Case-Control Analysis of Cochlear Implant Performance in the Elderly

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ABSTRACT

This study found that within the geriatric population younger implant users performed better on speech perception tests with a cochlear implant than with their hearing aids. Given that the major impairment among older implant patients may be secondary to the normal aging process, cardiovascular factors. This may have implications for cochlear implantation in older individuals. Patients and their families may need to be counseled differently with regards to expected post-implant performance. Further, implantation at an earlier age, when hearing first begins to approach implant criterion, may preserve central function into these advanced years. Ongoing longitudinal studies aim to determine whether early implantation achieves this goal.

RESULTS

<table>
<thead>
<tr>
<th>Younger (&lt;65)</th>
<th>Geriatric (≥65)</th>
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<tbody>
<tr>
<td>Average AAI</td>
<td>46.7 (±13.4)</td>
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<tr>
<td>Average LOD</td>
<td>9.3 (±10.4)</td>
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<tr>
<td>Preoperative HINTQ</td>
<td>23.0 (±23.0)</td>
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</tbody>
</table>

TABLE 1. Demographic data for the subject groups. Shown are average values ±1 standard deviation. Between groups the average HINTQ scores and SDs were within 1%. AAI=age at implantation, LOD=length of deafness.

FIGURE 1. Preoperative HINTQ scores as a function of age at implantation.

FIGURE 2. Average pre- and 1-year postoperative HINTQ performance for the young (circles) and geriatric (squares) cohorts. Both groups showed significant improvement in speech perception, however the older group showed poorer performance compared to the younger cohort (p<0.05).

FIGURE 3. Comparison of pre- and postoperative HINTQ scores for all subjects. Improvement in performance with a cochlear implant was observed for 55 of 56 subjects. There was a significant association between better preoperative and better postoperative performance by regression analysis.

FIGURE 4. Individual postoperative speech perception scores [HINTQ (A), HINTN (B), CNC (C)] as a function of age at implantation. For each speech perception measure, regression analyses were performed across all subjects and within each cohort. Significant negative effects of age were noted across all subjects for the CNC test (p<0.05), and within the geriatric population for the HINTQ test (p<0.01). The decline in HINTQ and CNC scores within the geriatric population did not reach statistical significance.

INTRODUCTION

Cochlear implantation is a treatment option available for those who have little to no hearing. Hearing loss is prevalent within the geriatric population, and is typically exacerbated with increasing age. Evidence has shown that cochlear implantation in the elderly population results in significant improvements in quality of life and auditory performance. Previous studies comparing younger to older populations were often cross-sectional, and typically included traditional cochlear implant candidates (i.e., sentence scores <30%). Recent expansions in candidacy criteria have included adults with increased residual hearing and speech perception abilities. The aim of this study was to investigate the effects of age on cochlear implant speech perception performance outcomes. Using a case-control study design, we studied the effects of advanced age at implantation as an independent predictor of postoperative performance for both traditional and borderline cochlear implant candidates. The study results may impact cochlear implantation of elderly patients and serve as evidence for further expansion of current Medicare cochlear implant candidacy guidelines.

METHODS

Approach: This IRB-approved study utilized a retrospective chart review approach. We accessed records to obtain preoperative hearing history, pre- and postoperative speech perception scores, cochlear implant device, and age at implantation. The speech perception test materials included single-syllable words (comprising nucleus-consonant-nucleus-consonant, or CNC) presented in quiet, and sentences (Hearing In Noise Test, or HINT) presented in quiet (HINTQ) and in background noise (HINTN).

Subjects: We accessed records from 251 adult cochlear implant patients currently followed by the Koss Cochlear Implant Program at the Medical College of Wisconsin. All patients with prelingual deafness were excluded from the analyses. There were a total of 81 patients with AAI <65 years. Of this geriatric cohort, 28 had both preoperative and 1-year postoperative HINTQ speech perception scores, which constituted the group for subsequent analyses. Based on preoperative performance on HINT in quiet, each patient from the geriatric cohort was matched to a patient with AAI <65.

Analyses: To determine whether age was a factor on speech perception performance within the younger cohort an ANCOVA analysis was performed. There was no significant effect of age found within the younger group, therefore all were considered appropriate matches for the geriatric cohort. Using rank-sum test and regression analyses, 1-year postoperative speech perception scores were compared between the younger and geriatric groups, and for all subjects as a function of AAI. Age-related performance within the geriatric group was also analyzed.

DISCUSSION

This study found that within the geriatric population increasing age negatively affects post-implant speech perception performance. This result was identified by analyzing cohorts of geriatric and younger patients matched for pre-implant sentence scores, a primary predictor of post-surgical performance. This result suggests that other factors play a role in the older patient that influence postoperative performance.

Given that the major impairment among older implant users is hearing in noise, this indicates that central processing may contribute to these difficulties. Central processing disorders in the older patient may be secondary to the normal aging process, cardiovascular disease, effects of medications, or as yet unidentified factors. This may have implications for cochlear implantation in older individuals. Patients and their families may need to be counseled differently with regards to expected post-implant performance. Further, implantation at an earlier age, when hearing first begins to approach implant criterion, may preserve central function into these advanced years. Ongoing longitudinal studies aim to determine whether early implantation achieves this goal.

CONCLUSIONS

- Irrespective of age, geriatric and younger implant candidates perform better on speech perception tests with a cochlear implant than with their hearing aids.
- Within the geriatric population, cochlear implantation at a later age portends worse postoperative performance when listening in noise.
- Central processing issues associated with age may explain the differences in performance between geriatric and younger cochlear implant patients.

REFERENCES


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