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THE EFFECT OF AIRCRAFT ENGINE NOISE ON THE HEARING OF ARMY AVIATION PERSONNEL

Nadeem Ahmed Sheikh, Syed Ausaf Ahmed Shah, Waseem Ashraf

Combined Military Hospital Gujranwala, Combined Military Hospital Bannu

ABSTRACT

Objectives: To determine the frequency and severity of noise induced hearing loss (NIHL) and its audiometric configurations among Pakistan Army Aviation personnel.

Study Design: Cross sectional descriptive study.

Place and Duration of Study: From June 2009 to May 2010 at ENT department of CMH Gujranwala.

Patients and Methods: A total of 100 individuals who were exposed to turbo-propeller aircraft's engine noise for more than two years were recruited and assessed for hearing impairment. All the subjects were evaluated through detailed history and clinical examination. Pure tone audiometry was carried out and pathological audiograms with sensorineural hearing loss were segregated. Hearing thresholds and audiometric configurations were recorded.

Results: Out of the 100 subjects enrolled NIHL was found in 32% individuals. Among them, 20 (62.5%) patients suffered from bilateral pathology. It was mild in 13 (40.62%), moderate in 14 (43.75), and severe in 5 (15.62%) cases. The most common audiometric configuration was the notched audiogram with a dip at 4 kHz occurring in 14 patients followed by slope configuration found in 13 patients.

Conclusion: Aviation workers are exposed to exceptionally intense noise which can render them physically and socially handicapped at times. The intricate nature of such impact entails a prompt recognition and adoption of necessary prophylactic measures to minimize the risk of developing a rather irreversible sensory handicap.

Key words: Frequency, Noise induced hearing loss, pure tone audiometry.

INTRODUCTION

Noise induced hearing loss (NIHL) is one of the most commonly encountered types of occupational hearing loss. It is the leading occupational disease in Singapore[1]. NIHL is a reduction in auditory acuity following prolonged exposure to loud noise[2]. Generally, prolonged exposure to sounds louder than 85 dBA is potentially injurious[3]. Various metabolic, vascular, and chemical mechanisms at cellular level in cochlea are thought to be responsible for NIHL[2]. Such hearing loss usually occurs in people working in factories, discos, aviation, road construction, and mines.

Aviation personnel who are exposed to the aircraft engine noise for a long time are always at risk of developing NIHL. This has been a matter of concern for developed world but has yet to be recognized in our country. No real effort has yet been made in this regard by the authorities, employers, and otologists. The literature is sparse in describing a relationship between occupational noise exposures and hearing loss among airport workers[4]. Therefore this study was aimed to evaluate the frequency of NIHL and its audiometric configurations among such individuals. This will not only help us to formulate safety measures to avoid this disability but also lead us to better understand the brunt of acoustic trauma on the human cochlea.

PATIENTS AND METHODS

This study was carried out at ENT department of CMH Gujranwala from June 2009 to May 2010 on individuals exposed to the engine noise of helicopters and Mushaq aircrafts at Army Aviation Base Gujranwala. One hundred subjects which included pilots, technicians, and crew members with >2 years of exposure to turbo-propeller aircraft's engine noise and with normal hearing thresholds at the time of their induction in army aviation were randomly selected and included in the

Correspondence: Major Nadeem Ahmed Sheikh, Graded ENT Specialist, CMH Gujranwala
Email: nadeem_ent75@yahoo.com
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study. However the intensity of sound exposure could not be assessed due to the non-availability of sound meter at army aviation base. A detailed history followed by clinical examination was carried out and findings were recorded on a pre-designed proforma.

Individuals with any metabolic disorder, perforated eardrum, conductive deafness, history of use of ototoxic drugs, deafness of sudden onset and without their previous audiometric record were excluded from the study.

Pure tone audiometry was carried out on each individual at 250, 500, 1000, 2000, 3000, 4000, 6000, and 8000 Hz frequencies. Audiometry was conducted with a diagnostic audiometer in a sound-attenuated booth. Masking was used for air conduction whenever the difference between the air conduction presentation level and the non-test ear bone conduction thresholds exceeded 40 dB for the lower frequencies and 60 dB for the higher frequencies[5]. For bone conduction testing, masking was done routinely when threshold levels between ears were asymmetric[6].

Hearing thresholds at each frequency and audiometric configurations were recorded. Audiograms with sensorineural hearing loss were divided according to the degree of hearing loss, audiometric configurations and unilateral / bilateral hearing impairment. Sensorineural deafness was characterized by equivalent (i.e. ± 10 dB) air and bone conduction[5].

