Audiological study of Geriatric Population

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ABSTRACT: Hearing loss leads to social isolation in aging persons. An early and adequate diagnosis has an important role in defining the medical strategy, such as adapting sound amplification devices and rehabilitation procedures for auditory function in the elderly. The Cross sectional study has been done of 75 cases of above 60 year during the year of Jan. 2010 to Oct.2011 from audiometry department of L.G. hospital and V.S. hospital. Pure tone thresholds tested for frequencies 500Hz to 8kHz in audiometry were increased in the geriatric population. Result showed that the onset of hearing loss is typically in the six and seven decade of life. Pure-tone thresholds in females were statistically lower at higher frequencies compared to males, suggesting that aging begins earlier in men. Subjects working outside home and exposed to noise pollution were affected more with the hearing impairment. Majority of Geriatric subjects showed bilateral sensorineural hearing loss. The degree of hearing loss was mild to moderate in majority of cases of Geriatric population. The complaint effect was not observed at the thresholds tested in this study. High-frequency audiometry may be used in audiology clinics as a routine procedure with advantages in diagnosis.

Key words: Audiometry, Deafness,Geriatric population

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INTRODUCTION : Hearing loss leads to social isolation in aging persons.[1,2] Research has attempted to describe the aging process as related to hearing, and has concentrated efforts on the study of audiometric thresholds, auditory processing. These studies have contributed to the early detection of sensory or neural changes, which may interrupt or minimize the social exclusion effect, consequently improving the quality of life, autonomy and independence of people with hearing loss.[3]An early and adequate diagnosis has an important role in defining the medical strategy, such as adapting sound amplification devices and rehabilitation procedures for auditory function in the elderly.

Presbycusis, or age-associated hearing loss, refers to aging changes that take place in the auditory system such as changes in the anatomy[4] and function of

the external and middle ear. These alterations also involve sensory, nerve, vascular striate, and Corte organ support cells, and changes in the plasticity of central nervous processing which include the cochlear nucleus, the superior livery nucleus, the lateral lemniscuses, the inferior colliculus, and the medial geniculate body. Certain environmental factors may have an influence on the degree of hearing loss at high frequencies, including the diet, contact or intake of chemical agents and medical drugs, and noise exposure.

One of the strategies used to study age-associated hearing loss is to compare pure-tone thresholds in young and old people[5]. However, not only sensory factors, but neural and cognitive aspects are also involved in people over 60 years, which complicates the evaluation of the effect of each variable on hearing and its aging process. Therefore, it is useful to study a younger population to precisely characterize the beginnings of age-related hearing loss[6]

A significant methodological challenge in studying presbycusis is to filter environmental variables and to collect the pure phenomenon.[7] One needs to include the largest possible number of risk factors for hearing loss in order to clarify the auditory sensorial aging process. This includes interviews on life habits, health and hearing, and a detailed ontological assessment. Knowing the variables in a study population allows an assessment of the part played by these variables in the aging process.

Aims and Objectives

1. To study pure tone Audiometry in Geriatric population.
2. To study audiogram configurations in geriatric population reporting hearing difficulty.
3. To find out type of Hearing loss caused by ageing.
4. To find out the severity/degree of hearing loss caused by ageing.
5. To study the difference in hearing loss with regard to gender.
6. To study the prevalence of Hearing Impairment in older adults coming with hearing difficulty.
7. To study the risk factors for hearing loss in geriatric population.

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Material And Methods: The Cross sectional study has been done of 75 cases of above 60 year during the year of Jan. 2010 to Oct.2011 from audiometry department of L.G. hospital and V.S. hospital. Multivariate analysis using the

software SPSS 11.5 was done to test age group effects, gender effects and auditory condition of complaint effects (with or with no complaint) on thresholds for each tested frequency. Pure-tone thresholds were fed into the software as dependent variables. The age group, gender and condition of complaint were inserted into the software as factors.

Investigations done were **Rinse's test:** To compares the ability of hearing through the medium of bone & of the air that means comparison of bone conduction with air conduction of the same ear. **Weber's test:** To compares bone conduction of the both ears and audiometry using audiometer.

Audiometer: The electronic instrument used for measuring the hearing threshold level is called an audiometer[4]. **Pure Tone Audiometry was done using Standard AS/NZS 1269.4**

RESULT AND DISCUSSION: Following observations were made from the study of Audiometry in Geriatric population.

Table: 1 Distribution of subjects according to Age group.

Age Group (yrs)	No of subject	Percent(%)
60 to 65	53	70.6
66 t0 70	18	24.1
>70	04	05.3
Total	75	100.0

Table: 2 Distribution of subjects according to Sex.

