Smart Phone Based Audiometry in City Traffic Police

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Abstract Noise induced hearing loss (NIHL) is defined as “reduction in auditory acuity associated with noise exposure”. Traffic police is a bundle of people who are the usual sufferer of this type of increased hearing threshold. In developing countries like India, many of them are unable to access audiology services, because of shortage of trained professionals and limited sources. Smartphone based audiometry is easy and can detect hearing loss as early as possible. To study hearing threshold in traffic police. Total 88 persons were included in the study. An occupational history was taken regarding duration of posting followed by smart phone based audiometry (Hearing Test TM software) test. Out of total 88 persons, 80 were having increased hearing thresholds which were suggestive of noise induced hearing loss. Out of total 88 persons 8 were in normal group, 24 were in mild hearing loss group, 42 were in moderate hearing loss group and 14 were in severe hearing loss group. Total number of person with notch at 4000/6000 Hz was 28, suggestive of particular pattern of noise induced hearing loss. During the last decade, mobile phones have evolved like anything. Furthermore, the utilization of health-related applications has gained increased focus. Health-related applications are useful, less time consuming and with increased efficiency by early diagnoses. There are many of smart-phone hearing applications

that are already in use. They use similar principle as audiometer. This kind of application will narrow down the supply and demand ratio of audiology service in developing countries.

Keywords Traffic police · Noise induced hearing loss · Smart phone based audiometry

Introduction

Police suffer from loss of perception of a narrow range of frequencies, impaired cognitive perception of sound and induced sensitivity to sound or tinnitus. Noise induced hearing loss (NIHL) is defined as “reduction in auditory acuity associated with noise exposure.” Hearing may deteriorate gradually from chronic and repeated noise exposure, such as loud music or background noise, or suddenly from a shot of high intensity noise such as gunshot or air horn. In both the cases, loud sounds over stimulate delicate hearing cells, leading to the permanent injury or death of the cells. In such a case hearing loss is irreversible. Smartphone based audiometry; the most important aspect of this type of deficit is to detect hearing loss as soon as possible. Audiological services provide early and accurate detection as solution. But in developing countries like India, many of them are unable to access such services, because of shortage of trained professionals and limited sources. There is huge difference between the demand for audiological services by number of individuals in need and capacity to meet the demand with the number of audiological services available. During the last decade mobile phones have evolved like anything. The awareness and utilization of health related applications has gained

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focus. These programs utilize the same principle of automated audiology in smart phone sized device.

Aim To study hearing threshold in traffic police.

Objectives

To know degree of hearing loss

To know effect of duration of service on hearing loss

Materials and Methods

The study was initiated after getting approval from Sumandeep Vidhyapeeth Institutional Ethics Committee. Total 88 persons were included in the study. Those with positive family history of hearing loss and ear related pathology was excluded. Study was conducted by going through traffic police station. Before administering this scale the traffic police was explained the entire procedure in detail and the procedure were conducted only after the traffic police gave his consent on the participation form. The evaluation test began with a diagnostic interview, comprising of participants necessary medical history. Then the occupational history was also taken regarding duration of posting followed by smart phone based audiometry (Hearing TestTM software) test. All the data was collected, tabulated and analysed.

Results

A significant number of traffic persons were found to have hearing problem. Out of total 88 persons, 80 were having increased hearing thresholds which were suggestive of noise induced hearing loss. Following observations have been made.

There was even number of persons in each age group suggestive of no significant relationship between age group and hearing loss (Table 1). Audiometry finding was divided in the groups of normal or mild or moderate or severe hearing loss. According to that out of total 88 persons 8 were in normal group, 24 were in mild hearing loss group, 42 were in moderate hearing loss group and 14 were in severe hearing loss group (Fig. 1). Those personnel who had less than 3 years service in the traffic branch had slightly less (73.33%) incidence of hearing loss as compared to others who had a higher incidence approximately in all (Table 2). Different pattern of audiometry were recorded like descending curve with hearing loss beyond 4000 Hz of frequency, notch at 4000 Hz or sloping type of curve at higher frequency. Total number of person with

Table 1 Age group and hearing loss

Age group in years	Number of persons	Number of persons with hearing loss
20–29	2	2
30–39	6	6
40–49	32	26
50–59	48	46
Total	= 88	

notch at 4000/6000 Hz was 28, suggestive of particular pattern of noise induced hearing loss (Fig. 2).

Discussion

Noise-induced hearing loss (NIHL) is defined as “reduction in auditory acuity associated with noise exposure”. People may have a loss of perception of a narrow range of frequencies, impaired cognitive perception of sound, or other impairment, including sensitivity to sound or ringing in the ears. Loud sound over stimulates delicate hearing cells, leading to either temporary threshold shift (TTS) which may recover in hours to days or the permanent injury or death of the cells which is called permanent threshold shift (PTS). It may occur following repeated TTS, or following single episode of noise exposure (acoustic trauma). Once lost, hearing cannot be restored in humans.

An average traffic sound in the city is about 60–100 dB by a close observer [1]. The traffic police usually work for 10–12 h in noisy environment. This leads to metabolic as well as structural changes in mechanism of cochlear function defined as noise induced hearing loss.

During the last decade, mobile phones have been converted from simple phones to pocket-sized computers. Furthermore, the utilization of health-related applications has gained acceptance [2]. Health-related applications are useful time savers and increase efficiency by speeding diagnoses. There are a number of smart phone hearing applications that are already in use. They use same principle as audiometer. In this study we used Hearing TestTM software for screening of hearing threshold in traffic police.

In our study we found that there was no significant relation between different age group and number of personal with increased hearing threshold. However age related increase in hearing threshold is always there which must be taken into consideration. Age has a cumulative effect on hearing loss.

The software gave us the information regarding hearing threshold which was categorised in normal, mild, moderate and severe hearing loss. Most of the personals were in mild and moderate hearing loss group. So many theories have

Fig. 1 Degree of hearing loss **Table 2** Duration of service and increased hearing threshold

Duration of service in years	Number of persons	Number of persons with hearing loss
0–3	30	22
4–6	32	32
7–9	10	10
10–12	2	2
> 12	14	14
Total	= 88

Fig. 2 According to notch at 4/6 kHz

been proposed as a cause and risk factor for noise induced hearing loss however the consensus is that NIHL is a multi-factorial and complex situation. The noise induced hearing loss results due to damage in the inner ear in the form of degeneration of cilia of outer hair cells [3].

In our study the maximum hearing loss was seen in people with increasing duration of exposure to noise which

is consistent with the earlier studies [4–6]. Duration of service gives an additive effect to noise in causing NIHL.

There is a characteristic notched audiometry configuration associated with noise induced hearing loss with maximum reduction in sensitivity to stimulation in the range of 3–6 kHz, and recovery at 8 kHz. We found 28 police with significant notch at 4/6 kHz which may suggest pathology as NIHL. However absence of such a notch doesn't exclude NIHL.

These smartphone-based hearing applications are available for free and are accessible. The individual can perform a self-test anytime. In addition, no skill or expertise is required to perform the test, which takes approximately 5 min. The results are saved on the mobile device and can be sent to any expert if necessary. Such applications can be useful where number of audiology centres are limited and thus provide a solution that will narrow the difference between the demand of the individual and the capacity of the audiology services.

Compliance with Ethical Standards

Ethical Approval “All the procedures performed in studies involving human participants were in accordance with the ethical standard of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards”. This article does not contain any studies with animals performed by any of the authors.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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