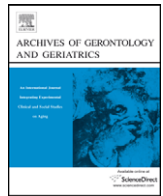




Contents lists available at ScienceDirect

Archives of Gerontology and Geriatrics

journal homepage: www.elsevier.com/locate/archger



Effects of hearing aids on cognitive functions and depressive signs in elderly people

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ARTICLE INFO

Article history:

Received 15 January 2010

Received in revised form 14 April 2010

Accepted 16 April 2010

Keywords:

Hearing aid in elderly

Treatment of presbycusis

Psychocognitive functions

Mini mental state examination (MMSE)

Geriatric depression scale (GDS)

ABSTRACT

With the physical, emotional and cognitive effects of senility, elderly people, especially those with impaired hearing, need rehabilitation for improving their life conditions. Hearing aids are frequently used to improve their daily life communications and activities. The aim of this study was to report the cognitive and psychological benefits of using hearing aids by the elderly people, over the age of 65. This was a prospective, single-arm interventional study in 34 elderly subjects with hearing impairment who answered the geriatric depression scale-short form (GDS) questionnaire and the mini mental state examination (MMSE) test, prior to, and 3 months following the use of hearing aid, after obtaining the patients' consent to participate in study. Patients with evidence of focal neurological loss with clinical examination, a confusional state, sudden hear loss and severe tinnitus were not included in the study. Scores of the effects of hearing aids on mood and cognitive functions were compared for each subject, before and after, and between males and females. After 3 months of using a hearing aid, all patients showed a significant improvement of the psychosocial and cognitive conditions, and all of them showed betterment of their problems, i.e., the social communication and exchanging information. In conclusion, for the elderly people with the effects of hearing aids in presbycusis and due to the significant improvement in psychological state and mental functions, using and being adaptable to hearing aids is a good solution.

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1. Introduction

Worldwide, with the improvement of quality of life (QoL) and health care, the population of elderly people and therefore presbycusis is increasing. The WHO has estimated that in the number of elderly people will be increased in the world. In Poland the elderly people population constituted 15.32% of the whole in 2005 and it expected to become 16% in 2020 (Betlejewski, 2006). While elderly population increase in numbers, as a result of presbycusis, the communication may become compromised. Beside of this, many old people may suffer from conductive hearing loss or a combination of conductive and sensorineural hearing loss which is called the "mixed hearing loss".

The presbycusis is very common between elderly people and the prevalence is changing in different parts of the world. The prevalence of sensorineural hearing loss in the Egyptian elderly (>65 years) is reported to be 44.3% while in Taiwan, its prevalence is reported to be 1.7% between 65 and 69 years of age; 3.2% between 70 and 74 years; 7.5% between 75 and 79 years and 14.9% in those who are older than 80 years (Chang and Chou, 2007). In a

study Chang et al. (2009), declare that nonaudiological factors like marital status and bad or normal general health, besides hearing level are significantly associated with self-perception of hearing handicap.

The presbycusis is a sensorineural type of hearing loss which cannot be medically or surgically treated and so hearing aids commonly used for amplifying sounds. Cox et al. (2005) concluded that 23% of hearing impaired elderly people actually seek and use hearing aids. Elderly people using hearing aids have been investigated and it was shown that programmable hearing aids have beneficial effects on hearing and the QoL (Yueh et al., 2001).

One should consider presbycusis as a social problem, and it has been shown (Joore et al., 2003) that improving life conditions of old people by using a hearing aid helps returning them to an ordinary lifestyle, and at the same time this is cost-effective. It has also been reported that for the hearing-impaired elderly people, the use of hearing aids was a cost-effective strategy (Chao and Chen, 2008).

Hearing impairment is a very common disorder in senile population. Many people with hearing impairment restrict deliberately their own physical activities and social contacts. Among elderly people there are wide differences. Through the use of a hearing aid, they aim to get protection of the social embarrassment that the presbycusis may cause. Hearing impairment, especially at elderly people, is a kind of chronic disorder

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(Bogardus et al., 2003) which make worsening of depressive symptoms, the self-assessed health conditions, and the performance of in social activities.

