Original Article

Artigo Original

Comparison between classification criteria of audiometric findings in elderly

Comparação entre critérios de classificação dos achados audiométricos em idosos

Jacqueline Pimentel Tenório[1]
João Alfredo Tenório Lins Guimarães[2]
Nayyara Glícia Calheiros Flores[3]
Maria Cecilia Martinelli Iório[4]

Keywords

Hearing loss/diagnosis
Presbyacusis/diagnosis
Aged
Hearing
Audiometry/classification

ABSTRACT

Purpose: To compare the audiological results of elderly subjects based on the classifications according to the criteria of Davis and Silverman and of the recommendation 02/1 of the *Bureau Internacional d'Audiophonologie* (BIAP). **Methods:** The records of 140 elderly subjects, 79 female and 61 male, with average age of 69.75 years, were analyzed. Data regarding their clinical history and the results from pure tone audiometry were gathered, and occurrences were classified according to: type of hearing loss; audiometric curve; affected ear; and degree of hearing loss, according to the purposes of Davis and Silverman and the recommendation 02/1 of the BIAP. Data were statistically analyzed. **Results:** The most frequent audiological complaints were *tinnitus*, itchiness, dizziness and otalgia. There were reports of noise exposition. Regarding the audiometric configuration, 105 ears showed descending curve, 88 had horizontal curve, and 24 presented normal curve configuration bilaterally. Fifty seven of the individuals with hearing loss were male and 59 were female, corresponding to 93.44% of the total number of male subjects and 74.68% of the female subjects. Mild and moderate sensorineural hearing losses were predominant, with little prevalence difference according to each of the classifications. The degree of hearing loss was worse and there were lesser cases of normal hearing when the BIAP classification was considered. The classification proposed by Davis and Silverman identified 99 cases of normal hearing, while the BIAP classification identified only 66 cases. **Conclusion:** The classification criteria suggested by Davis and Silverman and by the BIAP recommendation presented similar results. However, the BIAP criteria are more sensible to detect hearing loss in elderly subjects.

Descritores

Perda auditiva/diagnóstico
Presbiacusia/diagnóstico
Idoso
Audição
Audiometria/classificação

RESUMO

Objetivo: Comparar os resultados audiológicos de idosos com base nas classificações segundo os critérios de Davis e Silverman e da Recomendação 02/1 do *Bureau Internacional d'Audiophonologie* (BIAP). **Métodos:** Foram analisados 140 prontuários, pertencentes a 79 mulheres e 61 homens, com média de idade 69,75 anos. Foram coletados dados referentes à história clínica e resultados da audiometria tonal liminar, classificando ocorrências de acordo com: tipo da perda auditiva; curva audiométrica; orelha afetada; grau da perda auditiva de acordo com as propostas de Davis e Silverman e da recomendação 02/1 do BIAP. Os dados foram analisados estatisticamente. **Resultados:** As queixas audiológicas mais frequentes foram zumbido, prurido, tontura e otalgia. As doenças referidas foram hipertensão arterial e diabetes. Houve relatos de exposição a ruídos. Em relação à configuração audiométrica, 105 orelhas apresentaram curva descendente, 88 horizontal e 24 apresentaram configuração normal bilateralmente. Dos indivíduos com perda, 57 eram do gênero masculino e 59 do gênero feminino, o que indicou 93,44% do número total de homens, e 74,68% do número total de mulheres. Houve predomínio de perda auditiva sensorioneural, de grau leve e moderado, com pequenas diferenças quanto à prevalência de acordo com cada uma das classificações. O grau da perda foi considerado pior e houve menor quantidade de casos de audição normal na classificação BIAP. Na classificação de Davis e Silverman, ocorreram 99 casos de orelhas com limiares normais enquanto pela recomendação do BIAP, apenas 66. **Conclusão:** A utilização dos critérios de classificação sugeridos por Davis e Silverman e pela recomendação do BIAP apresentam resultados semelhantes. No entanto, o uso da recomendação do BIAP mostra-se mais sensível para a detecção de perdas auditivas em idosos.

Correspondence address:
Jacqueline Pimentel Tenório
Travessa José Cavalcante, 57, Ponta Grossa, Maceió (AL), Brasil, CEP: 57014-615.
E-mail: jackie.tenorio@yahoo.com.br

Received: 8/19/2010

Accepted: 3/31/2011

Study carried out at the School of Speech-Language Pathology and Audiology, Universidade Estadual de Ciências da Saúde de Alagoas – UNCISAL – Maceió (AL), Brazil.
(1) Post-graduate Program (Masters degree) in Special Education, Universidade Federal de São Carlos – UFSCar – São Carlos (SP), Brazil.
(2) School of Medicine, Universidade Estadual de Ciências da Saúde de Alagoas – UNCISAL – Maceió (AL), Brazil.
(3) School of Speech-Language Pathology and Audiology, Universidade Estadual de Ciências da Saúde de Alagoas – UNCISAL – Maceió (AL), Brazil.
(4) Universidade Federal de São Paulo – UNIFESP – São Paulo (SP), Brazil.

