AUDIOLOGIC PROFILE OF OLDER ADULTS SUBJECTED TO VESTIBULAR REHABILITATION THERAPY

Perfil audiológico de idosos submetidos à reabilitação vestibular

Sara Alois de Abreu Martins [1], Iara Bassi [2], Patrícia Cotta Mancini [3]

ABSTRACT

Purpose: to characterize the auditory profile of older adults with dizziness undergoing Vestibular Rehabilitation and compare the results obtained in the auditory evaluation of elderly without dizziness. **Methods:** a cross-sectional observational study of 87 seniors, including 35 in the group with dizziness and 52 in the group without dizziness. History, pure tone audiometry and speech audiometry were conducted. For statistical analysis, Statistical Package for Social Sciences version 17.0, with a significance level of 5% was used in all analyzes. **Results:** sensorineural hearing loss from mild to moderate degree was present in 72.4% of the sample, with worsening of hearing thresholds in frequencies above 4000Hz in both groups. Tinnitus was the most frequent symptom observed in the sample. **Conclusion:** the hearing profile of elderly patients with dizziness does not differ from that found in older adults without dizziness, being observed more frequently bilateral mild sensorineural hearing loss with downward sloping configuration.

KEYWORDS: Speech, Language and Hearing Sciences; Hearing; Aged; Presbycusis; Vestibule, Labyrinth

INTRODUCTION

Older adults, according to the World Health Organization (WHO), are individuals older than 65 years old; however, in Brazil, old age is considered to begin at 60[1,2]. Aging is associated with progressive and dynamic physiological changes, resulting in increased vulnerability and higher incidence of pathologies[1,3]. According to the WHO, by 2025, Brazil will rank sixth in the number of older adults worldwide, with an estimated elderly population of 32 million people[2,3]. The ongoing increase in life expectancy requires establishing care and adjustment to meet the needs of the elderly[3].

(1) Universidade Federal de Minas Gerais, UFMG, Belo Horizonte, MG, Brasil.

(2) Faculdade de Medicina da Universidade Federal de Minas Gerais, UFMG, Belo Horizonte, MG, Brasil.

(3) Departamento de Fonoaudiologia da Faculdade de Medicina da Universidade Federal de Minas Gerais, UFMG, Belo Horizonte, MG, Brasil.

Support: Pró-Reitoria de Pesquisa, Universidade Federal de Minas Gerais

Conflict of interest: non-existent

Aging is directly associated with the presence of otoneurological symptoms[4]. As the auditory system exhibits anatomical-physiological continuity with the labyrinth, aging is associated with physiological changes in both the cochlea, which is responsible for hearing, and the vestibular system, which is responsible for balance[5]. Both are located in the temporal bone, specifically in the labyrinth[4,6], and communicate through the *ductus reuniens*, which connects the saccule to the cochlear duct[4]. The organ of Corti is part of the membranous labyrinth, being contained in the same compartment as the utricular macula, saccular macula, and crista ampullaris. Therefore, otological complaints related to the inner ear are common among older adults.

The body balance is maintained by the vestibular, visual, and proprioceptive systems, and when those skills are affected, the response of those systems decreases, resulting in vertigo or dizziness[7,8]. The risk factors associated with dizziness include cardiovascular, cerebrovascular, neurological, sensory, and metabolic diseases[9].

The prevalence of presbycusis, i.e., age-related auditory loss, is high among older adults; this

condition impairs the ability to understand speech[4,10]. From the audiological perspective, it is characterized by sensorineural hearing loss, with the auditory threshold for high frequencies affected. As a function of age, the mitotic capacity of some cells decreases, intracellular pigments accumulate, and the intercellular fluid undergoes changes[11]. Thus, the entire auditory organ (outer, middle, and inner ear, central auditory pathways) is affected by aging[12,13]. As a rule, the hearing loss is due to degeneration of the cochlea, affecting the basal portion of this organ, where the high-frequency sounds are identified. Therefore, the appearance of those structural changes throughout the system is expected to cause hearing decline with age[6,13,14]. Presbycusis is considered to be the main cause of hearing deficiency among older adults, with a prevalence of 30% among individuals older than 65 years old[15,16].

