Hearing loss and depressive symptoms in elderly patients

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Aims: Hearing loss is a common disability that has a profound impact on communication and daily functioning in the elderly. The present study assesses the effects of hearing aids on mood, quality of life and caregiver burden when hearing loss, comorbidity and depressive symptoms coexist in the elderly.

Methods: A total of 15 patients aged older than 70 years suffering from hearing loss and depressive mood were recruited. Comorbidity was evaluated by the Cumulative Illness Rating Scale, functional ability by the Activities of Daily Living scale and the Lawton Instrumental Activities of Daily Living scale, cognitive capacity by the Mini-mental State Examination and the Clock Drawing Test, psychological status by the Center for Epidemiological Studies-Depression scale, and quality of life by the Short Form (36) Health Survey. Caregiver burden was appraised by the Caregiver Burden Inventory. Testing was carried out at baseline and at 1-, 3- and 6-month intervals, assessing the use of binaural digital and programmable hearing aids.

Results: Reduction in depressive symptoms and improved quality of life at statistically significant levels were observed early on with the use of hearing aids. In particular, general health ($P < 0.02$), vitality ($P < 0.03$), social functioning ($P < 0.05$), emotional stability ($P < 0.05$) and mental health ($P < 0.03$) all changed for the better, and were maintained for the study duration. The degree of caregiver burden also declined, remaining low throughout the study.

Conclusions: The benefits of digital hearing aids in relation to depressive symptoms, general health and social interactivity, but also in the caregiver–patient relationship, were clearly shown in the study. The elderly without cognitive decline and no substantial functional deficits should be encouraged to use hearing aids to improve their quality of life.

Keywords: depression, elderly, hearing aids, hearing loss, presbycusis, quality of life.

Introduction

The prevalence of hearing loss increases dramatically with age. Approximately 25% of adults aged 50–60 years, with hearing thresholds >30 dB in at least one ear, and 50% of those past the age of 85 years have self-reported hearing loss. These figures will likely increase going forward, as aging sectors of Western populations expand. It is estimated that in 25 years, adults aged 65 years or more will approach 19% in the USA and exceed 20% of the European population.1 In Italy, this age group already surpassed the 20% mark in 2009 (http://demo.istat.it/pop2009/index.html).
Age-related hearing loss, or presbycusis, is a progressive, bilateral and symmetric hearing deficit, primarily at high frequencies. Risk factors include genetic predisposition and/or environmental influences, such as prolonged exposure to noise or chronic ear infections. The impact on quality of life (QoL) for the elderly is significant. Resultant functional and cognitive impairments are sources of constant frustration that dampen mood, communicability, general wellness and routine social interactions essential for independent existence.\textsuperscript{2–5} Some studies have found that the untreated elderly with hearing loss often suffer feelings of sadness, anxiety, depression, insecurity and social isolation, all of which are lessened through cochlear implants or hearing aids.\textsuperscript{6–12} Other studies have likewise reported that audiological rehabilitation improved environmental interaction, as well as patient emotional and social profiles.\textsuperscript{13,14} Hearing aid or cochlear implant recipients also showed higher levels of self-esteem and socialization.\textsuperscript{15–17}

Table 1  Characteristics of study participants at baseline

<table>
<thead>
<tr>
<th>n = 15</th>
<th>Mean</th>
<th>SEM</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>10 Male/5 female</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>78.00</td>
<td>4.40</td>
<td>70–85</td>
</tr>
<tr>
<td>Education (years)</td>
<td>12.00</td>
<td>2.00</td>
<td>5–18</td>
</tr>
<tr>
<td>MMSE (score)</td>
<td>26.93</td>
<td>0.80</td>
<td>24–30</td>
</tr>
<tr>
<td>CDT (score)</td>
<td>1.93</td>
<td>0.28</td>
<td>1–4</td>
</tr>
<tr>
<td>ADL t0 (functions preserved)</td>
<td>5.8</td>
<td>0.10</td>
<td>5–6</td>
</tr>
<tr>
<td>IADL t0 (functions preserved)</td>
<td>F7.70</td>
<td>0.40</td>
<td>5–8</td>
</tr>
<tr>
<td>M4.60</td>
<td>0.30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CIRS index of severity (score)</td>
<td>1.65</td>
<td>0.23</td>
<td>1.31–2.00</td>
</tr>
<tr>
<td>CIRS index of comorbidity (score)</td>
<td>2.27</td>
<td>1.75</td>
<td>0–5</td>
</tr>
<tr>
<td>CES-D (score)</td>
<td>23.27</td>
<td>2.12</td>
<td>6–36</td>
</tr>
<tr>
<td>QoL SF 36 (total score)</td>
<td>387</td>
<td>35</td>
<td>194–613</td>
</tr>
<tr>
<td>CBI (score)</td>
<td>10,20</td>
<td>2,98</td>
<td>8–14</td>
</tr>
</tbody>
</table>