INTRODUCTION

According to the United Nation (UN), world's elderly population increases around 2% a year, becoming the most increasing age group when compared to other age ranges[1]. Such growth is clearly noted in Brazil, where 650 thousand people are incorporated to the elderly population every year, growing 600% in less than 50 years[2-3].

This epidemiological phenomenon demands changes in many areas in the country, including in organization and attention of health services to the population, in order to promote healthy aging. Even not directly related to diseases and handicaps, the occurrence of multiple chronic degenerative diseases is frequently registered among elderly[4-6] .

A literature review concerning hearing loss associated to aging has shown that there is an increased prevalence of presbyacusis due to growth of elderly population[2]. The term "presbyacusis" refers to a hearing disorder that develops along the aging process, translating the idea that hearing decreases with age. It is characterized by a bilateral symmetric sensorineural hearing loss that mostly affects higher frequencies.

Systematic alterations that come with age may affect the whole hearing system, from middle ear to auditory pathways, including the auditory cortex[2,7]. Some studies have shown that hearing loss is one of the three most prevalent chronic conditions in elderly, behind arthritis and hypertension[8].

It is common that an elderly person becomes unable to distinguish words during a conversation. Frequently, in certain hearing levels, speech discrimination by elderly is much more difficult when compared to a younger person, due to central and peripheral nervous system damages[9].

In a study carried out with 50 elderly subjects in São Paulo (SP), Brazil, it was observed that, among otological complaints, hearing loss is predominant in this group. Age and gender did not influence these complaints, and the level of hearing loss was relevant to hearing loss, tinnitus and communication difficulties complaints[10].

Some authors[7,10-12] emphasize the importance of a classification based on various frequency bands to determine the level of hearing loss in elderly. Moreover, there is correlation between complaints of communication difficulties and level of hearing loss, especially in higher frequencies, confirming that higher frequencies information are more strongly associated to communicative performance than medium frequencies. This could explain the frequent complaints of elderly people with presbyacusis that they do hear but cannot understand speech[7,10-12].

Among elderly people, there is a prevalence of descendent bilateral sensorineural hearing loss, mainly in higher frequencies (4, 6 and 8 KHz). Sometimes the results of pure tone audiometry do not match the results found in functional hearing evaluation in these patients. Elderly with mild hearing losses may present high levels of perceived functional handicap[2].

Low frequency preservation in hearing loss associated to the aging process requires the use of a wide frequency band classification which can characterize not only the decrease in hearing thresholds, but also the real difficulties elderly have in speech intelligibility[11]. Disregarding higher frequencies, the classification prioritize speech sound energy instead of its intelligibility. Because hearing loss has a gradual beginning and does not express itself as a disease, especially in the initial stages, it is not perceived[13].

In the present demographic scenery, it has become urgent to establish guidelines to the development of diagnosis programs, to acquire individual hearing aids, and, mainly, to develop a specific hearing re-education program directed towards elderly with hearing losses. Hence, they will be able to participate and enjoy social relationships, keeping a good quality of life[2].

The analysis of the degree of hearing loss allows a prediction of patient's difficulties concerning speech stimuli, therefore the result of frequency means must be analyzed, instead of each isolated frequency[13]. Audiogram is the basis for interpretation of type and degree of hearing loss. There are many ways to classify an audiogram regarding degree of hearing loss, which may lead to different possible interpretations of the same audiogram. In Brazil there is still no consensus about the most adequate classification.

The criteria of Davis and Silverman[14], which considers the mean pure tone air thresholds in each ear for 500 Hz, 1 and 2 kHz frequencies, seem to be the most used to determine degree of hearing loss. This classification does not cover high frequency hearing losses, and might not show results consistent with patients' complaints. Thus, studies have been developed and many professionals have begun to use a new method to determine degree of hearing loss. In this method, the means of air thresholds of 500 Hz, 1, 2 and 4 kHz are calculated, according to the recommendation 02/1 of the *Bureau Internacional d'Audio Phonologie* (BIAP)[15].

Based on the aforementioned data and the hypothesis that different interpretations of degree of hearing loss may lead to discordant audiogram interpretations, this study had the aims to obtain pure tone hearing thresholds and compare two classification, to get to know types and degrees of hearing losses, and to characterize the audiometric curves of the studied population.