Among older adults, hearing loss can be associated with difficulties in oral communication and in understanding the spoken language, especially in noisy environments, with relevant consequences for the elderly within their social and familial environment. Among sensory deficits, hearing loss is the one that exerts the greatest impact on the life of individuals because it reduces the ability to share ideas and thoughts through the oral language[16-18]. The main difficulties exhibited by older adults with hearing loss concern the ability to talk on the phone, understand some words, hear alarms and doorbells, locate the source of sounds, and talk with a large audience[19,20].

As a function of the aforementioned facts, the degree of hearing loss might be greater in older adults with dizziness compared to older adults without this complaint: the affection of the vestibular system might imply concomitant cochlear disorders, as both systems are anatomically located within the same organ.

The aim of this study was to characterize the auditory profile of older adults with dizziness subjected to vestibular rehabilitation therapy and to compare the results with the profiles of older adults without dizziness.

METHODS

This cross-sectional, observational and analytical study was approved by the research ethics committee of Federal University of Minas Gerais, ruling no. 0551/11. All the participants were informed as to the study procedures and voluntarily signed an informed consent form.

The study's non-probabilistic sample comprised 87 individuals cared for at two outpatient clinics of a public hospital from August to December 2013 who met the inclusion criteria and voluntarily agreed to participate in the study. The older adults with dizziness were referred from otorhinolaryngologists at primary care facilities to perform vestibular rehabilitation therapy, while the ones without dizziness were referred by geriatrists for auditory testing.

Individuals aged 60 years old or older from both genders were considered eligible to participate in the study. Individuals with physical, cognitive, or sensory limitations that could hinder the performance of the auditory tests and individuals unable to understand and respond to simple verbal commands were excluded from the study.

The participants were informed as to the voluntary nature of participation, as well as on the study procedures, stressing that they would not pose any health risk. The participants responded to a questionnaire that collected data on hearing complaints, family history of hearing loss, history of acoustic trauma, tinnitus, and balance-related complaints. Based on the questionnaire data, the participants were allocated into two groups: Group 1 – individuals with dizziness; and Group 2 – individuals without dizziness.

The participants were then subjected to inspection of the external auditory meatus to establish whether its condition was adequate for auditory assessment. Next, pure–tone threshold audiometry was performed in a sound-isolated room using an audiometer Interacoustics® model AVS-500. The air conduction audibility thresholds were measured using TDH-39 earphones at the frequencies 250, 500, 1,000, 2,000, 3,000, 4,000, 6,000 and 8,000 Hz. The bone-conduction thresholds were measured using vibrator B71 at the frequencies 500, 1,000, 2,000, 3,000 and 4,000 Hz bilaterally. Speech audiometry was performed by a single examiner using a loudspeaker, the intensity of which was controlled by the audiometer speech level indicator. The parameters assessed were the Speech Discrimination Score of 100% (SDS) and Speech Reception Threshold (SRT) of both ears. The results of pure-tone audiometry were analyzed according to the BIAP (1997) classification, which is based on the average air conduction audibility threshold at 500, 1,000, 2,000 and 4,000 Hz and considers values up to 20 dBal as normal[21]. The classification of the hearing loss type (sensorineural, conductive, or mixed) and audiometric configuration followed the criteria formulated by Silman and Silverman (1997)[21]. The results of speech audiometry were classified according to Jerger, Speaks & Trammell (1968)[22].

The database was discussed by the investigators and built using the software Excel. Statistical analysis was performed using the software SPSS (Statistical Package for the Social Sciences) version 17.0. The data were first subjected to descriptive analysis, including measures of proportion, central tendency, and dispersion, and then, the chi-square test was used to assess the categorical variables and the non-parametric Mann-Whitney test was used to assess the continuous variables. The significance level was set to 5% in all analyses.

RESULTS

The sample comprised 87 older adults, 35 of whom complained of dizziness (Group), while 52 did not (Group 2). That difference was because the sample was non-probabilistic, and more individuals without dizziness were referred for auditory testing than individuals with dizziness. Nevertheless, the average age was similar in both groups, 75.7 years old in Group 1 and 76.9 years old in Group 2; that difference was not statistically significant (p=0.661). The number of women with dizziness was larger; however, the difference in the number of women between the groups was not significant (p=1). Audiometry detected a predominance of bilateral hearing loss, as shown in Table 1.

