

Distribution of Audiometric Findings in Patients with Presbycusis

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ABSTRACT

The aim of the present study was to determine the audiometric pattern of patients suffering from presbycusis. Moreover, we tried to give an overview of affected patients in regard to age, gender, and concomitant diseases. In this prospective descriptive study we investigate the audiometric patterns of presbycusis patients older than 60 years attending the otolaryngology clinic of Imam Khomeini Hospital, Ahvaz, Iran. Moreover, a questionnaire about past medical history of all participants in regard to ear and hearing disorders and risk factors were obtained. A screening tympanogram and otoscopic evaluation were performed by an otolaryngologist before the enrolling the subject to the study. Our findings showed that the sensory pattern is the most frequent kind of presbycusis (64.29%), followed by neural, conductive, metabolic and sensory-neural with a frequency of 16.25%, 9.54%, 2.68% and 7.16% respectively. Tinnitus was detected in over 60 percent of participants. Presbycusis did not have significantly higher rates in smokers or patients with positive history of hypertension ($P=0.245$, $P=0.249$). In this study the most frequent audiometric pattern was sensory and there was no significant difference between presbycusis and smoking or hypertension.

Key words: Audiometry, Presbycusis, Age-Related Hearing Loss, Elderly

INTRODUCTION

Presbycusis, age-related hearing loss (ARHL), is an inevitable deterioration in hearing ability which gradually occurs in most individuals as they grow up¹. After hypertension and arthritis, ARHL is the third most common chronic disease among people aged over 65 years².

Presbycusis by definition is a progressive bilateral symmetrical age-related hearing loss³.

Although its etiology is not well known, previous studies suggested various types of physiological degeneration, environmental factors (i.e. noise exposure and ototoxic agents), and genetic susceptibility as the affecting causes. ARHL should be considered as a major public health problem, since it has diverse adverse effects on quality of life, cognitive, emotional and social functions of the older adults^{4,5}. The prevalence of hearing loss seems to be growing by age, from 40-60% in the 60s to over 80% in people older than 85⁶. It could

be detected in both men and women but the hearing loss showed different patterns among either genders previously^{1,7}.

The association between ARHL and tinnitus, smoking and several chronic diseases have been evaluated before^{2, 8, 9}. Besides, concomitant factors including; dyslipidemia, hypertension would aggregate the progression of presbycusis².

In spite of high prevalence and potential adverse effects of presbycusis, unfortunately it is still a diagnose dilemma. Schuknecht, *et al.* categorised presbycusis based on pathology and audiometric findings into sensory, neural, conductive, and metabolic(strial) types. Sensory presbycusis is defined as epithelial atrophy and loss of sensory hair cells and supporting cells of the organ of Corti, which is begun from the base and progress towards the apex. In this type slope of the audiogram occurs in the high frequencies therefore the speech discrimination is preserved. Neural presbycusis is result from nerve cells atrophy in the cochlea and central neural pathway. Atrophy occurs throughout the cochlea with no precipitous drop in high-frequency threshold in the audiogram. The speech discrimination severely decreases even before hearing loss is noted. Conductive or mechanical type stems from thickening and secondary stiffening of the basilar membrane of the cochlea with a gradual sloping high-frequency sensorineural hearing loss. Speech discrimination is preserved in this type. Atrophy of stria vascularis result in metabolic or strial presbycusis which affect the entire cochlea and show a flat curve in the audiogram.

The aim of the present study was to determine the audiogram pattern of patients suffering from presbycusis. Moreover, we tried to give an overview of affected patients in regard to age, gender, and concomitant diseases.

MATERIALS AND METHODS

This descriptive prospective study was conducted during March 2010 to March 2012 in Imam Khomeini Hospital, Ahvaz, Iran. Eligible subjects were all patients older than 60 years old

with hearing disorders attending to the otolaryngology clinic of Imam Khomeini Hospital. All participants first were evaluated by an otolaryngologist . Patients with any abnormal findings i.e tympan tearing, otosclerosis, and otitis serous were excluded. Then a questionnaire was completed for each participant. The hearing examination included an otoscopic evaluation, a screening tympanogram and pure-tone air- and bone-conduction assessments.