Sex	No of Subject	Percent (%)
Male	44	58.7
Female	31	41.3
Total	75	100.0

Table: 3 Distribution of subjects according to Education.

Education	No of subject	Percent (%)
Illiterate	21	28
Primary	21	28
Secondary	18	24
Higher sec	11	14.7
Graduation	04	5.3
Total	75	100.0

Table: 4 Distribution of subjects according to Occupation

Occupation	No of subject	Percent (%)
Working at home	29	38.6
Working outside home	46	61.4
Total	75	100.0

Table: 5 Distribution of subjects according to Otologial complaints

	RT Ear	Percent (%)	LT Ear	Percent (%)
Tinnitus	58	77.3	44	58.6
Fluid discharge	10	1.33	2	2.66

Table: 6 Distribution of subject according to Medical illness

	No of Subject	Percent (%)
Diabetes Mellitus	15	20.0
Hypertension	16	21.3

Table: 7 Distribution of Geriatric population according to Rinne's test and Weber's test

Rinse's test			
RT ear		LT ear	
BLSNHL (n=55)	positive	BLSNHL (n=55)	positive
UNSNHL (n=4)	Positive	UNSHL (n =16)	positive
Mixed (n=9)	negative	Mixed (n=3)	negative
Deaf (n=7)	No response	Deaf (n=1)	No response

According to this table Rinne's test is positive in 55 subjects of BLSNHL while negative in Mixed Hearing loss and No response in Deaf.

Table: 8 Distribution hearing loss at various frequencies

Degree of hearing loss	Right ear				Left ear			
	500Hz n=75(%)	1kHz n=75(%)	4kHz n=75(%)	8kHz n=75(%)	500Hz n=75(%)	1kHz n=75(%)	4kHz n=75(%)	8kHz n=75(%)
Normal	0	1(1.3)	0	0	0	1(1.3)	0	3(4.0)
Mild	18(24.0)	5(6.7)	3(4.0)	2 (2.7)	15(20)	4(5.3)	4(5.3)	25(33.3)
Moderate	47(62.7)	58(77.3)	59(78.7)	45(60.0)	57(76)	64(85.3)	61(81.3)	44(58.7)
Severe	3(4.0)	3(4.0)	5(6.7)	21(28.0)	1(1.3)	5(6.8)	8(10.7)	2(2.7)
Profound	7(9.3)	8(10.7)	8(10.7)	7 (9.3)	2 (2.7)	1(1.3)	2(2.7)	1(1.3)

Degree of hearing loss: Normal hearing = < 25 db HL, Mild hearing loss = 25-40 db HL , Moderate hearing loss = 41-65 dB HL, Severe hearing loss = 66-90 db HL, Profound hearing loss = 90+db HL ,

Notwithstanding the small sample size, there was a significant age group effect on thresholds, with reduced auditory sensitivity and increased thresholds at all frequencies in the older groups. This table shows degree of hearing loss at various frequencies. At higher frequencies like 4kHz and 8kHz there is moderate hearing loss (79% in right ear and 81% in left ear at 4kHz and 60% in right ear and 59% in left ear at 8kHz). In a previous study in Taiwan, Pure-tone thresholds was showed worsening, especially at frequencies >2 kHz, with increasing age. These data provide estimates of the prevalence and severity of hearing loss in community-dwelling older persons in Taiwan[8]. Sensitivity assessments at higher frequencies had been done previously, showing increased thresholds in parallel with increasing age.

Table: 9 Distribution of Type of Deafness in Geriatric Population

	AUD RT % (N=75)	AUD LT % (N=75)
BLSN HL	55(72.6)	55(72.6)
UNSN HL	4(5.0)	16(21.2)
Mixed HL	9(12.0)	3(4.0)
Deaf	7(9.3)	1(1.3)

According to this table Majority of subject's i.e.72.6% showed sensorineural hearing loss which is bilateral.

Table: 10 Distribution of Type of deafness respect to Age

Age group	Type of deafness							
	Right ear				Left ear			
	BLSNHL (N=55) (%)	UNSNHL (n=4) (%)	Mixed HL (n=9) (%)	Deaf (n=7) (%)	BLSNHL (n=55) (%)	UNSNHL (n=16) (%)	Mixed HL (n=3) (%)	Deaf (n=1) (%)
60 to 65 (n=53)	39 (73.6)	2(3.8)	6(11.3)	6(11.3)	39(73.6)	12(22.6)	2(3.8)	0
66 to 70 (n=18)	13(72.2)	1(5.6)	3(16.6)	1(5.6)	13(72.2)	4(22.2)	1(5.6)	0
>70 (n=4)	3(75)	1(25)	0	0	3(75)	0	0	1(25)
Chi-square =4.8492. df=6. P<0.05.					Chi-square =18.9332. df=6. P<0.05.			