The data collected in the interviews indicated that tinnitus was the most frequent complaint in either group. No statistically significant difference was detected regarding history of acoustic trauma, tinnitus, or family history of hearing loss between the groups (Table 2).

Table 1 – Descriptive data relative to the age, gender, and audiometry results of the sample

Variable		Group	
		With dizziness (N=35)	Without dizziness (N=52)
Age	Mean (SD)	75.7 (7.4)	76.9 (7.7)
	Minimum	60	62
	Maximum	93	97
Gender	Male N (%)	9 (25.7%)	12 (42.3%)
	Female N (%)	26 (74.3%)	30 (57.7%)
Audiometry result	Normal hearing	2 (5.7%)	5 (9.6%)
	Unilateral HL	4 (11.4%)	7 (13.5%)
	Bilateral HL	29 (82.9%)	40 (76.9%)

Caption: N: absolute number; HL: hearing loss; SD: standard deviation; %: percentage

Table 2 – Data on the presence of trauma, tinnitus, and family history in both groups

Interview		Group		*P**
		Without dizziness	With dizziness	
Hearing loss in the family	No	40 (46.0%)	28 (32.2%)	0.568
	Yes	12 (13.8%)	7 (8.0%)	
Acoustic trauma	No	47 (54.0%)	34 (39.1%)	0.220
	Yes	5 (5.7%)	1 (1.2%)	
Tinnitus	No	18 (20.7%)	9 (10.3%)	0.197
	Yes	34 (39.1)	26 (29.9%)	

*p significance value (chi-square test)

Analysis of the audibility thresholds found a predominance of sensorineural hearing loss. A loss of 5-10 dB per octave was detected in the average air conduction auditory thresholds toward the high frequencies, thus defining a mild downward sloping configuration (Table 3).

Audiometry revealed a predominance of sensorineural hearing loss, 79.3%, followed by normal hearing, 14.4%, and mixed hearing loss, 6.3%. Mild sensorineural hearing loss prevailed in the study sample. The audiometry findings corresponding to both groups are described in Table 4.

Table 3 – Data on air conduction thresholds of audibility in groups with or without dizziness

Hz	Group	Minimum	Maximum	SD	Mean	*P**
250	Without dizziness	5	100	17.521	31.97	0.910
	With dizziness	0	110	21.835	33.64	
500	Without dizziness	5	95	18.476	33.13	0.909
	With dizziness	5	110	22.094	34.21	
1,000	Without dizziness	0	80	19.179	33.75	0.869
	With dizziness	0	120	24.66	36.14	
2,000	Without dizziness	5	85	20.745	42.02	0.345
	With dizziness	5	120	24.122	40.86	
3,000	Without dizziness	5	100	21.727	49.13	0.363
	With dizziness	-5	110	22.237	46.52	
4,000	Without dizziness	0	115	24.662	55.53	0.328
	With dizziness	10	120	25.127	53.07	
6,000	Without dizziness	10	120	24.336	67.45	0.088
	With dizziness	25	115	22.136	61.16	
8,000	Without dizziness	5	100	21.476	64.18	0.425
	With dizziness	15	110	23.399	62.14	

*p significance value (Mann-Whitney test)
Caption: SD: standard deviation

Table 4 – Descriptive statistics of audiometry findings in the right and left ears

Classification	Group 1 (N=70 ears)				Group 2 (N=104 ears)				Total	
	RE		LE		RE		LE		N	%
	N	%	N	%	N	%	N	%		
Normal hearing	3	4.3	5	7.2	8	7.7	9	8.7	25	14.4
Mild SNHL	9	12.9	16	22.9	15	14.4	15	14.4	55	31.6
Moderate I SNHL	13	18.5	8	11.4	18	17.4	14	13.5	53	30.5
Moderate II SNHL	3	4.3	2	2.9	4	3.8	9	8.7	18	10.3
Severe I SNHL	2	2.9	1	1.4	1	1.0	0	0	4	2.3
Severe II SNHL	1	1.4	0	0	2	1.9	2	1.9	5	2.8
Profound I SNHL	0	0	1	1.4	0	0	0	0	1	0.6
Profound II SNHL	1	1.4	1	1.4	0	0	0	0	2	1.2
Mixed HL	3	4.3	1	1.4	4	3.8	3	2.8	11	6.3
Total	35	50	35	50	52	50	52	50	174	100

Caption: RE: right ear; LE: left ear; HL: hearing loss; SNHL: sensorineural hearing loss; Group 1: with dizziness; Group 2: without dizziness; N: absolute number; %: percentage.