As in the normal population, also in elderly people, mood disorders causing worsening of preexisting pathological conditions, represent one of the common psychiatric abnormalities (Katona et al., 1997). With the prevalence rates ranging from 1 to 16%, epidemiological studies showed that depression is the most common clinical condition among the community-living elderly people (Kay et al., 1985).

The aim of the present study was to investigate the socio-demographic and psychocognitive factors related to depressive symptoms in elderly individuals with hearing impairment.

2. Subjects and methods

2.1. Patient characteristics and follow-up

The sample was made up of hearing-impaired patients over 65 years of age coming to the clinic of otorhinolaryngology, from May 2009 to November 2009.

All patients were examined by an audiologist, and pure tone audiometry tests were carried out for all of them. After hearing impairment was determined by audiometric tests, the purpose of the study was explained to the patients, and they gave their written informed consent for the participation.

None of the subjects had used a hearing aid before. The patients with average hearing loss were more than 40 dB. Frequencies of 0.5, 1, 2 and 4 kHz in the better ear were included in the study, and on the basis of the results, a hearing aid was recommended.

All of the participants were over the age of 65 years, with a moderate to severe sensorineural hearing loss and mixed hearing loss, with sensorineural dominance. All of them were otherwise healthy and were examined by the same audiologist, and to all similar hearing aids were recommended.

Patients underwent geriatric assessments including the GDS for depression, and the MMSE for cognitive performance, by a separate observer. Patients with focal neurological loss, a confusional state, sudden hearing loss and severe tinnitus were not included in the study. These tests were applied at start and 3 months after using the hearing aid.

The GDS-short form which consists of 15 short questions, with required responses of yes/no type, is a way for detecting the depressive symptoms, frequently used in elderly populations. It takes nearly 10 min to apply. Sheikh and Yesavage (1986) suggested that a cut-off score of 7 should be used. Scores of >7 indicate the presence of depression and <7 were considered as subjects without depression. A good correlation was observed between the hearing impairment and presence of depression, manifesting itself frequently only as the feeling of loneliness, or undefendedness.

The MMSE consists of standardized questions, divided in 6 parts, developed to assess orientation, memory, attention and calculation, language, motor function and perception. According to the answers, the total score ranges from 0 to 30. The questionnaire was completed before a hearing aid was prescribed and also 3 months after using the hearing aid, and the scores were compared.

2.2. Statistical analysis

Quantitative data are expressed as the mean \pm S.D. whereas qualitative data are expressed as percentual differences. The parametric data were compared by using the Student's *t*-test, whereas nonparametric ones were compared using the χ^2 -test. A

$p < 0.05$ level was considered statistically significant. The SPSS 15.0 program (SPSS Inc., Chicago, IL, USA) was used for statistical analysis.

3. Results

3.1. Demographic results

A total number of 34 patients, 4 females (11.8%) and 30 males (88.2%) were included in the study. Their age ranged from 65 to 82 years, with a mean of 70.08 ± 4.8 years (\pm S.D.). General characteristics and demographic results of the groups are given in Table 1.

All patients complained about their hearing impairment, and with regard to pure tone audiometric tests, the right and left ear mean hearing loss was 57.2 and 56.3 dB, respectively.

3.2. Follow-up

As regards the MMSE scores, before using hearing aids the mean score was 20.3 ± 7.7 (range 7–30), and it increased to 23.0 ± 7.5 (range 9–30) after 3 months ($p < 0.005$). The GDS analysis revealed a mean score of 6.8 ± 3.9 (range 1–13) before using hearing aids, and it decrease to 4.9 ± 3.4 (range 0–10) after using the hearing aids ($p < 0.005$). As shown in Figs. 1 and 2, the changes in both the MMSE and GDS are statistically significant. When we compared two groups of married and widowed patients, neither the MMSE nor the GDS scores have shown any statistically significant difference ($p > 0.05$).

