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Screening of hearing ability and hearing threshold among traffic police

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ABSTRACT

Background: Traffic police are continually exposed to loud noise.The pure tone audiometric screening for hearing test has not been done in Biratnagar Nepal. The traffic police personnel in Biratnagar might have noise induced hearing loss. **Aims and Objective:** To Screen the hearing loss prevalence among traffic policemen of Biratnagar and to find out the hearing threshold among traffic police with normal hearing ability. **Materials and Methods:** The study was conducted among 36 traffic police personnel. The 25dB sound was administered with conventional audiometer and headphone in different frequency tones (1 kHz, 2 kHz, 3 kHz, 4 kHz and 8 kHz) for screening hearing loss in left and right ears. The threshold for hearing among normal hearing traffic personnel was compared with controls in all the frequencies. **Result:** Among 36 traffic police, 17 (47.2%) had hearing loss. Maximum (n = 8) hearing loss was seen in 4 kHz (4 - unilateral and 4 – bilateral) followed by 3 kHz(n = 4, 3 unilateral and 1 bilateral) and mixed 3kHz and 4 kHz frequencies. The percentage of hearing loss in 2 kHz, 3 kHz and 4 kHz frequencies was more in left ear compared to right. The threshold for hearing was higher in traffic police compared to controls.In the left ear, it was only in 4kHz {(25.91 ± 6.64 Vs20.45 ± 4.15,(p = .034)} whereas in right ear, the threshold was higher in 3 kHz {20.45 ± 5.22 Vs 15.91 ± 4.90, (p = 0.04)}, 4 kHz {25.45 ± 12.54 Vs 16.82 ± 5.60, (p = 0.05)} and 8000 kHz {18.64 ± 17.62 Vs 6.36 ± 3.23, (p = 0.04). **Conclusion:** The hearing loss was present in 47.2% of traffic policemen predominantly in 4 kHz. The threshold for hearing was also higher among traffic police compared to controls.

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Key words: Hearing loss; Hearing threshold; Traffic police; Biratnagar

INTRODUCTION

Traffic police are exposed continuously to loud noise. WHO estimates that globally 16% of individuals have a moderate to greater degree of hearing loss due to occupational noise exposure.[1] Audiometric screening is recommended for the person exposed to occupational noise. If any hearing loss is found, they should be referred for proper audiological test as it is preventable if the protective measures are used.[2] According to the studies conducted in different parts of Nepal, the noise level was above recommended value.[3,4] A study done in Kathmandu valley amongthe traffic police showed that traffic police are in constant risk of noise induced hearing loss (NIHL) and screening for hearing loss is recommended for people exposed to noise.[4] The study conducted to assess the hearing quality of traffic -policemen in Dharan-Biratnagar corridor suggested that the traffic police showed normal hearing on the questionnaire based test however the audiometric test was recommended.[5] So it was worth conducting the study to screen the traffic- police personnel of Biratnagar with pure tone audiometer for hearing quality and also to find out the threshold for hearing among traffic police. This study will help to assess the hearing ability of traffic policemen in Biratnagar which could be used as reference for study in larger population.

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MATERIALS AND METHODS

This cross-sectional study was conducted among traffic personnel in Biratnagar traffic office in Traffic-chowk. The study was conducted from September 2017 to October 2018. Ethical clearance was taken from Institutional Review board Nobel Medical College. The permission was also taken from traffic office for the test. A total of 44 traffic personnel were presently working there. Name, age and duration of job were enquired. Self prepared questionnaire was asked to each subject to evaluate the overall health status. Questionnaire also included the duration of job, use of protective measures such as mask and ear plugs, hobbies with possible excessive noise exposure such as listening to loud music, recent history of ear infection, and history of head or neck injury. History of exposure to chemicals and medications and family history of hearing loss were also asked.

