Abstract

Vascular disease has been proposed as a contributing factor for presbycusis (age-related hearing loss). The Leukoaraiosis/White matter disease (WMD) is the imaging term used to define symmetrical distribution of white matter, presenting with hyperintense signal on T2 sequence of magnetic resonance imaging (MRI). Although the pathophysiology remains obscure, it is considered that the high vulnerability of the white matter is due to its terminal vascularization, similar to cochlear vascularization.

The aim of this study is to correlate presbycusis levels and the degree of periventricular WMD in a group of elderly patients. We evaluated 30 patients by a clinical questionnaire, physical examination, tonal audiometry and cerebral MRI. We performed a semi-quantitative evaluation of the presence of hyperintense signal in the periventricular region in weighted images of T2 FLAIR, according to the covered area: adjacent to the frontal horn / side wall of the lateral / occipital horn ventricles, on a scale of 0 to 3: “0” (absent); “1” (hyperintense thin lines); “2” (faint halo); “3” (irregular hyperintensities, which extend to the deep white matter). We determined a total score ranging from 0 to 9.

The patients have between 65 and 82 years. The average hearing threshold was 50dB. There was a significant difference between the degree of presbycusis and the score of WMD, which was higher in patients with severe hearing loss. These results support the premise that vascular disease is one of the mechanisms underlying age-related changes in age-related hearing loss and brain MRI has prognosis value.

Methods and Materials

A total of 30 adults are evaluated by:

- Clinical structured interview
- Medical records
- Physical observation
- Pure-Tone audiometry
- Cerebral MRI (Figure 1)

Statistical analysis performed with SPSS software (p < 0.05)

Exclusion criteria: Previous hearing problems, not controlled hypertension (>140/90 mmHg) and/or diabetes (A1C test > 7%).

Results and Discussion

Patients included in the study are between 65 and 82 years, with an average age of 71 years. Twelve are males and 18 are females (Chart 1). In 57 % of cases did not detect any of the studied comorbidities (diabetes and hypertension). Forty percent of the population have controlled hypertension, 23% is complicated diabetic and 9 % have both comorbidities. The average Pure-tone thresholds at conventional frequencies of the studied population was around 50 dB , varying between a minimum and maximum loss of 25dB and 90dB (Chart 3). There was a statistically significant correlation between the degree of presbycusis and the score of WMD (Chart 2), and this is higher in patients with more severe hearing loss (R = 0.77, Spearman coefficient) (Chart 4). We also found that this association is independent of age and hypertension (Table 1).

Introduction

Vascular disease has been proposed as a contributor to age-related hearing loss or presbycusis.(3,5,6) This hypothesis is supported, in part, by observations of stria vascularis atrophy in human tissue. In addition, older gerbils raised without exposure to noise or ototoxic drugs exhibit stria vascularis atrophy with pronounced capillary loss and a reduction in the endocochlear potential, which provides the voltage to the outer hair cells (cochlear amplifier).(1,2) Consistent with evidence for vessel disease affecting the stria vascularis, as well as the spiral ganglion, there is cross-sectional evidence that cardiovascular risk factors and vascular events are correlated with age-related hearing loss.(3) WMD in fluid attenuated T2-weighted images and reduced white matter contrast in T1-weighted images in periventricular regions are markers of cerebral small vessel disease.(1,2)

Therefore, neuroimaging measures of periventricular white matter damage can reflect changes in vascular health.(1,2,4) The goal of this study was to test the prediction that older adults have WMD with the appearance and distribution that is typical of small vessel disease are more likely to have hearing age-related changes.

Figure 1. Cerebral MRI - A Semi-quantitative evaluation of the presence of hyperintense signal in the periventricular region in weighted images of T2 FLAIR are performed, according to the covered area: adjacent to the frontal horn / side wall of the lateral / occipital horn ventricles, on a scale of 0 to 3: “0” (absent); “1” (hyperintense thin lines) - (A); “2” (faint halo) – (B); “3” (irregular hyperintensities, which extend to the deep white matter) – (C). Total score ranging from 0 to 9.

Chart 1. Distribution by gender.

Chart 2. Score of WMD.

Chart 3. Distribution by The average Pure-tone thresholds.

Chart 4. Degree of correlation between the level of WMD and the degree of presbycusis / increase average hearing threshold

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<thead>
<tr>
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<th>P-value</th>
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<tr>
<td>Gender</td>
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<tr>
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<tr>
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Table 1. Statistical significance level at univariate analysis. Dependent variable - WMD Score

Conclusions

It is estimated that presbycusis affects 25 % of American people between 65 and 75 years old, which amounts to 38 % of the population over 75 years. In the Portuguese population the incidence is unknown.

Until the date, it is not published similar studies, however these findings are consistent with the genesis microvascular proposal as pathophysiological basis of presbycusis.

We admit that the study by cerebral MRI may have diagnostic and prognostic value in presbycusis but complementary research is necessary.

References