



ORIGINAL RESEARCH PAPER

Physiology

Auditory thresholds in Chronic Alcoholic Subjects - A Cross sectional study

KEY WORDS: SNHL-Sensori Neural hearing loss, Auditory thresholds, Puretone audiometry.

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ABSTRACT

BACK ROUND: Alcohol is one of the most important public health problems. Approximately 2 billion of the world's population consumes alcohol and 76.3 million people have alcoholic disorders. Alcohol affects almost all organs of the body and causes cirrhosis, neuropathy, and myocardial infarction and hearing loss. **AIM & OBJECTIVE:** To analyze the sensorineural hearing loss (SNHL) in alcoholic men by using Puretone audiometry. **METHODOLOGY:** A total of 134 subjects, in which 67 alcoholic men and 67 non-alcoholic men were included in this study. Alcoholic men, who were diabetic, hypertensive, smoker and subjects using ototoxic drugs were excluded from this study. Audiometric thresholds were recorded by using puretone audiometer. **RESULTS:** Unpaired't' test and Chi square tests were used. Out of 67 alcoholics, 44 were affected with sensorineural hearing loss ($p < 0.0001$). There is significant increase in auditory thresholds in alcoholics ($p < 0.0001$). **CONCLUSION:** Alcoholics were affected by high frequency (4KHz) hearing loss. The hearing loss is directly related to the duration and the amount of alcohol consumed. This study helps to raise the awareness of hearing loss in alcoholics and promote abstinence of alcohol in outpatient clinics.

INTRODUCTION

Consumption of alcohol is associated with physical, psychological and social problems. Around 2.3 million people die because of alcohol related disorders and the deaths due to alcohol are around 3.7%¹. In India, about 20 to 30% of adult male and 5% of adult females are consuming alcohol. About 28% of traffic injuries are due to alcohol, according to a study conducted recently in Bangaluru¹.

It affects almost all systems of the body. The effects are mainly due to the production of free radicals.

Several investigators reported that acute and chronic alcohol intake in larger doses, causes alteration in the auditory brain stem potentials and middle latency responses. Some studies reported that the moderate level of alcohol consumption causes cardio protective effect.

The basic and gold standard procedure to evaluate the auditory threshold measurement is puretone audiometry. The subject can perceive a number of frequency sounds from 250Hz to 8000Hz and the findings are recorded.

There are so many different opinions in the studies related to the quantity and duration of alcohol consumption which causes hearing impairment. In India, there are very few studies regarding the hearing impairment associated with alcohol intake. The purpose of this study was to evaluate the relation between alcohol use and hearing loss in men.

AIM & OBJECTIVES:

To study the hearing loss in alcoholics and to compare it with that of normal individuals by using Puretone audiometry. To evaluate the correlation between the duration of alcoholism and quantity of alcohol with the hearing impairment.

MATERIALS AND METHODS:

The study group consists of 67 male alcoholics (consumed alcohol for more than 2years) between the age group of 25-55 years and the control group consists of 67 non-alcoholics of same age group. The alcoholics were selected by using AUDIT (Alcohol Use Disorders Identification Test) questionnaire. This cross sectional study was conducted in the Department of physiology, Coimbatore Medical College, Coimbatore from June 2013 to October 2014. Approval from the institutional ethics committee

was obtained. Informed written consent was obtained.

Patients who were above 60 years of age, history of diabetes mellitus, hypertension, ear infections, ototoxic drug users and workers with exposure to noise were excluded from this study.

PROCEDURE

Pure tone audiometry

Detailed history, general and clinical examination was done. The procedure was explained to the subjects. All of them were made to sit comfortably in a chair inside a sound proof room.

Puretone audiometer (MAICO- MA 52) was used with supra-aural headphones and Bone conduction vibrator to study the auditory thresholds. The frequencies were recorded in the order of 1000Hz, 2000Hz, 4000Hz, 8000Hz, 500Hz and 250Hz by using the 5-up 10-down procedure². The bone conduction was tested in the order of 1000Hz, 2000Hz, 4000Hz, 500Hz and 250Hz. Finally, all recordings of both ears were plotted on an audiogram and classified according to the hearing impairment.

STATISTICAL ANALYSIS AND RESULTS:

The statistical analysis was done by using unpaired't' test and Chi-square test to analyze the association between alcoholics and hearing loss. A total of 134 subjects, Group A consists of 67 cases of alcoholics, age matched males and Group B consists of 67 controls, age matched males.

Table 1 : Hearing Loss as per Puretone Audiometry in Cases and Controls

Group	Hearing Loss	
	Present	Absent
Group A	44	33
Group B	5	62

The above statistical table showed that there is a significant ($P < 0.001$) hearing loss among the alcoholics (65.7%) when compared with the Non-alcoholics (7.5%).

Table 2: Effect of duration of alcoholism on hearing

Up to 5 yrs	2	7	9
6 – 10 yrs	6	6	12
11 – 15 yrs	12	9	21
16 – 20 yrs	17	1	18
>20 yrs	7	0	7

Duration (years)		
Mean	15.98	9.09
SD	5.84	4.22
'p'	<0.0001 Significant	

Table 3 : Effect of Quantity of Consumption of alcohol on hearing.

Alcohol consumption per week (Units)	Hearing Loss		
	Present	Absent	Total
25 – 30	1	17	18
31 – 40	17	4	21
41 – 50	17	2	19
Above 50 Units	9	0	9

Units (1 unit=8gm alcohol)		
Mean	45.1 Units	30.9 Units
SD	8.7 Units	7.6 Units
'p'	<0.0001 Significant	

All the above tables show there is more sensorineural hearing loss among the alcoholics in respect to duration, and quantity of alcohol intake, when compared to the Non-alcoholics.