4. Discussion

Summarizing the results of this study, we found a decrease of depressive signs and an increase of cognitive functions after using the hearing aids. Deceleration of cognitive functions of the elderly people indicates usually a progression of dementia, and it is accompanied by an increased morbidity, mortality and causes also care problems. Depression also is a risk factor for dementia (Cankurtaran et al., 2008). That's one of the reasons why we discuss both MMSE and GDS scores of the elderly patients.

For elderly people sensorial deficits, like hearing impairment, have negative implications at their socio-environmental interactions, and that may cause social isolation and dependence. That's why the sensory deprivation may cause anxiety, thus worsening their depression (Baptista et al., 2006). Schneider et al. (2008) found an association between hearing deficit and lack of autonomy in a functional assessment on 148 elderly people. Gazzola et al. (2009) who observed an association between chronic dizziness and worsened depressive symptoms in elderly people concluded that elderly people with dizziness and hearing deficit were twice as likely to present depressed mood.

Table 1
Demographic properties of the patients.

| Parameters | n (%) |
|-----------------------------|-----------------|
| Number | 34 |
| Female | 4 (11.8) |
| Male | 30 (88.2) |
| Age, year (mean \pm S.D.) | 70.08 \pm 4.8 |
| Living conditions | |
| Alone | 4 (11.8) |
| With relatives | 8 (23.5) |
| With partner | 22 (64.7) |
| Nursing home | 0 (0.0) |
| Marital status | |
| Married | 26 (76.5) |
| Widow | 8 (23.5) |

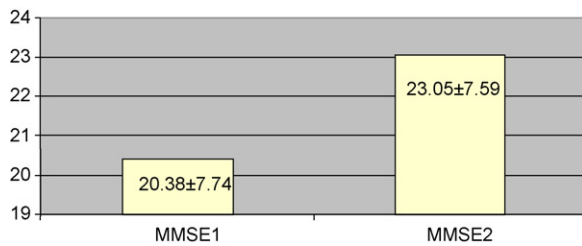


Fig. 1. Comparison of the mean MMSE scores in patients before (1) and after (2) hearing improvement ($p < 0.005$).

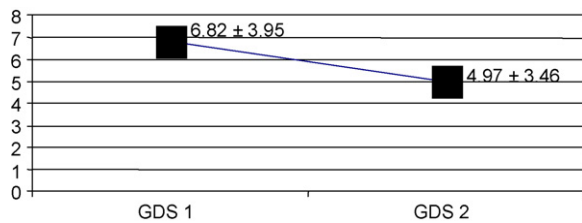


Fig. 2. The mean GDS scores in patients before (1) and after (2) the hearing improvement ($p < 0.005$).

In this study we considered both the general characteristics and the social status of the study population. Chang et al. (2009) in a study defends that among elderly people with hearing impairment, besides hearing level, marital status, general health perception and the social environment are significantly associated with the self-perceived hearing handicap. Andersson et al. (1995) indicate that senility and insecurity cause distress and signs of depression associated with self-perceived hearing impairment. According to those studies the social status is important in the self-perception of hearing loss, although in our present study the two groups of married and widowed subjects displayed no significant differences in either the MMSE or the GDS scores.

Metselaar et al. (2009), in their study with 254 hearing-impaired patients used GDS and found no significant relationship between hearing loss and depression scores. Their population made of both first time hearing aid users and experienced users differently from our population. Also they took 1-year follow-up period, although we used only 3 months, and this may be another reason for contrasting the depression scores. Effects of hearing aids may be most distinctive at the early periods of use.

In our study, as we used the same cut-off rate of Metselaar et al. (2009) in the search for GDS, the patients did not have significant depression signs before fitting the hearing aids, but after 3 months of fitting them, improvements of GDS scores were gained. So, in long-term the benefits of the aids become equal to the normal population. Maybe it would be better to search for the long-term

effects of hearing aids on the MMSE scale for a better understanding of the benefits achieved.

In conclusion, among elderly individuals with hearing impairment, greater numbers of depressive symptoms are associated with cognitive and concentration disorders and they can be improved by using hearing aids.

Conflict of interest statement

None.

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