Exclusion criteria

Subjects with diabetes mellitus, hypertension, ear drum perforation, acute or chronic suppurative otitis media, wax and suffering from ear diseases were excluded from the study. After detailed physical examination, ear examination was done. Three subjects were found to have chronic suppurative otitis media, one had hypertension and two subjects including female were office staffs who were not directly exposed to noise, two could not manage to come because of their busy schedule. So the study was conducted among total of 36 traffic police, after written informed consent. Conventional audiometer with headphone was used for screening and it was performed in quiet room. The sound level was measured with audiometer. Wearing the audiometer earphones, the screening frequency pure tones (1000 Hz, 2000 Hz, and 4000 Hz) was heard at a level of 10 dB. (Guidelines for hearing screening in the School Setting)[6] the test was done during morning hour before the duty hour and those on duty were called later to avoid the stress of night shift. 25 dB sounds was administered for screening the hearing loss.[7] Those who could not hear 25dB sound were referred to ENT OPD for further treatment. Out of 36 traffic policemen, 19 had normal hearing. They were requested to come to ENT OPD to find out the hearing threshold out of which only eleven could come for the test. Age, sex and Body mass index matched laboratory technicians who were working in the same area were taken as controls. BMI matched controls were chosen as a increased prevalence of hearing loss has been found in underweight and obese person.[8] Convenient sampling technique was done. The controls were screened and those with normal hearing within 25dB were selected. The threshold for hearing at different hertz was taken with audiometer in both ears. Each ear was evaluated separately. When the subject heard the tone, the tone was reduced by 10 dB till subject stopped hearing. Once this stage was reached, the tone was raised by 5 dB. If the subject heard this tone, the sound was again decreased by 10 dB. If he did not hear, the tone was again raised by 5 dB. In this way the exact hearing threshold was obtained.[7]

Statistical analysis

All the data were entered in excel sheet and analysis was done. The frequency of hearing loss in right and left ears were calculated. The comparison of anthropometric variables and threshold of hearing between controls and normal hearing traffic police was done with independent t-test. The comparison of hearing between left and right ears in both traffic police and controls was also done with paired t- test. Data were expressed as frequency and percentage. The threshold of hearing was expressed as Mean±SD.

RESULTS

The characteristics of traffic policemen is tabulated in Table 1 Out of 36 traffic police examined, 17(47.2%) had hearing loss (Table 2). Out of these17 traffic policemen,eight (n=8) of them had hearing loss in 4 kHz (4 - unilateral and 4 – bilateral),4 of them had loss in 3kHz (n=4, 3 unilateral and 1 bilateral) and remaining 5 of them had hearing loss in mixed 2kHz, 3kHzand 4kHz frequencies (Table 3).Out of both right and left 36 ears (Table 4), when PTA was done in 4000 kHz, 15 (41.7%)

Table 1: Distribution of characteristics of traffic policemen (n=36)

Characteristics	Number	Percentage (%)
Tinnitus		
Yes	8	22.2
No	28	78.2
Earfullness		
Yes	8	22.2
No	28	78.2
Protection		
Yes	2	5.6
No	34	94.5
Duration of service		
<5	2	5.55
5-9	13	36.11
10-14	13	36.11
>14	8	22.22
Working hours in a day		
8-10 hrs	24	66.66
11-16 hrs	12	33.33

Table 2: Screening of hearing test among traffic police

Number and % hearing at 25dB	Number and % not hearing at 25dB	Total number of subjects (n)=36
19 (52.8)	17 (47.2)	36

Table 3: Frequency of unilateral and bilateral hearing loss among traffic policemen

Unilateral 4kHz loss	bilateral 4kHz loss	Unilateral 3kHz loss	Bilateral 3kHz loss	Unilateral 2kHz, 3kHz, 4kHz loss	Mixed frequencies loss	Normal	Total (n)
4 (11.11)%	4 (11.11%)	3 (8.33)%	1 (2.77)%	1 (2.77)%	4 (11.11)%	19 (52.77)%	36

n=number of subjects

Table 4: Frequency oh hearing loss in right and left ear

Frequency Hz	Numberand percentage (%) of subjects n=36			
	Left		Right	
	Heard 25db	Not heard 25db	Heard 25db	Not heard 25db
1000	36 (100)	0	36 (100)	0
2000	34 (94.4)	2 (5.6)	36 (100)	0
3000	30 (83.3)	6 (16.7)	32 (88.9)	4 (11.1)
4000	21 (58.3)	15 (41.7)	25 (69.4)	11 (30.6)
8000	36 (100)	0 (0)	36 (100)	0 (0)

n=Total number of subjects

Table 5: Comparison of anthropometric variables between traffic police and controls

Anthropometric Parameters	Traffic police n=11	Controls n=11	p-value
Age	29.27±4.71	28.91±4.94	0.86
SBP	114.55±7.90	107.45±6.69	0.035
DBP	74.55±4.29	72.0±6.38	0.288
BMI	23.16±1.43	22.69±0.93	0.381

