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Quality of Life Outcomes for Cochlear Implantation in the Elderly

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Key Words

Elderly population · Cochlear implant · Speech processor · Filters · Remote control

Abstract

Objectives: To determine whether individuals older than 60 years of age suffering from profound, bilateral, sensorineural hearing loss and unable to use hearing aids can benefit from a cochlear implant in order to improve hearing performance. Additionally, to evaluate how they manage the external components of their implanted system. **Materials and Methods:** The records of 68 cochlear implant users over 60 years of age were reviewed. They had undergone tonal and speech audiometry evaluations of hearing before and after implantation. A subset of 27 elderly patients were asked to respond to a specially designed questionnaire regarding the use of the external components of the implanted system. **Results:** Patients over 60 years of age benefit from cochlear implants. The earlier the implantation, the better the results tend to be. Certain limitations when using the external components of the implanted system were evident among the elderly. **Conclusions:** People >60 years of age suffering from profound, bilateral, sensorineural hearing loss show improved hearing performance following cochlear implantation. Using the implanted system includes some limitations that should be studied and overcome.

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Introduction

Over 5% of the world's population (360 million people) experience disabling hearing loss. As the world's population ages, there are increasingly more people suffering from hearing loss: 1 in every 3 elderly people over 65 years of age is already affected by it (165 million people worldwide), according to the World Health Organization [WHO, 2013].

An elderly patient accepts progressive, permanent hearing loss as part of the process of growing old. The hearing loss, depending on its severity, limits communication within their daily environment and has an impact on socioemotional areas. It may poten-

tially lead to social isolation in the most severe cases. The implications of hearing loss for the elderly, therefore, will change their interactions within their family and social lives. These changes may mean becoming increasingly indifferent to the outside world and interpreting verbal language and sounds less effectively due to reduced processing power. This situation becomes more severe when associated with several diseases, such as senile dementia, Alzheimer, Parkinson, stroke, and/or previous hearing loss [Peelle et al., 2011]. As a result, this elderly population is very heterogeneous and, thus, requires individual auditory and technical support. Technical hearing assistance and support will contribute to mitigate the effects of the hearing loss and improve auditory discrimination.

Recommending cochlear implant (CI) treatment to manage the hearing loss in patients over 60 years of age is possible, and while they do show benefit from implantation, their results tend to be relatively poorer the older they are implanted [Lin et al., 2012].

The aim of our study was to examine the benefits following CI treatment in the elderly CI recipient patient population of our clinical cohort and to evaluate the limitations in external device use associated with the aging process.

Materials and Methods

Subjects. From our clinical cohort, we identified and examined a population of 68 postlingually deaf, retrospectively implanted CI users older than 60 years of age suffering from profound, bilateral, sensorineural hearing loss. Records for all patients were extracted from the general clinical database used for recording data related to the routine management of implanted patients.

The patient population included 32 male and 36 female subjects with a mean age of 69.2 years, ranging from 61 to 85. Age at onset of profound sensorineural hearing loss was 58.7 years (SD 11.42). The majority (57/68) presented with progressive hearing loss (83.8%), and the remaining 11 cases experienced sudden hearing loss (16.2%). There was a wide range of etiologies: 6 of genetic origin (8.8%), 3 due to ototoxicity (4.4%), 28 of unknown origin (41.2%), 7 postnatal infections (10.3%), 6 due to otosclerosis (8.8%), 4 of traumatic origin (5.9%), and 14 cases due to other causes (20.6%). No ossifications or cochlear malformations were identified. Prior to implantation, 52 cases (76.5%) used a hearing aid; 13.5% presented with comorbidities, including 6 cases of diabetes (7.4%), one oncologic disorder (1.2%), one neurological disease (1.2%), and 3 other comorbidities (3.7%). Further details can be found in table 1.

A selected subset of these elderly patients (27/68), using the Cochlear™ Nucleus® CP800 sound processor for consistent daily use since the first activation of their CI system, were additionally requested to complete a questionnaire to investigate and record their experiences when using the external components of their CI system. All 27 patients had been instructed via the same clinical routine procedure by an experienced clinic nurse from the ENT

Fig. 1. Pure tone average thresholds (0.5 kHz, 1 kHz, 2 kHz, and 4 kHz) before and after use of CI over 12 years of follow-up. Small numbers within the graph represent outliers by clinic patient number.

Fig. 2. Spanish disyllabic words recognition scores over 12 years of follow-up. Small numbers within the graph represent outliers by clinic patient number.

Audiology Department on how to use the external components of their CI system.