In speech audiometry, the SDS values found indicated difficulty with speech at a normal conversational level[21]. That finding is compatible with the predominance of participants with mild to moderate I sensorineural hearing loss. The results of speech audiometry corresponding to both groups are described in Table 5.

Table 5 – Speech audiometry findings in groups with or without dizziness

	Dizziness	Ear	Minimum	Maximum	Mean	SD
SRT	absent	RE	15	95	41.05	17.99
		LE	10	90	41.05	18.34
	present	RE	10	90	35.57	22.48
		LE	5	80	34.85	17.29
SDS mono	absent	RE	16	100	75.53	23.91
		LE	16	100	74.53	25.93
	present	RE	20	100	71.97	34.29
		LE	32	100	77.02	28.55

Caption: RE: right ear; LE: left ear; SD: standard deviation, SRT: Speech Reception Threshold; SDS mono: Speech Discrimination Score for monosyllabic words.

DISCUSSION

The sample of this study comprised 87 participants, and women predominated in both groups (with or without dizziness). According to the Brazilian Institute of Geography and Statistics, the number of women in the Brazilian population is larger than the number of men, as the life expectancy of the former is longer compared to the latter[23]. Those facts account for the larger percentage of women among older adults[1,9]. In this study, dizziness predominated among the women, which corroborates reports in the literature indicating that the frequency of dizziness is significantly higher among women [1,13,20].

Presbycusis is a form of sensorineural hearing loss, and it is considered to be the main cause of hearing deficiency among older adults, its prevalence varying from 30 to 66.4% among individuals older than 65 years old[15,16]. In this study, bilateral hearing loss predominated in both groups, with a much higher proportion than has been reported in other studies[15,16]. Moreover, other factors might also affect hearing in older adults[11,24], which makes it difficult to establish whether the high proportion of bilateral hearing loss found in this study might be exclusively attributed to aging of the inner ear.

The prevalence of hearing loss and tinnitus increases with age[25]. Tinnitus is one of the main symptoms associated with hearing loss and is sometimes more disturbing than deafness itself[26]. According to some studies, tinnitus might interfere with leisure activities, rest, sleep, social life, activities of daily living, and professional activities, with consequent impact on the mental domain, inducing irritation, anxiety, depression, and insomnia[27]. Some studies have found bilateral tinnitus in more than 50% of individuals with presbycusis[26,28]. In this study, tinnitus was the symptom most frequently reported by the participants in both groups, with prevalences similar to the values reported by the abovementioned studies.

From the audiological perspective, presbycusis is characterized by sensorineural hearing loss, with poorer auditory thresholds in the high frequencies[1,16]. It is considered to be the sensory deficiency most commonly associated with aging, with a prevalence of up to 35% among individuals aged 60 to 70 years old [26]. In this study, more than 70% of the sample exhibited mild-to-moderate hearing loss (Table 4), with a mild downward sloping configuration in both groups (Table 3). These findings corroborate the results of other studies that investigated hearing in older adults[10,23,24,29]. As presbycusis is associated with aging, being caused by auditory degeneration of the basal portion of the cochlea[12,24], the predominance of sensorineural hearing loss attended by gradual affection of the audibility thresholds was expected, as the high frequencies are the most severely affected in presbycusis.

That fact might be explained on physiological grounds, as the loss of hair cells occurs in the basal portion of the cochlea, where high-frequency sounds stimulate the local nerve fibers[12,13,16].

Understanding speech is an essential requirement for efficacious communication; for that reason, the performance of speech audiometry is

indispensable in the assessment of hearing[30]. In this study, the average SDS for monosyllabic words was approximately 70% in both ears, which indicates moderate difficulty in understanding speech[22]. Sensorineural hearing loss is characterized by reduced speech discrimination, resulting in difficulties in understanding the spoken language and in oral communication, especially in noisy environments, with consequent reduction of the social and family activities of older adults[16,17,19]. Hearing loss is a serious limitation for the elderly, eventually resulting in social isolation as a function of the difficulty in communicating with their environment[28].

