

Cigarette smoking and auditory effects: Correlation between pack years of smoking and changes in hearing thresholds

Ashwini K Shetty^{1*}, Karthiyanee Kutty², Vinutha Shankar M S³

¹Associate Professor, Department of Physiology, MVJMC and RH, Hoskote, Bangalore, Karnataka, INDIA.

²Professor, ³Professor and HOD, Department of Physiology, Sri Devaraj Urs Medical College, Kolar, Karnataka, INDIA.

Email: ashshetty31@gmail.com

Abstract

Background: Cigarette smoking, a well known risk factor for chronic diseases may affect hearing sensitivity. This study aims at studying correlation of pack years of smoking with changes in hearing threshold using pure tone audiometry. **Aims and Objectives:** To correlate the pack years of smoking with changes in hearing thresholds. **Materials and Methods:** The study group consisted of 50 cigarette smokers aged between 20-40 years. Study subjects selected were given a questionnaire to collect information regarding their smoking history expressed in pack years. An assessment of auditory thresholds was done for different frequencies by using pure tone audiometer (ELKON-GIGA3) for study group in a sound proof room. The parameters studied in pure tone audiogram are air conduction (AC) and bone conduction (BC) hearing thresholds of both the ears at various frequencies of sound. They are recorded on audiogram chart which depicts the auditory thresholds of the particular ear. Descriptive statistical analysis was carried out on this data. **Results:** Results showed that there is positive correlation of pack years of smoking with air conduction thresholds of smokers in both right and left ear at all frequencies and also positive correlation of pack years of smoking with bone conduction thresholds were found at higher frequencies (1,2 and 4 kHz) in both right and left ear. **Conclusion:** As the pack years of smoking increase it causes deleterious effects on the auditory thresholds.

Key Words: Smoking, hearing loss, auditory thresholds.

*Address for Correspondence:

Dr. Ashwini K. Shetty, Associate Professor, Department of Physiology, MVJMC and RH, Hoskote, Bangalore, Karnataka, INDIA.

Email: ashshetty31@gmail.com

Received Date: 19/06/2018 Revised Date: 10/07/2018 Accepted Date: 02/08/2018

DOI: <https://doi.org/10.26611/103722>

Access this article online

Quick Response Code:



Website:

www.medpulse.in

Accessed Date:
04 August 2018

INTRODUCTION

The study group consisted of 50 cigarette smokers aged between 20-40 years. The subjects were recruited from teaching and non teaching staff of Sri Devraj Urs Academy of Higher Education and Research and also attenders of patients coming to R.L.Jalappa Hospital, Kolar after taking informed consent. Ethical clearance

was also obtained from Institutional Ethical Clearance Committee for the study.

The study group included subjects who are not exposed to occupational noise, with no history of use of ototoxic drugs like streptomycin, cisplatin, neomycin, gentamycin etc and no history of chronic diseases like diabetes, hypertension. Subjects with history of head injury and history of ENT infections in past 3 months were also not included in the study.

Study subjects thus selected were given a questionnaire to collect information regarding their smoking history expressed in pack years. Pack years of smoking will be defined as the number of packs (one pack=20 cigarettes) smoked per day multiplied by the duration of smoking in years. A detailed general physical and systemic examination was conducted in all subjects. Also a detailed ear, nose and throat examination was carried out to rule out any unidentified pathology.

An assessment of auditory thresholds was done for different frequencies by using pure tone audiometer (ELKON-GIGA3) for study group in a sound proof room. Pure tone audiometer contains sound thresholds in decibels and frequencies in Hertz. Auditory threshold is the lowest level of sound threshold in decibels, at a particular frequency of sound at which the human ear can perceive it as a sound. The parameters studied in pure tone audiogram are air conduction (AC) and bone conduction (BC) hearing thresholds of both the ears at various frequencies of sound. They are recorded on audiogram chart which depicts the auditory thresholds of the particular ear. The audiogram was recorded for both the ears separately.

Statistical Treatment of the data

The data was suitably arranged into tables for discussion under different headings. Descriptive statistical analysis was carried out on this data. Results on continuous measurements are presented as mean + standard deviation and results on categorical measurements are presented in

number. Significance was assessed at 5% level of significance. The Pearson correlation between pack years of smoking and AC, BC conduction hearing thresholds for both ears was also done with significance test by student ‘t’ test and ANOVA test.

RESULTS AND OBSERVATIONS

Study subjects were divided based on pack years(PY) into <2 PY, 2-5 PY, >5 PY (Table1).ANOVA revealed that there is significant difference in AC and BC thresholds between the groups at all frequencies in the right ear and left ear(Table 2 and3).Results also showed that there is positive correlation of pack years of smoking with air conduction thresholds of smokers in both right and left ear at all frequencies and also positive correlation of pack years of smoking with bone conduction thresholds were found at higher frequencies (1,2 and 4 kHz) in both right and left ear(Table 4).

