiski[22] and McBride[12]. They display that exposure to noise more than 8 hours at workplaces create a high risk of hearing impairment. In the present study 10 workers (25%) of the noise exposed workers had mild sensorineural

hearing loss (20-35 dBA), 13 workers (32.5%) with 4 KHz dip and 3 workers (7.5%) with 6 KHz dip, this goes with the results of McBride[20] and Sandra[11] who found that although the notch at 4 KHz is a well established clinical sign and may be valuable in confirming the diagnosis of noise trauma, the 6 KHz is variable and of limited importance.

Conclusions and recommendations

In the present study the chronic exposure to noise caused sensorineural hearing loss, which is preventable disease rather than treatable as seen in those using ear protection, mainly give 4 KHz dip, therefore ear protection, decreasing of the daily exposure and monitoring audiometric examinations can minimize the hearing loss.

References

1. Brookhouser PE, Worthington DW, Kelly WJ. Noise induced hearing loss in children, Laryngoscope. 199; 102: 645-655.
2. Peter W Alberti. Noise and the ear. In Scott-Brown's Otolaryngology, Vol.2, 6th edition (1997), London. Butterworth-Heinemann. (11) PP: 1-34.
3. Berglund B, lindvall T, In: The world Health Organization (WHO). Health Cities Programme. Community noise. Arch. Cent. Sensory Res. 1995, 2: 1-195.
4. Nikar A Amond Swe, Stephanie M. Kieszak, Alice E. Holmes, Emito Esteban, Carol Rubin and Derba J. Brody. Estimated Prevalence of noise induced hearing threshold shifts among children 6-9 years of age: The third national health and nutrition examination survey, 1988-1994, United State. Paediatrics, 2001; 108: 40-43.
5. Katz J. Handbook of clinical Audiology. Battimore, MD: Williams & Wilkins; 1994: 20-21.
6. Dalton D.S., Cruickshanks K.J.; Wiley T.L., Klein B.E., Klein R., Tweed T.S. Association of leisure- time noise exposure and hearing loss. Audiology. 2001; 40: 1-9.
7. Jeannie H. Chung, Catherine M. Des Roches, John Meunier and Ronald D. Eavey. Evaluation of noise induced hearing loss in young people using a wed-base survey technique, Paediatrics. 2005; 115: 861-867.
8. Michael A. Stone, Brain C.J. Moore and Hugh Greenish. Discrimination of envelope statistics reveals evidence of sub-clinical hearing damage in a noise exposed population with normal hearing thresholds. International Journal of Audiology 2008; 47: 737-750.
9. Monique C.J. Leensen, Jan A.P.M. deltt and Wouter A. Dreschler. Speech in noise screening tests by internet, Part 1: Test evaluation for noise induced hearing loss identification. International Journal of Audiology 2011; 50: 823-834.
10. Brookhouser P. E. Prevention of noise induced hearing loss. Preventive Medicine, 1994; 23: 665-669.
11. Sandra S, Jackson C.A., Ryder T, Brown M.J. Noise exposure and hearing loss among student employees working in university entertainment venues. Ann. Occup. Hyg. , 2002, 46(5): 455-463.
12. McBride D.I., Firth H.M., Herbison G.P. Noise exposure and hearing loss in agriculture: a survey of farmers and farm workers in the southland region of New Zealand. Occupational Medicine 2004; 54: 290-296.
13. Toppila E., Pyyko I, Stark J. Age and noise induced hearing loss. Scandinavian Audiology 2001, 30(4): 236-244.
14. Osowole O.S., Nwaorgu O.G., Osisanya P.A. Perceived susceptibility to noise induced hearing loss and attitude towards preventive care among metal workers at gate. Ibadan: a pilot study. African Journal of Medicine and Medical Sciences 2004; 32(2): 231-233.
15. Bray A., Szymanski M., Mills R. Noise induced hearing loss in dance music disk jockeys and an examination of sound level in night clubs. The Journal of Laryngology and Otology.2004; 118: 123-128.
16. Golz A, Thomas S. Westerman, Liane M. Westerman, Goldenberg D, Netzer A., Tracey wiedmyer B. A., Milo F. and Joachims H. The effect of noise on the vestibular system. American Journal of Otolaryngology 2001; 22(30): 190-196.
17. Ahmed H.O., Dennis J.H., Bardan O., Ismail M., Ballal S.G., Ashoor A. and Jerwood D. Occupational noise exposure and hearing loss of workers in two plants in eastern Saudi Arabia. Ann.Occup.Hyg.2001; 45(5): 371-380.
18. Daniell W.E., Swan S.S., McDaniel M.M., Morgan M., Stebbins J.G., Seixas N.S. Noise exposure and hearing conservation practices in an industry with high incidence of workers compensation claims for hearing loss. American Journal of Industry Medicine 2002 Oct., 42(4): 309-317.
19. Lusk S.L. Preventing noise induced hearing loss. Nurs. Clin. North America 2002 Jun.; 37(2): 257-262.
20. McBride D.I., Williams S. Audiometric notch as a sign of noise induced hearing loss. Occup. Enviro. Med. 2001; 58: 46-51.
21. Solecki L. Risk of noise induced hearing loss in farm tractors operators. Med. Pr. 2001; 52(4): 265-270 (Medline source from Pub.Med.gov.).
22. Sulkowski W.J., Szymaczac W., Kowalska S., Sward M.M. Epidemiology of occupational noise induced hearing loss in Poland. Journal of Otolaryngology Poland.2004; 58(1): 233-236.