The following auditory tests were performed: pure-tone audiometry and speech audiometry using recorded open set Spanish disyllabic words for speech recognition in the free field before and after implantation. Performance scores were compared before implant in the best-aided condition and after implant in the daily listening condition to assess performance benefits drawn from the CI. The follow-up period for these tests ranged from 6 months to 12 years across patients, with a mean duration of 3.51 years. A questionnaire was specifically designed to investigate CI user skills and limitations regarding the use of the external components of their CI system. There were a total of 9 questions (sample questions can be found in table 2). The mean experience of the subset of elderly CI users assessed was 1 year and 1 month (range: 1 month to 3 years and 3 months) at the time they completed the questionnaire. The frequency of responses to the various questions is reported for the subgroup.

Results

Audiological Findings. The tonal audiometry shows stable threshold responses over a 12-year period. The four-frequency (500 Hz, 1 kHz, 2 kHz, 4 kHz) average threshold response for the implanted ear was 40 dB SPL for the group (SD 8.9). Variation among patients was small. With these auditory levels, they can identify daily life sounds and perceive speech (fig. 1).

CI users demonstrated speech recognition ability for disyllabic words presented in the open-set, free-field condition. There are noteworthy differences among CI users, showing wide disparity in performance. There is a slow, constant progression over time (fig. 2). When analyzing the performance of these patients older than 60 years of age based on their age at implantation, there was a significant correlation quotient (fig. 3); that is, the earlier they were implanted, the better the results on speech performance measures; however, all patients show stability of their achieved performance on speech measures in the long term. All users, except one, use their CI daily and reported that they were happy with the benefit obtained.

Table 1. Demographic data of elderly CI recipients (postlingual patients with profound sensorineural hearing loss)

Patients	68	Prior use of HA	
Gender		No	16 (23.5%)
Male	32	Yes	52 (76.5%)
Female	36	Implanted ear	
Etiology		Left	27 (39.7%)
Genetic	6 (8.8%)	Right	41 (60.3%)
Ototoxicity	3 (4.4%)	Type of CI	
Unknown	28 (41.2%)	Nucleus	60 (88.2%)
Postnatal infection	7 (10.3%)	A B	8 (11.8%)
Otosclerosis	6 (8.8%)	Comorbidities	
Traumatic	4 (5.9%)	Diabetes	6 (7.4%)
Others	14 (20.6%)	Oncologic diseases	1 (1.2%)
Age at implantation	69.17 years (range 61–85)	Neurologic diseases	1 (1.2%)
Onset of deafness		Others	3 (3.7%)
Sudden	11 (16.2%)	No ossifications or cochlear malformations were present in the CI recipients.	
Progressive	57 (83.8%)		
Age at onset of profound SNHL	58.69 years (SD 11.42)		

Table 2. Questionnaire (translated from the original Spanish version)

Questions	First week of use	Second week of use	3 months of use	Never
1. Do you know how to switch on/off the speech processor? When did you learn to do it?				
2. Do you know how to place the speech processor?				
3. Do you know how to place the transmitter?				
4. Do you know which program you are using? When did you learn to do it?				
5. Do you know where the switch is to change the program? When did you learn to do it?				
6. Are you able to change the batteries? When did you learn to do it?				
7. Are you able to change the rechargeable batteries? When did you learn to do it?				
8. Are you able to change the filters? When did you learn to do it?				
9. Do you know how to use the remote control? When did you learn to do it?				

Fig. 3. Correlation between age at implantation and disyllabic words recognition at 3 years of follow-up. Data from 64 patients aged >60 years (mean: 69.17, range: 61–85) with normal anatomy. Small numbers within the graph represent outliers by clinic patient number. $CC = -0.345$; $p < 0.05$; $r^2_{lineal} = 0.119$.

Questionnaire Report. Regarding the use of the CI external components, they are able to place the CP800 Cochlear processor (95%) and the transmitter coil (88%) into position on their head in the first 2 weeks of using it, as well as switching on and off the processor (80%). However, nearly 50% of the subjects (13/27) reported limitations in their ability to change the sound processor programs and could not perform this task comfortably. Replacing or recharging the batteries is accomplished by 58% over the 1st week and by 40% over the 2nd week of using the implant; thus, 98% are capable of undertaking this task after 2 weeks. Replacing the filters on the processor could not be accomplished by 94% of the CI users, and only 36% had learned to use the CR110 remote control unit.

Why do these limitations exist for this elderly population? Firstly, the typical visual or manual dexterity limitations experienced by an elderly person as part of the aging process, may influence their ability in general and, secondly, the small size of the external components coupled with the advanced technology integrated for operation of the CI system may, in turn, contribute to their inability to benefit from the available state-of-the-art technology.

Conclusions

The majority of people older than 60 years of age in our clinical cohort benefit from CIs; they use them daily and demonstrate hearing benefits from its continuous use. Elderly patients demonstrate the ability to manage the external components of their implant system independently, despite the inherent limitations when

changing channels/programs, substituting filters and using the remote control. It is strongly recommended that manufacturers of CI systems heed these preliminary findings and customize products for this population, which is growing in numbers.

Disclosure Statement

The authors state that there is no conflict of interest to be disclosed.

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