Baseline characteristics of patients recruited for the study (mean ± standard errors of means included in the table on the bottom). ADL, Activity of Daily Living; CBI, Caregiver Burden Inventory; CDT, Clock Drawing Test; CES-D, Center for Epidemiological Studies-Depression Scale; CIRS, Cumulative Illness Rate Scale; IADL, Instrumental Activities of Daily Living; MMSE, Mini-Mental State Examination; QoL SF36, Health Survey Short-Form.

Methods

Participants

A total of 18 outpatients ≥70 years-of-age (12 men and 6 women), who were referred to the Department of Internal Medicine, Section of Geriatrics (University of Genova, Genova, Italy) from March 2008 through to November 2009 for the complaint of hearing loss (duration of hearing loss 2–15 years; 8.00 ± 1.05 years), and showing depressive symptoms were recruited for the study (Table 1). Just three patients were taking antidepressant therapy with selective serotonin reuptake inhibitor for at least 1 year. During the observation period, no change in dose or type of molecule was made. Therefore, it is supposed that the antidepressant therapy did not in any way affect the study. Informed consent was obtained from each participant, and the Local Medical Ethics Committee of the University Hospital approved the study.

Clinical and cognitive assessments

After a preliminary interview, which ruled out a history of chronic ear infections and noise-related hearing loss, and physical exam, participants were subjected to mental status assessment. A structured interview, the Mini-Mental State Examination (MMSE)\textsuperscript{21} and the Clock Drawing Test (CDT)\textsuperscript{22} served as screening tools. No MMSE score lower than 24 out of 30 was achieved.
and all CDT scores were at acceptable levels. For CDT interpretation, Shulman’s five-point scoring system was utilized, with higher scores reflecting greater cognitive impairment.

To determine the presence of depressive symptoms, the Center for Epidemiological Studies-Depression Scale (CES-D) was utilized, with a total score ≥16 showing significant depressive symptoms. Comorbidity states and disease severities were evaluated with the Cumulative Illness Rating Scale (CIRS), one of the few standardized instruments for rating medical problems by organ system.

Each patient was individually evaluated by an otolaryngologist to reliably assess their presbycusis. Pure tone audiometry and tympanometry were carried out for each patient, and the thresholds of speech recognition and speech detection were established by the mean of dB threshold at 500, 1000 and 2000 Hz frequency. Just 15 of the patients (10 men and 5 women) consented to insertion of a device for moderate to severe sensorineural hearing loss. Those who agreed were provided with updated hearing aids for trial use.

To monitor functional independence of the patients, the Katz Index of Independence in Activities of Daily Living (ADL) was enlisted, where a score of 6 equates full function, 4 signifies moderate impairment, and 2 or less denotes severe functional impairment. The Lawton Instrumental Activities of Daily Living Scale (IADL) was also used.

Females were scored from 0 to 8 on eight areas of function, whereas three areas (food preparation, housekeeping and laundering activities) are usually excluded for males, who were scored from 0 to 5.

The lowest scores represented poor functionality/dependency and the highest scores represented best functionality/independence. For the statistical comparison, our scores for males were extrapolated to the female maximum.

QoL was measured by the Health Survey Short-Form (SF-36), entailing one multi-item survey of eight health concepts: (i) health-related physical activity limitations; (ii) social activity restrictions as a result of physical or emotional problems; (iii) usual role activities curtailment by physical health problems; (iv) bodily pain; (v) general mental health parameters (psychological distress or wellbeing); (vi) usual role activities curtailment by emotional problems; (vii) vitality (energy and fatigue); and (viii) general health perceptions. The higher the SF-36 score, the better the QoL.