SBP-Systolic blood pressure, DBP-Diastolic blood pressure, BMI- Body mass index

had hearing loss in left ear and 11 (30.6%) had loss in right ear. In 3000 kHz, 6 (16.7%) had hearing loss in left ear and 4 (11.1%) had loss in right ear. In 2000 kHz, 2(5.6%) had hearing loss in left ear where no hearing loss was seen in right ear. No hearing loss was seen in other frequencies. The anthropometric variables between traffic police and controls were compared. (Table 5) No significant difference was appreciated between two groups. When the threshold of hearing was compared between traffic police and controls, (Table 6) the traffic police showed higher threshold for hearing in 4000 kHz in left ears {(25.91±6.64 vs.20.45±4.15, (p=.034)} whereas no significance was seen among other frequencies. When the same comparison was done in right ear, the significance was seen in 3000 kHz {20.45±5.22 Vs 15.91±4.90, (p=0.04)}, 4000 kHz {25.45±12.54 Vs 16.82±5.60, (p=0.05)} and 8000 kHz {18.64±17.62 Vs 6.36±3.23, (p=0.04)}.The right ears and left ears of both traffic police and controls were compared (Table 7). The threshold of hearing was more in left ears in both groups. However, among the traffic policemen, the threshold of hearing was higher in 250Hz, 500Hz and 2000Hz whereas among controls also the threshold of hearing was higher in left ears but it mainly involved 3000Hz and 8000Hz frequencies.

DISCUSSION

The traffic police are continually exposed to loud noise. The increased traffic volume in Biratnagar showed that they might be exposed to noise induced hearing loss (NIHL). The studies done in different parts of Nepal have shown that the noise level in the many cities is more than the recommended level.[3,4] So, the study was conducted among traffic Police of Biratnagar to screen the hearing ability and also to compare the normal threshold of hearing among traffic police and controls. Among 44, only 36 were selected for the study. In our result 22.2% (Table 1) showed tinnitus which is similar to the study done in Kathmandu valley[4] but it is slightly less than the study done in Dharan- Biratnagar corridor (33.33%).[5] It may be because of difference in number of sample size. In our study only 22.2% (Table 1) of the traffic policemen showed ear fullness which is slightly less than the study done among traffic police in Kathmandu valley.[4] Only 5.6% (Table 1) of them used protective measures which is similar to study done in Biratnagar- Dharan corridor. Duration of working hours is 8-10 hrs in 66% of traffic policemen.On pure tone audiometric screening, 17 (47.2%) showed hearing loss (Table 2). It is less than the study done in Kathmandu valley which showed 66.4%. It might have differed because of the difference in the number of sample size and the area where it was conducted. But the result in our was similar to the study conducted in Colombo Srilanka.[9] Studies have also shown that 4KHz is mainly affected however neighboring frequencies are also affected.[7,10,11] Similarly studies have suggested, though noise induced hearing loss(NIHL) is typically bilateral it can also be unilateral.[7] In our study also, 8 (22.22%) had involvement in 4 KHz where the percentage of unilateral or bilateral hearing loss was same 4 (11.11%) unilateral and 4 (11.11%) however in 3Hz frequency loss, unilateral loss was more (Table 3). Though the exact physiology behind the asymmetric hearing is not clear, left ears are shown to be affected more. However some have reported hearing loss in right ears also. [11]In our study left ear was affected more compared to right ear (Table 4) which is similar to the studies done in Kathmandu city[4] but it is different from another study which showed involvement of right ears compared to left ears.[12] In our study, all those subjects having NIHL were referred to ENT OPD for further consultation. Out of 19 traffic police with normal hearing, only 11 could come for threshold measurement. Same numbers of age, sex and BMI matched controls were taken (Table 5) while