According to this table P value is < 0.05 which is highly significant .It shows a strong association between ageing and hearing loss. In a previous study, when the data were crudely averaged and interpolated, roughly 30% of men and 20% of women in Europe were found to have a hearing loss of 30 dB HL or more by age 70 years, and 55% of men and 45% of women by age 80 years[9].

Table: 11 Distribution of Type of Deafness with respect to Gender in Geriatric group

Gender	Type of deafness							
	Right ear (n=75)				Left ear(n=75)			
	BLSNHL (N=55) (%)	SNHL (n=4) (%)	Mixed HL (n=9) (%)	Deaf (n=7) (%)	BLSNHL (n=55) (%)	SNHL (n=16) (%)	Mixed HL (n=3) (%)	Deaf (n=1) (%)
Male (n=44)	36(81.8)	2(4.5)	1(2.3)	5(11.4)	36(81.8)	6(13.6)	2(4.5)	0
Female (n=31)	19(61.3)	2(6.5)	8(25.6)	2(6.5)	19(61.3)	10(32.3)	1(3.2)	1(3.2)
	Chi sq=10.0328, df=3,p= 0.0183				Chi sq=5.4998,df=3, p=0.1387			

The our present study the P.value <0.05 which shows a strong association between sex and type of hearing loss. 36% of male have while 19% of female have hearing loss. Age-associated hearing loss is slower in women, affecting all frequencies uniformly, resulting in horizontal audiometric curves. The beginning of the auditory sensitivity loss process has little effect on lower frequencies, affecting mostly higher frequencies in men.

Table12. Distribution of Type of Deafness with respect to Occupation in Geriatric group

Occupation	**Type of deafness**							
	Right ear (n=75)				**Left ear(n=75)**			
	BLSNHL (N=55) (%)	**ULSNHL (n=4) (%)**	**Mixed HL (n=9) (%)**	**Deaf (n=7) (%)**	**BLSNHL (n=55) %**	**ULSNHL (n=16) %**	**Mixed HL (n=3) %**	**Deaf (n=1) %**
Working at home (n=30)	19 63.3	2 6.7	7 23.3	2 6.7	19 63.3	9 30.0	1 3.3	1 3.3
Working out (n=45)	36 80.0	2 4.4	2 4.4	5 11.1	36 80.0	7 15.6	2 4.4	0
	Chi sq=6.5813 df=3,p= 0.0865				Chi sq=3.99978,df=3, p=0.02617			

According to this table P value is <0.005 which is significant. So there is strong association between Occupation and hearing loss. In present study 19% of cases working at home were affected while 36% of cases working outside showed hearing loss. This is supported by a study showing the effects of aging on noise-induce hearing loss[10].

Table 13 Type of Deafness with respect to various Ear related complaints in Geriatric group.

Ear related complaints	Type of deafness								
	Right ear (n=75)					Left ear(n=75)			
	BLSNHL (N=55) (%)	UNSN HL (n=4) (%)	Mixed HL (n=9) (%)	Deaf (n=7) (%)		BLSNHL (n=55) %	UNSN HL (n=16)%	Mixed HL (n=3) %	Deaf (n=1) %
Tinnitus (n=53)	43 74.1	4 6.9	6 10.3	5 8.6	**Tinnitus (n=49)**	39 79.6	6 12.2	3 6.1	1 2.0
Fluid discharge (n=10)	1 10.0	1 10.0	8 80.0	0	**Fluid discharge (n=2)**	0	0	2 100.0	0

80% of the subjects having bilateral sensorineural hearing loss had complaint of tinnitus. Hearing loss affects many people is accompanied by tinnitus.

Table14 Type of Deafness with respect to h/o HT and DM in Geriatric group

H/o	Type of deafness							
	Right ear (n=75)				Left ear(n=75)			
	BLSNHL (N=55)(%)	UNSNHL (n=4)(%)	Mixed HL (n=9) (%)	Deaf (n=7) (%)	BLSNHL (n=55)%	UNSN HL (n=16)%	Mixed HL (n=3)%	Deaf (n=1)%
HT (N=16)	15(93.8)	1(6.2)	0	0	15(93.8)	1(6.2)	0	0
DM (N=15)	8(53.3)	1(6.7)	3(20.0)	3(20.0)	8(53.3)	6(40.0)	1(6.7)	0

This table is showed P value > 0.05 which is not significant. So there is no association between Diabetes and hearing loss. In a previous study diabetes was not associated with an overall greater risk of hearing loss[11], hearing loss starts at an early age than the normal population. but eventually the general population catches up, so that by the age of 60, they are difficult to distinguish[12]. In previous pathological studies suggested that it is due to

microangiopathic involvement of inner ear blood vessels and subsequent stria vascularis atrophy and hair cell loss[13].