The degrees of hearing impairment were classified as per WHO criteria[4,7]. They are; Normal: hearing thresholds less than 25 dB, Mild: hearing thresholds between 26-40 dB, Moderate: hearing thresholds between 41-60 dB, Severe: hearing thresholds between 61-80 dB, and Profound: hearing thresholds above 80 dB.

The criteria for definition of each audiometric configuration were derived from previous studies[8,9]. They are; Notch: hearing loss at a given frequency that is 15 dB or more than that of adjacent frequencies, Slope: hearing loss that gradually increases at higher frequencies without recovery of hearing at the highest frequencies, and Flat: when the difference in hearing loss between all the frequencies tested does not exceed 10 dB.

Data was analyzed using SPSS version 15. Descriptive statistics were used to describe the data i.e. mean and standard deviation (SD) for quantitative variables and frequency along with percentage for qualitative variables.

RESULTS

Among 100 individuals included, 58% were pilots, 28% technicians and 14% crew members. All these subjects were males and their mean age was 35±6.37 years. The mean duration of exposure to the aircraft engine noise was 6±2.25 hours per day for 11±6.5 years.

Sensorineural hearing loss was found in 32% subjects. Among them, 20 (62.5%) patients suffered from bilateral pathology. Mild, moderate, and severe hearing impairment was found in 13 (40.62%), 14 (43.75%) and 5 (15.62%) patients respectively, while none of them had profound hearing loss.

Out of the 32 pathological audiograms, notched configuration was seen in 16 (50%), slope configuration in 13 (40.62%), and flat configuration in 3 (9.37%) cases. Among the notched audiograms, dip occurred at 4 kHz in 14 (87.5%) and at 6 kHz in 2 (12.5%) cases.

DISCUSSION

Exposure to sound produces harmful effects, which has been recognized for centuries but generally ignored until sometime of industrial revolution when it was fully reckoned. Noise is the third environmental pollution agent after air and water. We are currently reaping the rewards of unwanted increase in noise in an epidemic of hearing loss, which is incurable, but surely preventable. Noise from any source is detrimental to hearing and its association with work is the main cause of noise induced hearing loss[4].

Noise induced hearing loss is among the ten leading work-related diseases and injuries in the United States[10]. However little research has been done in this area in Pakistan. The National Institute for Occupational Safety and Health (USA) has identified work-related

hearing loss as a priority area for research and prevention[11]. The US National Institute of Health states that a noise level of 85 dBA for an 8 hour daily exposure is potentially damaging and will produce permanent hearing loss after many years[12]. There is lack of accurate epidemiological data relating to noise induced hearing loss throughout the world but particularly in developing countries.

Aviation workers are exposed to potentially harmful levels of noise, the actual consequences of which are still poorly documented. We could find only one study on this topic in Pakistan which was done on aviation workers of Karachi International Airport[4]. The frequency of NIHL was higher i.e. 66% in that study as compared to our study due to the reason that aviation workers of Karachi International Airport were more exposed to noise because it is a busy commercial international airport with a high rate of landings and take offs as compared to an aviation base. In our study, the most common audiometric configurations were notched and slope configurations occurring in 50% and 40.62% cases respectively which are in contrast to some of the other studies where the most frequently seen audiometric configuration was notched audiogram while slope configuration was found in only 17% cases[10,13]. The most common frequency for notch to occur was 4 kHz in our study. This is in contrast to a study done on French military pilots in which notch mostly occurred at 6 kHz[14]. In our study NIHL was bilateral in 62.5% patients which is comparable to a study on Chinese pilots where NIHL was bilateral in 58.33% cases[15].

Unfortunately in Pakistan, there is no serious effort on part of government, employer and the employee to check this problem. People at risk of developing NIHL are neither fully aware of this problem nor of their rights. There is poor usage of hearing protection devices and lack of effective hearing conservation programmes for aviation workers. In many countries, noise is the most compensated occupational hazard[12]. Hearing aids which are of some benefit to such patients can not be afforded by many patients making their life more miserable. Developed countries of the world have implemented legislation for individuals at risk. Such legislation is yet to be premeditated in Pakistan. The National Institute for Occupational Safety and Health (USA) recommends limiting occupational noise exposure to a time-weighted average of 85 dBA for 8 hours per day[3].

CONCLUSION

The frequency of hearing loss among those army aviation personnel who are frequently exposed to aircraft engine noise for a long time is 32% which is quite alarming. This hearing impairment may not only hazard the flying in aviation but may also lead to or aggravate sensorineural deafness. The magnitude of physical, psychological, and social handicap resulting from this disability is significant. Therefore effective programs for preventing excess hearing loss are strongly recommended with availability of sound meters at every aviation base to monitor the intensity of aircraft engine noise.

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