METHODS

The present study was approved by Ethics Committee of the Universidade Estadual de Ciências da Saúde de Alagoas (UNCISAL), under protocol number 1258/10. It is a retrospective census study that included all records from elderly patients with ages over 60 years who were evaluated in the period between January and December 2009 in an Audiology clinic.

The survey comprised 140 files from elderly people, 79 (56.42%) female and 61 (43.58%) male, with ages between 60 and 96 years, mean age 69.75±8.13 years.

Initially, information regarding identification, auditory history and general health were accessed. After that, pure tone audiometries were analyzed and classified regarding: presence and type of hearing loss (sensorineural, mixed or conductive); audiometric curve types; affected ear; and degree of hearing loss according to the criteria of Davis and Silverman[14] and BIAP[15].

Statistical analysis used descriptive statistics and specific statistical tests in the SPSS® software (version 15.0 for Win, SPSS Inc). Numerical data described: mean, median, sum and standard deviation, for each index of the sample. Differences were analyzed through the Paired Student's t test, with at a significance level of 5% ($p<0.05$). Categorical variables were arranged in tables and figures.

RESULTS

Every subject presented some kind of audiological complaint. The most common were tinnitus (n=96; 68.57%), pruritus (n=62; 44.26%), dizziness (n=54; 38.57%) and otalgia (n=36; 25.71%). Concerning general health status, the most referred diseases were high blood pressure (51.43%, n=72), diabetes (17.86%, n=25). There were 29 reports (20.71%) of noise exposure.

The descending type of audiometric curve was the most common, in 105 ears (37.5%), followed by the horizontal curve, in 88 ears (31.43%). Only 24 subjects in our survey (17.14%) presented bilateral normal audiometric results for both classifications adopted in this study.

From 116 subjects with hearing loss, 57 (49.14%) were male and 59 (50.86%) were female, with prevalence of 93.44% among male subjects and 74.68% among female subjects. Age mean for subjects with hearing loss (70.73 years) was higher when compared to the mean age of the whole group of subjects. Only 11 (9.48%) subjects presented unilateral hearing loss, while 105 (90.52%) presented bilateral hearing loss.

Regarding type of hearing loss, there was predominance of sensorineural loss (192 ears; 82.76%), followed by mixed loss (30 ears; 12.93%), and conductive loss (10 ears; 4.31%). In the quantitative analysis of hearing loss degree, there was a predominance of mild and moderate degrees, with little differences between both classifications (Tables 1 and 2).

It was observed a higher degree of hearing loss and less normal hearing thresholds in the BIAP classification. When the Davis and Silverman's classification[14] was adopted, 99 (35.36%) ears presented normal thresholds, while 66 (23.57%) ears were normal when the BIAP classification was adopted.

Davis and Silverman's[14] and BIAP[15] classifications presented statistically different means, with $p<0.001$ for $\alpha=0.1$, bilaterally. Means obtained through the BIAP classification were higher in both ears (Tables 3 and 4).

DISCUSSION

In this study, more male subjects presented hearing loss (93.44%) compared with the female group (74.68%). These findings corroborate national and international studies which have shown predominance of occurrence of hearing loss in male subjects[7,16-19].

Every subject of this survey related some kind of audiological complaint during the anamnesis. Other studies[11,12,20] also found as common complaints regarding tinnitus, dizziness, otalgia and pruritus. Regarding general health condition, the main disease referred by elderly were high blood pressure (51.43%), similar to other studies involving elderly populations[11,21,22].

Various subjects in this survey reported noise exposure. A few works have shown that men are more exposed to noise than women[17, 23]. This could explain a greater proportion of hearing loss among male subjects in the present study.

Table 1. Audiometric findings from right and left ears, according to Davis and Silverman's hearing loss classification[14]

Classification	Right ear		Left ear		Total	
	n	%	n	%	n	%
Normal	51	36.43	48	34.29	99	35.36
Mild	38	27.14	40	28.57	78	27.86
Moderate	40	28.57	41	29.29	81	28.93
Severe	6	4.29	8	5.71	14	5.00
Profound	5	3.57	3	2.14	8	2.86
Total	140	100.00	140	100.00	280	100.00

Table 2. Audiometric findings from right and left ears, according to the Bureau International d'AudioPhonologie's hearing loss classification[15]