Finally, the caregivers of the patients, usually a spouse or daughter who lives with the patient or is the closer relative, were also studied for the life stress. Caregiver stress was evaluated through the Caregiver Burden Inventory (CBI). Scores ranged from 0 to 96, with heightened feelings of burden assigned to higher scores.

All testing was carried out at baseline and at 1-, 3- and 6-month intervals. The prescribed hearing aid was a binaural digital and programmable device produced by Linear Apparecchi Acustici SrL (Linear Hearing Aids), Genova, Italy. Technician-performed adjustments were scheduled 15 days after the hearing aid delivery and subsequently every month for 1 year to assure optimal TV, radio and telephone listening for patients. During these sessions, the personnel (technician and/or physician) also provided assistance on the proper use of hearing aids and periodic counseling was designed to achieve good hearing rehabilitation and the best compliance. The hearing aids were provided by the Italian National Health System according to the applicable laws.

**Statistical analyses**

All data are reported as mean ± standard error. Means comparisons of repeated measures (matched groups) over time were analyzed with one-way analysis of variances (ANOVA), and Dunnett’s post-test compared all subsequent results with baseline values. A P-value of <0.05 marked statistical significance.

**Results**

The age of the 15 patients ultimately studied (10 men and 5 women) ranged from 70–85 years (mean 78.0 ± 4.4 years). The mean for years of education was 12.0 ± 2.0. Each patient claimed at least three chronic diseases, with mean index scores of 1.65 ± 0.23 for severity and 2.27 ± 1.75 for comorbidity by CIRS scale.

According to standardized audiometric tests, 12 patients (80%) showed sensorineural hearing loss, one (7%) conductive hearing loss and two (13%) hearing loss that was mixed. For 14 patients (93%), the sensorineural deficit was moderate-to-severe (56–70 dB; 58.39 ± 3.64); whereas in one patient (7%), it was severe (71–90 dB). All patients maintained a high degree of compliance until the end of observation, wearing their devices between 6 and 12 h per day by the end of study.

The patients at baseline were free of disability (ADL 5.8 ± 0.1; IADL for women 7.7 ± 0.4; for men 4.6 ± 0.3), and these functional scores remained stable over time. Final scores were unmodified (ADL 5.9 ± 0.1; IADL for women 7.9 ± 0.4; for men 4.8 ± 0.5).

The evaluation of cognitive status and mental functioning (MMSE and CDT) showed scores within the normal range that remained substantially steady until the end of the study (MMSE initial 26.93 ± 0.60; final 28.17 ± 0.56; CDT initial 1.93 ± 0.28; final 1.93 ± 0.24).

Conversely, the CES-D, as a measure of depressive mood, showed a marked swing from 23.27 ± 2.12 at baseline (threshold for psychological distress typically ≥16) to 13.27 ± 1.76 at 1 month, 14.20 ± 2.21 at...
3 months and 11.33 ± 1.55 at 6 months post-hearing aid insertion (ANOVA F = 3.43, P < 0.01; Fig. 1). Scores for caregiver burden (CBI) were initially low at 10.20 ± 2.98 (significant burnout risk is >24 points), but showed further significant decreases over time (1 month 7.50 ± 2.95; 3 months 7.00 ± 2.28; and 6 months 3.80 ± 1.12; F = 8.39, P < 0.001; Fig. 1).

The QoL score by SF-36 questionnaire showed a progressive increase in global scoring, from a baseline value of 387 ± 35 to 523 ± 27 after 6 months of observation (F = 12.97, P < 0.001). Although single-item analyses differed significantly for general health (F = 3.96, P < 0.02), vitality (F = 3.51, P < 0.03), social functioning (F = 3.07, P < 0.05), role-emotional (F = 2.95, P < 0.05) and mental health (F = 3.53, P < 0.03), respective changes in physical functioning (F = 2.07), role physical (F = 2.09) and bodily pain (F = 0.69) indices did not achieve statistical significance (Fig. 2).

