



Original Article

Noise-Induced Hearing Loss in the Police Force

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ABSTRACT

Background: Noise-induced hearing loss (NIHL) is a major preventable occupational health problem with 250 million people worldwide known to have disabling impairment of moderate to greater severity. The aims of the study are to estimate the prevalence of NIHL in the police force; and study its association with age, sex, duration of service (years), smoking and alcohol habits, use of hearing protective devices, as well as preexisting chronic diseases.

Methods: A cross-sectional study was conducted on 543 police personnel who had undergone periodic medical examination over a 12-month period. The diagnostic criteria for NIHL were (1) history of occupational noise exposure, (2) bilateral hearing loss, (3) hearing loss of ≥ 25 dBA at 4,000 Hz in two consecutive audiograms, and (4) no significant medical history affecting hearing. Severity of NIHL was based on the World Health Organization grading.

Results: Males (74.8%) made up the majority of the police force. The mean age for police personnel was 35.55 ± 9.57 years, and the mean duration of service was 14.75 ± 9.39 years. Compliance with the usage of hearing protective devices was seen in 64.4%. The prevalence of NIHL in this study population was 34.2%, with a higher prevalence in males (37.7%) than in females (23.9%). The study also showed strong associations between NIHL and male sex (odds ratio, 1.9; $P < 0.05$), and hypertension (odds ratio, 3.3; $P < 0.001$). Overall, 93% were found to have mild NIHL, 3.5% had moderate NIHL, and 3.5% had severe NIHL. No police personnel were found to have profound hearing loss.

Conclusion: The prevalence of NIHL in this study is high compared to other similar studies among police personnel. This study shows that increasing age, male, presence of hypertension, diabetes, and longer duration of service are significant associated factors for NIHL. Preventative strategies include health surveillance, implementation of a hearing conservation program, and legislation.

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1. Introduction

Noise-induced hearing loss (NIHL) is sensory neural hearing loss due to exposure to intense impulse or continuous sound. Exposure to noise can be occupational or nonoccupational. The audiologic profile of NIHL is the presence of sensorineural hearing loss that is most pronounced in the high-frequency region between 3,000 Hz and 6,000 Hz of the audiogram, and the greatest amount of hearing loss is typically around the 4,000-Hz region (i.e., 4,000 Hz dip) [1].

The World Health Organization (WHO) currently estimates that 250 million people worldwide have disabling hearing loss of moderate to profound severity [2]. Adult-onset hearing loss ranks

15th in the list of leading causes of Global Burden of Disease and second in the list of leading causes of Years Lived with a Disability [2]. The Norwegian Labour Inspectorate in 2006 reported 3,392 cases of work-related diseases, of which 59% were attributed to NIHL [3]. The main causes of hearing loss resulting in deafness in adults in the United States are excessive noise, age, and ear infection [4]. Although occupational hearing loss is a well-recognized occupational condition arising from industries or occupations with exposure to high noise levels (e.g., airline crew), it has not been fully evaluated in occupations where the risk is not so overt, such as the police force. Whereas many studies have been carried out to assess the relationship between hearing loss and gunfire in

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military personnel [5,6], only a few similar studies have been conducted in police officers. Police officers are potentially exposed to multiple sources of noise, including vehicle horns, gunfire, barking from police dog, and traffic noise [7,8]. Specifically for police motorcyclists, the noise exposure can range from 63 dBA to 90 dBA, and up to 105 dBA in open roads [9].

In Brunei Darussalam, all Royal Brunei Police Force (RBPF) personnel are required to undergo shooting practice at least annually or when required. The provision and compulsory use of hearing protection devices such as ear muffs were introduced into the RBPF since 2005. Prior to this, RBPF personnel with exposure to excessive noise, particularly during shooting practices or in job designations such as police motorcyclists or traffic police, did not have any hearing protection at all. The discovery of a number of NIHL among these police personnel led the study team to carry out a survey to estimate the prevalence of NIHL in this working population, as well as to study the relationship between NIHL and its associated factors. Further to this, we aimed to assist the RBPF force in the implementation of a hearing conservation program as a control measure in the prevention of NIHL. The introduction of such a program could also be adopted in other workplaces with excessive noise levels.

2. Materials and methods

The Occupational Health Division (OHD) conducts periodic medical examinations for RBPF personnel at the nonofficer level 3-yearly when their job contractual agreement is due for expiry. RBPF personnel who are nonofficers hold posts of different ranks such as Police Constable, Lance Corporal, Corporal, Sergeant, Staff Sergeant, and Sergeant Major.