Table 4 : Comparison of Degree of Hearing loss among Alcoholics and Non-Alcoholics

According to the American Speech Language and Hearing Association (ASHA) 3

Hearing loss	Group A	Group B
Normal hearing (□10 to 15 dB)	33	62
Minimal hearing loss (16 to 25 dB)	39	5
Mild hearing loss (26 to 40 dB)	5	0
Moderate hearing loss and Severe loss (41 to >90 dB)	0	0

This table shows the alcohol intake causes mild hearing loss when compared to the non-alcoholics.

DISCUSSION

The study showed that there was significant association ('p' value <0.0001) between the alcohol intake and hearing impairment. According to the puretone audiometry findings 65.7% of alcoholics had hearing loss, when compared with the controls who had only 7.5% affected.

Few researchers observed the relationship between the alcohol and hearing loss. Sander Beatriz et al⁴ in Brazil, Kavitha Ashokkumar et al⁵ in India, Tahwinder Upile et al⁶ in U.K, Marcielle Belle et al⁷ in Brazil, Perez et al⁸ had investigated the auditory effects of alcohol and suggested that there was strong relationship between alcohol and hearing loss. In Kavitha Ashok Kumar et al study showed that alcohol causes damage to the outer hair cells of the cochlea and also proved that the sensorineural hearing loss was seen in high frequencies like 4000Hz to 8000Hz⁵.

Due to the higher frequency loss which was above the normal speech frequency, the alcoholics never complain of hearing loss.

In Sandra Beatriz et al⁴, Roshan K Varma et al⁹, J.H.Hwang et al¹⁰ studies proved that higher frequencies above 3000Hz were mostly affected in alcoholics. They also proved that alcohol was the only auditory risk factor in the study of TEOAE(Transient Evoked Oto Acoustic Emissions) study in alcoholic subjects with no exposure to noise. In contrast the

Tahwinder Upile et al suggested that the lower frequencies like 1000Hz were also affected by alcohol which was used to discriminate vowels⁶.

Our study indicated that the duration of consumption of alcohol also influenced the hearing loss. Whenever the duration of intake of alcohol increases, hearing impairment also increases ('p' value <0.0001 Significant). 22.2% of cases had hearing loss in case of less than 5 years duration but almost all the 7 cases(100%) were affected who had more than 20 years of alcohol intake. This study correlated with the findings of Sandra Beatriz et al study which described that the high frequency hearing loss was due to the long term use of alcohol⁴. Marcielle Belle et al noticed in their study that alcohol consumed for longer periods had more incidences of hearing impairment⁷. In contrast, Kavitha Ashok Kumar et al found that there was no relationship between duration of alcohol and severity of hearing loss⁵.

The study showed that there is greater significance ('p' value <0.0001) between the amount of consumption of alcohol and hearing loss. When intake of alcohol was less than 30 units only 5.6% of alcoholics got hearing loss and the severity increases proportionately with the increase of intake of alcohol. Almost all(9) of the cases(100%) had hearing loss when they consumed more than 50 units/week. According to the classification of Royal college of Physicians, Psychiatrists and General practitioners, low risk for men who consume alcohol up to 21 units/week, Increased risk for men is from 22 units to 50 units/week and High risk for men when it is 50 units/week. Juen-Haur Hwang et al suggested that the DPOAE (Distortion Product Oto Acoustic Emissions) changes produced by alcohol were concentration dependent¹⁰. Tahwinder Upile et al showed that moderate consumption of alcohol affected the hearing thresholds by producing dullness to the puretones in speech frequencies⁶.

Juen-Haur Hwang et al described the possibilities of outer hair cell damage such as (1) Alcohol and its metabolites causes disturbances in the endocochlear environment and abnormal outer cell motility¹⁰, (2) Alcohol enhances the inhibitory transmission via GABA_A type receptors and suppresses the excitatory transmission via N-Methyl D-aspartate receptors^{10,11} (3) Alcohol affected the middle ear muscles and thereby affected the acoustic reflex thresholds^{5,10}.

Juen-Haur Hwang et al finally concluded that alcohol not only affects the central nervous system but also affects the functions of outer hair cells¹⁰. Kavitha Ashok Kumar et al found that there was damage to the outer hair cells of organ of corti in alcoholics which caused the hearing loss⁵

Juen-Haur Hwang et al in their study of Acute effects of alcohol on Auditory Thresholds and DPOAE in Humans, suggested that the acute changes in hearing loss were completely reversible whereas chronic changes were irreversible¹⁰.

CONCLUSION

The study showed that, long term consumption of alcohol causes mild sensorineural hearing loss mainly high frequency hearing loss(>4KHz). A positive correlation was documented between duration of consumption of alcohol and quantity of the intake and the hearing loss. Alcohol affects the peripheral auditory system by altering the prestin, a motor protein in the outer hair cells and reduces the cochlear amplification and electromotility of the hair cell¹³.

Hearing loss can interfere with the quality of life, restricting the ability to interact with others. This leads to stress and misunderstandings in communications. Hearing impairment filtering out sound experiences, which gives pleasure and meaning to life. The study confirms the positive correlation

between alcoholism and hearing loss.

“Prevention is better than cure”. Early detection of hearing impairment among the alcoholics is essential as appropriate management can improve their quality of life.

The outcome of this study will raise the awareness among the alcoholics regarding the hearing loss and prevent the further progression of hearing impairment. For prevention of hearing loss in alcoholics, the first step is the abstinence of alcohol by giving health education regarding the risks by outpatient counseling¹⁴.

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