Body balance is maintained by the vestibular, visual, and proprioceptive systems. Older adults with hearing loss might exhibit greater difficulty in maintaining body balance due to the reduction in auditory feedback, in addition to reduction of the ability to locate sounds and of auditory discrimination[7,8]. Although in this study, only the group of participants with dizziness exhibited profound sensorineural hearing loss (Table 4), no difference was found in the auditory profile between the groups.

Among the limitations of this study, the difference in the size of the groups stands out. As this study was merely observational, further studies with larger numbers of participants with severe and profound sensorineural hearing loss are needed to elucidate the possible association.

CONCLUSION

Although the vestibular and auditory systems are anatomically located in the same organ, characteristics indicative of differences in the auditory profile between individuals with or without dizziness were not found. The highest proportion of cases corresponded to mild bilateral sensorineural hearing loss, attended by mild downward sloping toward the high frequencies.

RESUMO

Objetivo: caracterizar o perfil auditivo de idosos com tontura submetidos à Reabilitação Vestibular e comparar os resultados obtidos nas avaliações auditivas de idosos sem tontura. **Métodos:** estudo observacional analítico transversal com 87 idosos, sendo 35 no grupo com tontura e 52 no grupo sem tontura. Foram realizadas anamnese, audiometria tonal limiar e vocal. Para a análise estatística foi utilizado o programa estatístico *Statistical Package for the Social Sciences* versão 17.0, com nível de significância de 5% nas análises. **Resultados:** a perda auditiva neurossensorial de grau leve e moderada esteve presente em 72,4% da amostra, com piora dos limiares de audibilidade por via aérea a partir de 4000Hz em ambos os grupos. O zumbido foi a queixa mais frequente observada na amostra. **Conclusão:** o perfil auditivo de idosos com tontura não se diferencia daquele encontrado em idosos sem tontura, sendo observada com maior frequência a perda auditiva neurossensorial leve bilateral de configuração descendente.

DESCRITORES: Fonoaudiologia; Audição; Idoso; Presbiacusia; Vestíbulo do Labirinto

REFERENCES

1. Guerra TM, Estevanovic LP, Cavalcante MAM, Silva RCL, Miranda ICC, Quintas VG. Perfil dos limiares audiométricos e curvas timpanométricas de idosos. Brazilian J Otorhinolaryngol. 2010;76(5):663-6.

2. Esteves CC, Brandão FN, Siqueira, CGA, Carvalho SAS. Audição, zumbido e qualidade de vida: um estudo piloto. Rev CEFAC. 2012;14(5):836-43.

3. Veras RP, Ramos LR, Kalache A. Crescimento da população idosa no Brasil: transformações e consequências na sociedade. Rev Saúde Públ.1987;21: 225-33.

4. Ganança MM, Albernaz PLM, Fukuda Y, Munhoz MSL, Caovilla HH. Neuroanatomofisiologia do Sistema Vestibular – Correlações Clínicas. In: Filho OL, Campos CAH. Tratado de Otorrinolaringologia. São Paulo: Roca; 1994. P. 814-25.

5. Santos EM, Gazzola JM, Ganança CF, Caovilla HH, Ganança FF. Impacto da tontura na qualidade de vida de idosos com vestibulopatia crônica. Pró-Fono R Atual Cient. 2010;22(4):427-32.

6. Filho OL. Anatomofisiologia clínica dos órgãos da audição. In: Filho OL, Campos CAH. Tratado

de Otorrinolaringologia. São Paulo: Roca; 1994. P. 481-509.

7. Patatas OHG, Ganança CF, Ganaça FF. Qualidade de vida de indivíduos submetidos à reabilitação vestibular. Brazilian J Otorhinolaryngol. 2009;75(3):387-94.

8. Ricci NA, Gazzola, JM, Coimbra, IB. Sistemas sensoriais no equilíbrio corporal de idosos. Arq Bras Ciên Saúde. 2009;34(2):94-100.

9. 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.

10. 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.

11. Gonçalves CGO, Mota PHM, Marques JM. Ruído e idade: análise da influência na audição em indivíduos com 50-70 anos. Pró-Fono Rev Atual Cient. 2009;21(4):57-62.