Classification	Right ear		Left ear		Total	
	n	%	n	%	n	%
Normal	36	25.71	30	21.43	66	23.57
Mild	48	34.29	49	35.00	97	34.64
Moderate degree 1	26	18.57	29	20.71	55	19.64
Moderate degree 2	16	11.43	18	12.86	34	12.14
Severe degree 1	8	5.71	3	2.14	11	3.93
Severe degree 2	1	0.71	6	4.29	7	2.50
Profound degree 1	3	2.14	1	0.71	4	1.43
Profound degree 2	1	0.71	0	0.00	1	0.36
Profound degree 3	0	0.00	1	0.71	1	0.36
Anacousia	1	0.71	3	2.14	4	1.43
Total	140	100.00	140	100.00	280	100.00

Table 3. Comparison of audiometric findings according to the classifications of degree of hearing loss proposed by Davis and Silverman[14] and the Bureau International d'AudioPhonologie[15] for the right ear

Right ear	Davis e Silverman	BIAP
Mean	35.81*	38.68*
Median	33	36
SD	±20.158	±20.59
Sum	5014	5416

* Significant values (p<0.0001) – Paired t test
Note: SD = standard deviation

Table 4. Comparison of audiometric findings according to the classifications of degree of hearing loss proposed by Davis and Silverman[14] and the Bureau International d'AudioPhonologie[15] for the right ear

Left ear	Davis e Silverman	BIAP
Mean	35.21*	39.23*
Median	32	36
SD	± 19.43	± 20.16
Sum	4825	5375

* Significant values (p<0.0001) – Paired t test
Note: SD = standard deviation

It was evidenced an increase of mean age in subjects with hearing loss. Other authors suggest that the decrease of hearing thresholds are not directly proportional to age[18, 22, 24].

In the audiometric evaluation it was observed a predominance of descending bilateral sensorineural hearing loss, with greater damage in higher frequencies. These data corroborate the findings of other authors[11,19,22,23,25,26]. A recent research has shown prevalence of bilateral sensorineural hearing loss, followed by bilateral mixed and bilateral conductive hearing loss[20].

Concerning Davis and Silverman's classification, there was predominance of mild and moderate degrees of hearing loss, similar to the results found by other researchers[7,11,23-27]. In the present study, BIAP classification has shown similar results regarding the degree of hearing loss. On the other hand, there were less ears with normal results when the BIAP classification was adopted, a result similar to another study[11]. That is due to the adoption of distinctive intensity parameters to determine loss degree. These results corroborate data from other studies that demonstrated greater prevalence of mild and moderate hearing loss among elderly people, despite different incidences[7,11,23-26].

Many authors have reported the importance of using a wider frequency range to determine the degree of hearing loss among elderly. The use of low frequencies to calculate means may interfere in the diagnosis and lead to inadequate approaches regarding elderly people with presbyacusis who still do not present threshold alterations in these frequencies[7,11].

CONCLUSION

The use of the classification criteria suggested by Davis and Silverman and by the BIAP recommendation present similar results. However, the BIAP classification is more sensitive to detect hearing loss in elderly people. This classification presents more accurate evaluations which allow better clinical choices regarding the approach of hearing loss in elderly populations.