Table 1: Pack years of smoking among study group

Pack years	Number of subjects	%
<2.0 pack years	24	48.0
2-5 pack years	13	26.0
>5 years	13	26.0
Total	50	100.0

Table 2: comparison of AC and BC auditory thresholds with pack years of smoking for right ear

Pack years	Frequency(Right ear)						
	0.25khz	0.5khz	1khz	2khz	4khz	6khz	8khz
AC							
<2	14.58±5.50	16.04±6.08	13.96±6.25	14.38±6.31	18.96±9.7	17.50±7.66	14.58±8.33
2-5	21.15±5.46	23.08±5.22	18.85±6.50	21.54±7.18	22.31±9.7	24.23±9.32	16.54±8.99
>5	23.08±6.93	24.23±5.72	25.77±10.17	25.77±12.3	29.23±8	33.46±9.66	27.69±13.0
P value	<0.001**	<0.001**	<0.001**	0.001**	0.001**	<0.001**	0.001**
BC							
<2	9.58±5.50	11.04±5.51	8.75±6.12	8.33±6.37	10.00±7.94	-	-
2-5	10.77±5.72	10.38±5.94	9.62±5.58	11.54±5.91	14.62±9.00	-	-
>5	12.69±5.99	12.69±5.99	18.08±6.63	17.69±11.48	17.69±7.80	-	-
P value	0.292	0.569	<0.001**	0.005**	0.025*	-	-

Results are presented in mean ± SD, ANOVA test has been used to compute p value

Table 3: comparison of AC and BC auditory thresholds with pack years of smoking for left ear

Pack years	Frequency(Left ear)						
	0.25khz	0.5khz	1khz	2khz	4khz	6khz	8khz
AC							
<2.0	16.67±4.82	16.67±6.37	16.04±6.75	15.21±6.5	18.33±9.52	17.92±8.71	15.21±8.01
2-5	22.31±4.84	23.46±4.27	20.38±5.19	23.08±6.9	26.15±9.82	26.54±9.8	19.23±8.62
>5	22.31±7.53	23.08±6.30	26.15±13.56	25.77±12.3	29.23±12.05	35.00±11.1	26.15±12.61
P value	0.004**	0.001**	0.006**	0.001**	0.007**	<0.001**	0.007**
BC							
<2.0	9.79±5.00	9.79±4.77	8.96±6.59	8.13±5.86	10.21±8.91	-	-
2-5	11.92±6.30	10.38±5.94	10.77±5.34	11.92±7.23	14.62±6.60	-	-
>5	11.15±6.18	12.69±6.65	17.69±6.96	17.31±11.48	19.23±8.13	-	-
P value	0.525	0.324	0.001**	0.007**	0.009**	-	-

Results are presented in mean ± SD, ANOVA test has been used to compute p value

Table 4: Pearson correlation of pack years of smoking with auditory thresholds(AC and BC) in both the ears

Pack years	Frequency(Right ear)						
	0.25khz	0.5khz	1khz	2khz	4khz	6khz	8khz
AC							
r value	0.355	0.334	0.416	0.366	0.398	0.555	0.390
p value	0.011*	0.016*	0.003**	0.009**	0.004**	<0.001**	0.005**
BC							
r value	0.239	0.151	0.497	0.393	0.355	-	-
p value	0.095+	0.297	<0.001**	0.005**	0.011*	-	-
Pack years	Frequency(Left ear)						
	0.25khz	0.5khz	1khz	2khz	4khz	6khz	8khz
AC							
r value	0.337	0.366	0.326	0.382	0.379	0.475	0.408
p value	0.017*	0.009**	0.021*	0.006**	0.007**	<0.001**	0.003**
BC							
r value	0.173	0.217	0.481	0.408	0.407	-	-
p value	0.230	0.130	<0.001**	0.003**	0.003**	-	-

DISCUSSION

Cigarette smoking is an important risk factor for chronic lung diseases and cardiovascular diseases. Relatively little data exists on the exposure of cigarette smoking as a risk factor for hearing loss, although link was established over 40 years ago. Information on the effects of smoking at the cochlear and auditory central nervous system levels has become available only recently.^{1,2,3} Various studies have shown that smoking induces changes in auditory thresholds among smokers as compared to a non-smoker. Study conducted to compare the auditory threshold in low and high frequencies, within a group of male smokers and non-smokers aged between 18 and 40 years which concluded that statistically significant difference in auditory thresholds between the smokers and non-smokers in both low and high frequencies, the smoker group having higher auditory thresholds.⁴ A retrospective cross sectional study done on men in Israel who underwent a hearing test as part of a routine periodic examination showed significant higher incidence of hearing loss in current and past smokers than in non-smokers. Both sensorineural and conductive impairment were found to be associated particularly with smoking.⁵ Also a prospective study indicated that smoking was associated with higher prevalence and incidence of hearing loss.⁶ The possible explanation for the above finding may be that a higher prevalence of rhino sinusitis or eustachian tube dysfunction is seen among smokers which is thus related to conductive hearing loss,^{7,8,9,10} whereas sensorineural hearing loss might be due to an oxidative damage caused by toxic substances inhaled with the cigarette smoke.³ This study was aimed at studying correlation of pack years of smoking with changes in hearing threshold using pure tone audiometry. Presbycusis is physiological alteration in hearing acuity as a consequence of aging this study