12. Ribeiro LCC, Alves PB, Meira EP. Percepção dos idosos sobre as alterações fisiológicas do envelhecimento. Revista Ciência, Cuidado e Saúde. 2009;8(2):220-7.

13. Raynor LA, Pankow JS, Miller MB, Huang GH, Dalton D, Klein R et al. Familial aggregation of age-related hearing loss in an epidemiological study of older adults. Am J Audiol. 2009;18:114-8.

14. Liporaci FD, Frota SMMC. Resolução temporal auditiva em idosos. Rev Soc Bras Fonoaudiol. 2010;15(4):533-9.

15. 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.

16. Teixeira AR, Freiras CLR, Milão LF, Gonçalves AK, Junior BB, Santos AMPV, et. al. Relação entre a queixa e a presença de perdas auditivas entre idosos. Arq. Int. Otorrinolaringol. / Intl. Arch. Otorhinolaryngol. 2009;13(1):78-82.

17. Souza MGC, Russo ICP. Audição e percepção da perda auditiva em idosos. Rev Soc Bras Fonoaudiol. 2009;14(2):241-6.

18. Tenório JP, Guimarães JATL, Flores NGC, Iório MCM. Comparação entre critérios de classificação dos achados audiométricos em idosos. J Soc Bras Fonoaudiol. 2011;23(2):114-8.

19. Azzolini VC, Ferreira MID. Processamento Auditivo Temporal em Idosos. Arq. Int. Otorrinolaringol.2010;14(1):95-102.

20. Cruz MS, Lima MCP, Santos JLF, Duarte YAO, Lebrão ML, Ramos-Cerqueira ATA. Deficiência auditiva referida por idosos no Município de São Paulo, Brasil: prevalência e fatores associados (estudo SABE, 2006). Cad. Saúde Pública. 2012;28(8):1479-92.

21. Sistemas de Conselhos Federal e Regionais de Fonoaudiologia. Manual de procedimentos em audiometria tonal limiar, logoaudiometria e medidas de imitância acústica. Fevereiro, 2013. Disponível em: http://www.fonoaudiologia.org.br/cffa/index.php/guias-e-manuais/

22. Jerger J, Speaks C, Trammell J. A new approach to speech audiometry. J Speech Hear Disord.1968;33:318.

23. Instituto Brasileiro de Geografia e Estatística 2000 [acessado em 2012]. Disponível em: http://www.ibge.gov.br

24. Huang Q, Tang J. Age-related hearing loss or presbycusis. Eur Arch Otorhinolaryngol (2010) 267:1179-91.

25. Pinto PCL, Sanchez TG, Tomita S. Avaliação da relação entre severidade do zumbido e perda auditiva, sexo e idade do paciente. Braz J Otorhinolaryngol. 2010;76(1):18-24.

26. Sogebi OA, Olusoga-Peters OO, Oluwapelumi O. Clinical and audiometric features of presbycusis in Nigerians. African Health Sciences. 2013; 13(4):886-92.

27. Humes LE, Dubno JR, Gordon-Salant S, Lister JJ, Cacace AT, Cruickshanks KJ et al. Central Presbycusis: a review and evaluation of the evidence. J Am Acad Audiol 2012;23:635-66.

28. Mondelli MFCG, Souza PES. Qualidade de vida em idosos antes e após a adaptação do AASI. Braz J Otorhinolaryngol. 2012;78(3):49-56.

29. Meneses C, Mário MP, Marchori LLM, Melo JJ, Freitas ERFS. Prevalência de perda auditiva e fatores associados na população idosa de Londrina, Paraná: estudo preliminar. Rev CEFAC. 2010;12(3):384-92.

30. Menegotto IH. Logoaudiometria básica. In: Bevilacqua MC, Martinez MAN, Balen SA, Pupo AC, Reis ACMB, Frota S. Tratado de Fonoaudiologia. São Paulo: Santos Editora; 2012. P. 81-99.

Received on: July 03, 2014
Accepted on: November 03, 2014

Mailing address:
Patrícia Cotta Mancini
Universidade Federal de Minas Gerais –
Faculdade de Medicina
Av. Professor Alfredo Balena, 190 / 251, Santa
Efigênia
Belo Horizonte – MG – Brasil
CEP: 30130-100
E-mail: pmancini@medicina.ufmg.br