Table 6: Comparison of threshold of hearing between traffic police and controls

Frequency (Hz)	Threshold traffic police (right ear) Mean±SD n=11	Threshold control (right ear) Meann±SD n=11	p-value	Threshold traffic police (left ear) Mean±SD n=11	Threshold control (left ear) Mean±SD n=11	p-value
250	11.82±5.60	13.64±3.93	0.390	20.45±6.50	15.45±7.89	0.121
500	15.91±5.39	16.36±3.23	0.814	20.91±5.83	15.45±6.50	0.052
1000	15.91±7.68	12.73±4.67	0.257	19.55±6.10	15.45±5.68	0.119
2000	18.64±5.95	16.82±3.37	0.3	20.91±5.39	18.18±4.62	0.218
3000	20.45±5.22	15.91±4.90	0.04	23.64±7.77	19.55±4.71	0.155
4000	25.45±12.54	16.82±5.60	0.05	25.91±6.64	20.45±4.15	0.034
8000	18.64±17.62	6.36±3.23	0.04	17.27±9.31	11.82±7.83	0.153

Table 7: Comparison of hearing threshold between left and right ear

Frequency (Hz)	Threshold traffic police (right ear) Mean±SD n=11	Threshold traffic police (left ear) Mean±SD n=11	p-value	Threshold control (right ear) Mean±SD n=11	Threshold control (left ear) Mean±SD n=11	p-value
250	11.82±5.60	20.45±6.50	0.000	13.64±3.93	15.45±7.89	0.397
500	15.91±5.39	20.91±5.83	0.000	16.36±3.23	15.45±6.50	0.588
1000	15.91±7.68	19.55±6.10	0.070	12.73±4.67	15.45±5.68	0.167
2000	18.64±5.95	20.91±5.39	0.016	16.82±3.37	18.18±4.62	0.192
3000	20.45±5.22	23.64±7.77	0.111	15.91±4.90	19.55±4.71	0.038
4000	25.45±12.54	25.91±6.64	0.902	16.82±5.60	20.45±4.15	0.070
8000	18.64±17.62	17.27±9.31	0.781	6.36±3.23	11.82±7.83	0.014

comparing normal threshold between traffic police and control, in the left ear traffic police had higher threshold of hearing only in 4kHz compared to controls (p=.034) (Table 6) but when compared in right ears, traffic policemen have higher threshold for hearing in 3000Hz (p=0.04), 4000Hz (p=0.05) and 8000Hz (p=0.04). This has some similarity with the study which has shown that the traffic policemen have higher thresholds in 2000Hz, 4000Hz and 8000Hz in both right and left ears.[13] But in our study the difference was mainly seen in right ears. This might be becausein our study we had selected only those subjects with normal hearing level. Since the percentage of hearing loss was more in left ears, we also compared the hearing threshold between left and right ears in each groups separately (Table 7), which showed traffic policemen had higher hearing threshold in left ears in frequencies of 250Hz, 500Hz and 3000Hz which was also seen among controls but in frequencies of 3000 and 8000 Hz.It is quite supportive to the studies which showed higher threshold of hearing in left ears compared to right ears in frequency between 3-6KHz.[14] But the differences in other frequencies needs further study.

CONCLUSION

Noise induced hearing loss was seen among traffic policemen. When the threshold of hearing was compared between traffic policemen and controls with hearing ability at 25dB, the threshold of hearing was higher among traffic police compared to controls. The left ears had higher threshold for hearing compared to right in both traffic police and controls. The observation suggests that proper system should be implemented to control further loss of hearing ability.

Limitation

The Limitation of the present study was the small sample size of subjects. So the statistical significance of the results should be interpreted with caution and also we could not quantify the noise level at different junctions. It is necessary to extend and the same observation in large scale.

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NG- Concept and design of the study, manuscript preparation, statistically analyzed and interpreted, critical revision of the manuscript; **SKT-** Concept and design of the study, critical revision of manuscript and review of the study; **AKJ-** Data collection, Interpretation reviewed the literature, preparing first draft of manuscript; **RY-** helped in preparing first draft of data, reviewed the literature, preparing first draft of manuscript; **SM-** helped in preparing first draft of data, reviewed the literature, preparing first draft of manuscript.

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APPENDIX

Questionnaire for screening of traffic policemen

S.N -

Name	Age
Sex	Height
Weight	BMI

History

Duration of service-

Working hour in a single day-

previous job-

Do you listen to loud music-?

H/O Diabetes Mellitus, Hypertension or any other disorders -

H/O any ear infection-

H/O Tinnitus-

H/O ear-fullness-

H/O of neck or head injury-

General examination

Pulse	Icterus
Cyanosis	Clubbing
Lymphnode	edema

Blood pressure

Systemic examination

Ear findings

Pure tone audiometric examination