In this study, the medical examinations included obtaining a detailed occupational history, significant medical history, past and current noise exposure history as well as compliance with usage of hearing protective devices, and physical examination, which included body mass index and otoscopic examination for external ear conditions such as ear drum perforation, ear wax impaction, or external ear infections. Other tests such as full blood count, fasting blood sugar, fasting cholesterol, liver function tests, renal function tests, and urine microscopy as well as audiometry test, were also carried out to complete the medical examination. The audiometry test was conducted at least 16 hours after the last noise exposure to exclude temporary threshold shift, a condition where there is temporary hearing loss after noise exposure.

Audiometric testing at the OHD is conducted using a screening audiometer (model AS 208) manufactured by Interacoustic A/S (Assens, Denmark). This is usually carried out by doing air conduction test at frequencies of 500 Hz, 1,000 Hz, 2,000 Hz, 3,000 Hz, 4,000 Hz, and 6,000 Hz taken for each ear in a closed room environment with a minimal ambient noise level of 20–25 dBA. Further information obtained by face-to-face interview with an occupational health nurse at this stage would include any history of hobbies with possible excessive noise exposure such as listening to loud music, singing or karaoke activities, part-time work in a noisy environment, recent ear infection, history of head and/or neck injury, exposure to chemicals and ototoxic medications, or a family history of hearing loss. Severity of NIHL is based on the WHO grading. Hearing within 0–25 dBA or less (better ear) is classified as normal hearing, 26–40 dBA as mild impairment, 41–60 dBA as moderate impairment, 61–80 dBA as severe impairment, and > 80 dBA as profound impairment [10]. These ranges of levels are categorized as such by averaging the hearing level at frequencies 500 Hz, 1,000 Hz, 2,000 Hz, and 4,000 Hz in the better ear. Environmental noise level at the shooting range was not measured owing to inaccessibility.

2.1. Study design and study population

A cross-sectional study was conducted on police personnel (employed by the RBPF) at nonofficer level who were seen for periodic medical examination at the OHD during the period of January 2012 until December 2012. Each person had to have been in service for at least 3 years and a maximum of 30 years. Diagnosis of NIHL was based on (1) history of occupational noise exposure, (2) bilateral hearing loss, (3) hearing loss of > 25 dBA at 4,000 Hz frequency in two consecutive audiograms, and (5) no significant medical history affecting hearing [11]. Other causes of hearing loss needed to be excluded such as nonoccupational noise exposure, ototoxic medications, family history of hearing loss, recent or chronic ear infections, head and neck injury, radiotherapy to the head and neck, and history of mumps. New police recruits during this period were also excluded. Of note, part of the selection criteria to join the RBPF was absence of any hearing impairment. Smoking and alcohol consumption were included as part of the demographic data. In cases where NIHL was diagnosed, the individual was referred to the Ear, Nose, and Throat department at a tertiary hospital for further diagnostic and confirmatory tests.

2.2. Ethical consideration

The study protocol was approved by the Medical Health Research and Ethics Committee of the Ministry of Health, Brunei Darussalam.

2.3. Data collection and statistical analysis

Collection of data was performed by the study team from OHD by reviewing the clinical records. Relevant information was collected from the findings of routine periodic medical examination that police personnel undergo at the OHD. The information was entered into a database for study analysis as well as for the Division's record keeping system. Statistical analysis was done using SPSS version 16 for Windows (SPSS Inc., Chicago, IL, USA). Further analysis was carried out using Pearson Chi-square tests and risk estimation by odds ratio (OR). These variables were further analyzed by multiple logistic regression and OR.

3. Results

A total of 543 police personnel were identified for the period from January 2012 to December 2012. Of this total, 365 were eligible for the study—i.e., there was a presence of occupational noise exposure in the shooting range and traffic noise.

The remaining 178 were excluded from the study population. Demographic details from this group indicated that there were 148 (83.1%) males and 30 (16.9%) females, with a mean age of 36.2 years and a mean duration of service of 15.8 years. The reasons for their exclusion were as follows: hobbies involving frequent singing or karaoke activities, listening to loud music, part-time work in a noisy environment (74, 41.6%); use of ototoxic medications (9, 5.1%); history of head injury (19, 10.7%); family history of hearing loss (19, 10.7%); exposure to solvents (35, 19.7%); and history of chronic ear infection (79, 44.4%).

The descriptive characteristics of the study population and presence of NIHL are presented in [Table 1](#).

The study population was predominantly male (74.8%). The mean age of police personnel was 35.55 years, with a mean duration of service of 14.75 years. The majority of the personnel (43.3%) were Additional Police Officers whose job scope included mainly operational duties, whereas the higher ranks handled more administrative duties. Overall, 64.4% of the study population used

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