A questionnaire about the ear and hearing-related medical and surgical history, noise exposure, acoustic trauma, congenital disorders, previous history of using ototoxic agent, smoking, and hypertension was administered as an interview for all subjects.

The sample size was calculated using the following equation:

$$n = \frac{z_{(1-\frac{\alpha}{2})}^2 p(1-p)}{d^2}$$

where Prevalence (p) and difference (d) based on Gate, *et al* was 0.37 and 0.05, respectively¹. The frequency of different type of presbycusis was calculated. The Chi-squard test was used for analysis of qualitative variables. All reported P-values less than 0.05 were considered as statistically significant.

RESULTS

Five hundred and sixty patients over the age of 60 (315 male and 245 female) were evaluated in four different age groups (Table 1).

The sensory pattern was the most frequent one, which was detected in 360 (64.29%) of patients. It followed by neural, conductive and metabolic patterns in 91 (16.25%), 54 (9.54%), and 15 (2.68%) patients respectively. Forty patients (7.14%) showed a combination of sensory and neural pattern in audiometry. Recent group had normal hearing ability in low and medium frequencies, but showed a severe hearing loss in high frequencies. Besides, the speech discrimination was impaired in this group.

The majority of patients, 339 (60.5%), complained of tinnitus. This complaint was associated with sensory-neural hearing loss the most (72.5%) (Table.2)

A sensory-neural pattern was more frequent among females (55%), while four other

patterns showed a higher frequency in men (Table 3).

Smoking and hypertension were more accompanied by conductive pattern, 87 (15.5%) and 255 (45.5%) respectively. Metabolic presbycusis patients had no smoking history. There

Table 1: The age distribution of presbycusis audiometric patterns

Audiometric pattern	Age*				Total
	60-69	70-79	80-89	90-99	
Sensory	263(73.1%)**	78(21.7%)	19(5.3%)	0(0%)	360(100%)
Neural	46(50.5%)	23(25.3%)	18(19.8%)	4(4.4%)	91(100%)
Conductive	18(33.3%)	25(46.3%)	11(20.4%)	0(0%)	54(100%)
Metabolic	11(73.3%)	4(26.7%)	0(0%)	0(0%)	15(100%)
Sensory-Neural	23(57.5%)	17(42.5%)	0(0%)	0(0%)	40(100%)
Total	361(64.5%)	147(26.3%)	48(8.6%)	4(0.7%)	560(100%)

* Years

** Number(percent)

Table 2: The association between tinnitus and audiometric patterns

Audiometric pattern	Tinnitus*		
	Present	Abscent	Total
Sensory	220(61.1%)**	140(38.9%)	360(100%)
Neural	45(49.5%)	46(50.5%)	91(100%)
Conductive	38(70.4%)	16(29.6%)	54(100%)
Metabolic	7(46.7%)	8(53.3%)	15(100%)
Sensory-Neural	29(72.5%)	11(27.5%)	40(100%)
Total	339(60.5%)	221(39.5%)	560(100%)

*Number (percent)

Table 3: The gender distribution of different audiometric patterns

Audiometric pattern	Gender		
	Male	Female	Total
Sensory	209(58.1%)*	151(41.9%)	360(100%)
Neural	48(52.7%)	43(47.3%)	91(100%)
Conductive	29(53.7%)	25(46.3%)	54(100%)
Metabolic	11(73.3%)	4(26.7%)	15(100%)
Sensory-Neural	18(45.0%)	22(55.0%)	40(100%)
Total	315(56.3%)	245(43.8%)	560(100%)

*Number(percent)