includes samples between 20-40 years. This study revealed that there is significant difference in AC and BC thresholds between groups with different pack years at all frequencies in the right ear and left ear. It also showed that there is positive correlation of pack years of smoking with air conduction thresholds of smokers in both right and left ear at all frequencies and also positive correlation of pack years of smoking with bone conduction thresholds were found at higher frequencies (1,2 and 4 kHz) in both right and left ear. Various studies in the past have also shown positive correlation between pack years and hearing loss.^{1,2,11} In our study most of correlation between pack years and changes in hearing threshold found, comes from less than 2 PY. Further sample size is very small and there is unequal distribution of samples i.e. <2PY (n=24), 2-5PY (n=13), >5(n=13). Hence, these results need to be confirmed by population based studies.

Studies have also found negative association between smoking and hearing loss, The longitudinal study of aging done at Baltimore, found no association between cigarette smoking and development of hearing loss in 531 white men.¹² A study which tested hearing with audiometry done at Framingham showed that there is no association between cigarette smoking and hearing loss.¹³ There is no clear physiologic parameter to differ between these populations. A possible explanation for this discrepancy may be the different methodologies used in the studies and the fact that they related to different populations (Spanish and North Americans) at different ages. In our study only male subjects were used, consequently generalization cannot be made across genders and also pure tone audiometry is a subjective test; there might be chances of error while recording auditory thresholds.

CONCLUSION

Among the various environmental factors associated with hearing loss, Smoking is important preventable risk factor hence modification of smoking habits may prevent or delay age related declines in hearing sensitivity.

REFERENCES

1. Cruickshanks, K, Klein R, Klein B, Wiley T, Nondahl D, Tweed, T. Cigarette smoking and hearing loss: the epidemiology of hearing loss study. *Journal of the American Medical Association* 1998; 279: 1715-1719.
2. Nakanishi N, Okamoto M, Nakamura K, Suzuki K, Tataru K. Cigarette smoking and risk for hearing impairment: a longitudinal study in Japanese male office workers. *J Occup Environ Med* 2000;42(11):1045-9.
3. Maffei G, Maini P. Experimental tobacco poisoning: Resultant structural modifications of the cochlea and tuba acoustica. *Arch Otolaryngol* 1962; 75:386-396.
4. Oliveira D, Lima M. Low and high frequency tonal threshold audiometry: comparing hearing thresholds between smokers and non-smokers. *Brazilian journal of otolaryngology* 2009;75(9):738-44.
5. Sharabi, Y, Reshef-Haran I, Burstein M, Eldad, A. Cigarette smoking and hearing loss: lessons from the young adult periodic examination in Israel (YAPEIS) database. *Israel Medical Association Journal* 2002; 4 : 1118-1120.
6. Ferruci L, Guralnik JM, Penninx BW, Leveille S. Cigarette smoke Exposure and hearing loss. *J Am Med Assoc* 1998; 280(11):963.
7. Kraemer MJ, Richardson MA, Weiss NS, *et al.* Risk factors for persistent middle-ear effusions. Otitis media, catarrh, cigarette smoke exposure and atopy. *J Am Med Assoc* 1983; 249(8):1022-5.
8. Gulya AJ. Environmental tobacco smoke and otitis media. *Arch Otolaryngol Head Neck Surg* 1994;111(1):6-8.
9. Kraemer MJ, Marshall SG, Richardson MA. Etiologic factors in the development of chronic middle ear effusions. *Clin Rev Allergy* 1984; 2(4):319-28.
10. Ilicali OC, Keles N, Deger K, Savas I. Relationship of passive cigarette to otitis media. *Arch Otolaryngol Head Neck Surg* 1999; 125(7):758-62.
11. Noorhassim I, Rampal KG. Multiplicative effect of Smoking and Aging on Hearing Impairment. *Am J Otolaryngol* 1998;19:240-243.
12. Brant LJ, Gordon-Salant S, Pearson JD, *et al.* Risk factors related to age-associated hearing loss in the speech frequencies. *J Am Acad Audiol* 1996; 7(3):152-60.
13. Gates GA, Cobb JL, D'Agostino RB, Wolf PA. The relation of hearing in the elderly to the presence of cardiovascular disease and cardiovascular risk factors. *Arch Otolaryngol Head Neck Surg* 1993; 119(2):156-61.

Source of Support: None Declared
Conflict of Interest: None Declared