REFERENCES

1. Assis M. Promoção da saúde e envelhecimento: avaliação de uma experiência no ambulatório do Núcleo de Atenção ao Idoso da UnATI/UERJ [Tese]. Rio de Janeiro: Escola Nacional de Saúde Pública, Fundação Oswaldo Cruz; 2004.
2. Veras RP, Mattos LC. Audiologia do envelhecimento: revisão da literatura e perspectivas atuais. Rev Bras Otorrinolaringol. 2007; 73(1):128-34.
3. Brasil. Ministério da Saúde. Portaria n. 587, de 07 de outubro de 2004. Determina a organização e implantação de redes estaduais de atenção à saúde auditiva [Internet]. Diário Oficial da República Federativa do Brasil, Brasília (DF); 2004 Out 7. [citado 2010 Jul 17]. Disponível em: http://dtr2001.saude.gov.br/sas/PORTARIAS/Port2004/PT-587.htm
4. Alves LC, Leimann BC, Vasconcelos ME, Carvalho MS, Vasconcelos AG, Fonseca TC, et al. A influência das doenças crônicas na capacidade funcional dos idosos do Município de São Paulo, Brasil. Cad Saúde Pública. 2007;23(8):1924-30.
5. Silva MC. O processo de envelhecimento no Brasil: desafios e perspectivas. Textos sobre Envelhecimento [Internet] 2005 [citado 2010 Jul 17]; 8(1). Disponível em: http://www.unati.uerj.br
6. Veras R. Fórum. Envelhecimento populacional e as informações de saúde do PNAD: demandas e desafios contemporâneos. Introdução. Cad Saúde Pública. 2007;23(10): 2463-6.
7. Baraldi GS, Almeida LC, Borges AC. Evolução da perda auditiva no decorrer do envelhecimento. Rev Bras Otorrinolaringol. 2007;73(1):64-70.
8. Bess FH, Williams HA, Lichtentein MJ. Avaliação audiológica dos idosos. In: Miusiek FE, Rintel-Nann WF. Perspectivas atuais em avaliação audiológica. Barueri (SP): Manole; 2001. p. 343-69.
9. Meyerhoff W, Patt B. Distúrbios otológicos. In: Calkins E, Ford A, Katz P. Geriatria prática. 2a ed. Rio de Janeiro: Revinter; 1997. p.117-26.
10. Calais LL, Borges AC, Baraldi GS, Almeida LC. Queixas e preocupações otológicas e as dificuldades de comunicação de indivíduos idosos. Rev Soc Bras Fonoaudiol. 2008;13(1):12-9.
11. Kano CE, Mezzena LH, Guida HL. Estudo comparativo da classificação do grau de perda auditiva em idosos institucionalizados. Rev CEFAC. 2009,11(3):473-7.
12. Russo IC, Pereira LD, Carvalho RM, Anastasio AR. Encaminhamentos sobre a classificação do grau de perda auditiva em nossa realidade. Rev Soc Bras Fonoaudiol. 2009. 14(2):287-8.
13. Santos TM, Russo IC. Prática da audiologia clínica. 5a ed. São Paulo: Cortez; 2005. p. 292-310.
14. Davis H, Silverman RS. Auditory tests and hearing aids. New York: Holt Rinehart and Winston; 1970. Hearing handicap standards for hearing and medicolegal rules; p.253-79.
15. Bureau International d' Audiophonologie (BIAP). [Les recommendations] [Internet]. Liège: BIAP; 2005. Recommendation BIAP nº 02/1bis. Classification audiométrique des déficiences auditives; [cited 2011 May 15]; p.5. Available from: http://www.biap.org/recom02-1.htm. French
16. Sousa MG, Russo IC. Audição e percepção da perda auditiva em idosos. Rev Soc Bras Fonoaudiol. 2009; 14(2):241-6 .
17. Kim S, Lim EJ, Kim HS, Park JH, Jarng SS, Lee SH. Sex differences in a cross sectional study of age-related hearing loss in Korean. Clin Exp Otorhinolaryngol. 2010;3(1):27-31.
18. Pratt SR, Kuller L, Talbott EO, McHugh-Pemu K, Buhari AM, Xu X. Prevalence of hearing loss in black and white elders: results of the cardiovascular health study. J Speech Lang Hear Res. 2009; 52(4):973-89.
19. Mattos LC, Veras RP. A prevalência da perda auditiva em uma população de idosos da cidade do Rio de Janeiro: um estudo seccional. Rev Bras Otorrinolaringol. 2007;73(5):654-9.
20. Silva BS, Sousa GB, Russo IC, Silva JA. Caracterização das queixas, tipo de perda auditiva e tratamento de indivíduos idosos atendidos em uma clínica particular de Belém – PA. Arq Int Otorrinolaringol. 2007; 11(4):387-95.

21. Marchiori LL, Rego Filho EA, Matsuo T. Hipertensão como fator associado à perda auditiva. Rev Bras Otorrinolaringol. 2006;72(4):533-40.
22. Meneses C, Mário MP, Marchori LL, Melo JJ, Freitas ER. Prevalência de perda auditiva e fatores associados na população idosa de Londrina, Paraná: estudo preliminar. Rev CEFAC. 2010;12(3):384-92.
23. Pinzan-Faria VM, Iorio MC. Sensibilidade auditiva e autopercepção do handicap: um estudo em idosos. Distúrb Comun. 2004;16(3):289-99.
24. Stewart R, Wingfield A. Hearing loss and cognitive effort in older adults' report accuracy for verbal materials. J Am Acad Audiol. 2009; 20(2):147-54.
25. Magalhães AT, Gomez MV. Índice de reconhecimento de fala na presbiacusia. Arq Int Otorrinolaringol. 2007; 11(2):169-74.
26. Costa MH, Sampaio AL, Oliveira CA. Avaliação do benefício da prótese auditiva digital e da percepção da desvantagem auditiva ou "Handicap" em idosos não institucionalizados. Arq Int Otorrinolaringol. 2007;11(2):159-68.
27. Teixeira AR, de La Rocha Freitas C, Millão LF, Gonçalves AK, Becker Junior B, Santos AM, et al. Relação entre a queixa e a presença de perda auditiva entre idosos. Arq Int Otorrinolaringol. 2009;13(1):78-82.