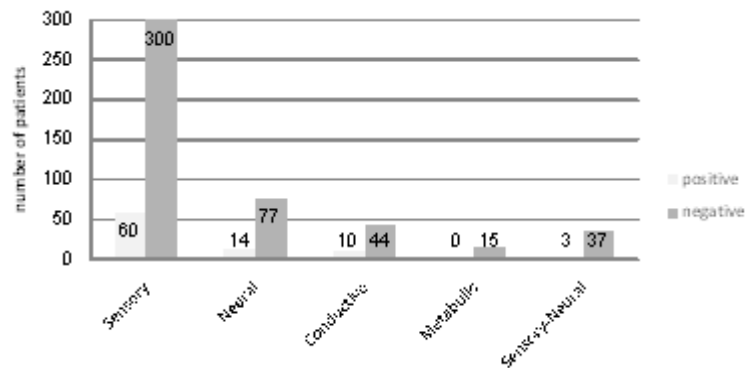


Fig. 1: Frequency of smoking history in different audiometric patterns

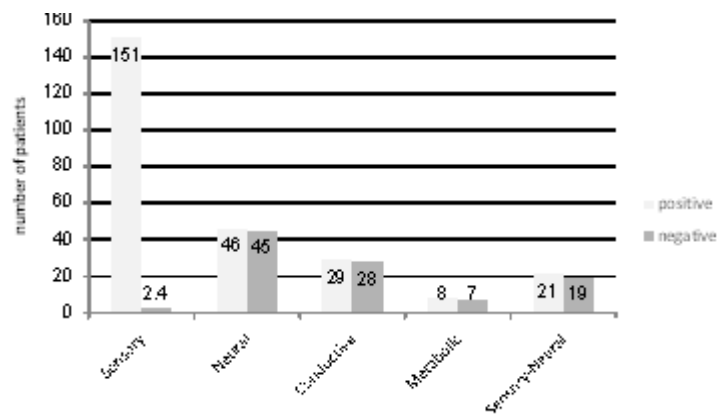


Fig. 2: Frequency of hypertension history in different audiometric patterns

were no significant differences between smoking and presbycusis ($P=0.245$). The least frequent audiometric pattern in hypertensive patients was sensory presbycusis. The association between hypertension and presbycusis was not statistically significant ($P=0.249$) (Figure 1,2).

DISCUSSION

The population older than 60 years is going to increase at a fast rate during coming decades. Both peripheral and central auditory systems affect by advancing age. ARHL gradually progress and leads to social isolation of the elderly population. There are supporting data about the association between presbycusis and the cognitive decline¹⁰⁻¹².

The findings of the present study suggest that the most frequent presbycusis pattern in our studied population was sensory (64.29%), which

is defined as the hearing loss in low and medium frequencies. Baradli, *et al.* (2005) studied 211 elderly patients and revealed that the major decrease in low frequency hearing loss occurs in the 90s and older, but high-frequencies hearing loss occur before mentioned age¹³.

Presbycusis is a common cause of tinnitus and 60.5% of our participants present this symptom. This result is in a line with Do Carmo *et al.* (2008) survey in Brazil which reported 72.5% and 64.4% tinnitus in male and female population respectively⁷.

Cruickshank *et al.* (1998) in an epidemiological study of hearing loss reported that current smokers had 1.69 times more hearing loss than nonsmokers. Besides, nonsmoking participants who lived with a smoker were more likely to have a hearing loss than those who were not exposed to a household member who smoked.

But our results showed no statistically significant relationship between smoking and presbycusis.

Gate GA *et al.* investigated the relationship between cardiovascular disease and hearing status in the elderly and they revealed that there is a statistically significant relationship between these two factors¹⁴. In the present study the relationship

between hypertension and presbycusis was investigated, which was not statistically significant (P =0.249).

In conclusion in this study the most frequent audiometric pattern was sensory and there was no significant difference between presbycusis and smoking or hypertension.

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