Table 15 Type of deafness according H/o of Smoking or Tobacco chewing in Geriatric population

H/o tobacco consumption	Type of deafness							
	Right ear (n=75)				Left ear(n=75)			
	BLSNHL (N=55) (%)	UNSNHL (n=4) (%)	Mixed HL (n=9) (%)	Deaf (n=7) (%)	BLSNHL (n=55)%	UNSNHL (n=16) (%)	Mixed HL (n=3) (%)	Deaf (n=1) (%)
< 10 years(n=11)	10(90.9)	0	0	1(0.1)	10(90.9)	1(0.1)	0	0
>= 10 years(n=9)	9(100)	0	0	0	9(100)	0	0	0

Table no 15 is shows mild to moderate degree of hearing loss in 66% subjects in right ear while 60% in left ear in 60 to 65 yrs age group. Also with increase in age we can see that more subjects are affected by mild to moderate hearing loss. After the age of 70 yrs the hearing loss becomes severe.

History of tobacco is postulated to accentuate atherosclerotic changes in blood vessels aggravating presbycusis. In our study 90.9 % of subjects have positive history of tobacco use. P value is <0.05 which shows a strong association between use of tobacco and hearing loss. *Smoking* was an independent factor for Hearing Impairment in two large population-based studies with more than 3000 participants each and in a large US study among over 2000 Medicare beneficiaries[14].

Tabe16 Distribution of Degree of hearing loss by Age in Geriatric group

Age group (years)	Degree of hearing loss			
	Right ear		Left ear	
	Mild& moderate (n=46)(%)	Severe & profound (n=29)(%)	Mild & moderate (n=45)(%)	Severe & Profound (n=30)(%)
60 to 65(n=53)	35(66.0)	18(34.0)	32(60.3)	21(39.7)
66 to 70 (n=18)	11(61.1)	7(3.89)	12(66.7)	6(33.3)
>70(n=4)	0	4(100)	1(25)	3(75)

Table17. Degree of hearing loss according to Gender, Occupation in Geriatric group

	Degree of hearing loss			
	Right ear		**Left ear**	
	Mild & moderate (n=46)(%)	**Severe & profound (n=29)(%)**	**Mild & moderate (n=45)(%)**	**Severe & profound (n=30)(%)**
Occupation				
Working at home(n=29)	19(65.5)	10(34.5)	16(55.2)	13(44.8)
Working outside home(46)	27(93.1)	19(6.9)	29(63)	17(37)
Gender				
Male(n=44)	26(59.1)	18(40.9)	28(63.6)	16(36.4)
Female(n=31)	20(64.5)	11(35.5)	17(54.8)	14(44.2)

According to this table mild to moderate degree of hearing loss is seen in 59% in right ear and 63% in left ear in men while 64% in right ear and 54% in left ear in female of Geriatric population.

More subjects working outside the home are affected with hearing loss. 65% subjects working at home are affected with mild to moderate hearing loss as against 93% working outside home.

CONCLUSION

- Pure tone thresholds tested for frequencies 500Hz to 8kHz in audiometry were increased in the geriatric population.
- The onset of hearing loss is typically in the six and seven decade of life.
- Pure-tone thresholds in females were statistically lower at higher frequencies compared to males, suggesting that aging begins earlier in men.
- Subjects working outside home and exposed to noise pollution were affected more with the hearing impairment.
- Majority of Geriatric subjects showed bilateral sensorineural hearing loss.
- The degree of hearing loss was mild to moderate in majority of cases of Geriatric population.
- The complaint effect was not observed at the thresholds tested in this study.
- High-frequency audiometry may be used in audiology

clinics as a routine procedure with advantages in diagnosis.

ABBRAVATIONS : BLSNHL- Bilateral sensorineural Hearing loss, dB- Decible, DM – Diabetes Mellitus, Et al –A nd others, HT- Hypertension, LT Ear – Left Ear, RT Ear – Right Ear, SPL- Sound pressure level, SNHL- Sensorineural Hearing loss, ULSNL – Unilateral sensorineural Hearing loss, Yrs – Years, % - Percent,

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