Discussion

The aim of the present study was to assess the influence of digital hearing aids – which not only augment sound intensity, but also provide near-normal hearing – on sensory rehabilitation and depressive symptoms of the hearing impaired elderly. We followed patients for up to 6 months to assure compliance and observe the long-term effects of the devices. Results were much better and quicker than expected.

Decreased CESD scores were observed at 1 month after hearing aid insertion and remained lower for the 6-month study duration. Although it was difficult in this instance to ascertain the onset of depressive symptoms and judge whether hearing loss played a definitive role, some interesting studies do confirm that deafness, at least in part, contributes to mood depression and that implants or hearing aids significantly improve associated psychological, social, physical and functional conditions.

One of the largest cross-sectional studies (CCHS, Canada Community Health Study) reported that the prevalence of the patients with hearing problems nearly doubles every 10 years, starting at 2.2% in the fourth decade and reaching 50% past the age of 90 years.30 Accordingly, the CCHS study showed that those afflicted had difficulty communicating and more frequently showed significant comorbidity. At all ages, males more than females (nearly 2:1) were more likely to incur hearing deficits.

In another analysis, a possible association of deafness and suicide was probed. Despite inconclusive findings, it was shown that hearing impaired adults had higher levels of depressive symptoms compared with the general population.31 Still, other authors examined the incidence of depressive symptoms in a large group of Japanese patients aged 65 years and older (the Karabuchi longitudinal study).32 After 3 years, they noted a 19.6% rate of depression in the group with hearing handicaps versus 8.0% in normal controls. They thus concluded that hearing loss was predictive of future depression with an odds ratio of >2.0. A number of recent studies have since supported these data.6,8–12,33,35 Furthermore, the patients with long-standing hearing impairment accrued the worst functional status.2,36–39 The need for operational vision and hearing in maintaining healthy mental activity.
implies that intellectual vigor and sensory efficiency are linked.⁴,⁴⁰–⁴²

Another facet of the present study was to determine if recovery of hearing acuity also improved the QoL and subjective perception of health for patients, and we sought to gauge how relatives/caregivers are affected in the process. QoL was assessed by the multi-item SF-36 test. In our hands, general health perception, social function and vitality, along with mental well-being and emotional perception, all improved with hearing aid use. It is interesting that the cluster of scores (vitality, social function and general health) most improved were those having noteworthy physical and mental correlations. As expected, less benefit was derived in terms of physical health, even though a 13.2-point improvement on average is qualified as a major change, and we are convinced that overall progress was made by every patient. The most relevant and statistically significant health change corresponded with a far better mental habitus. In particular, results showed that hearing handicaps interfered greatly with social activities. The present results are in agreement with research by Mo et al.,⁴³ Vuorialho et al.⁴⁴ and Stark et al.,⁴⁵ uniformly citing improved emotional and social performance with hearing aid use, while differing in modes of assessment.

In the present study, it was not possible to note any change of cognitive status, because all the patients were within the normal range at baseline. It is probable that by increasing the number of patients involved and including a group with cognitive impairment, after the application of hearing aids, a significant improvement would be observed.

The QoL improvement shown by our patients also conferred greater comfort for caregivers, who ultimately showed less ongoing stress at the end of the study. Based on the CBI (a scale quantifying various aspects of caregiver burden), a significant and unexpected decrease was observed in degree of anxiety and behavioral discord, not characterized as pathological or heavy. A near disappearance of these stresses was noted after the introduction of an efficient hearing device, reflecting an associated transformation of the home environment through better relationships and communication.

Recent work by Wallaghenn et al.,⁴⁶ Desbiens et al.⁴⁷ and Kuzuya et al.⁴⁸ have similarly confirmed that hearing aid use ameliorates family/caregiver burden in these circumstances.

The conclusions to be drawn here are indeed optimistic. Technological advances in hearing aids and exemplary customer care might do more than improve hearing capacity and favor the observed long-term compliance. The mood, social life, general health and overall mental profile of patients also stand to benefit. Sufficient attention to the special needs of older patients should therefore lead to a wider use of hearing aids and to a better QoL for elderly patients.

References

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