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Cochlear Implantation in the Elderly

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Key Words

Cochlear implants · Partial deafness treatment · Aging · Hearing preservation

Abstract

Hearing disorders become an increasingly important issue that influences quality of life and many other economic factors. Due to the prolongation of human life and the more active lifestyles of people in retirement age, there is an increasing requirement for the available treatment options of hearing loss in the aging population. The aim of this study was to compare the hearing preservation outcomes of adult patients implanted with the Cochlear™ Nucleus® CI422 when divided into two groups by age, younger and older than 65 years of age. The study cohort consisted of 62 patients implanted from January 2011 through December 2013 at our clinic. All patients were assessed and classified according to the hearing preservation classification. Comparing the results between subgroups, we observed that the degree of hearing preservation was greater in younger adults than in older adults. Results of this review may suggest that deeper insertion is to be recommended for an older population of cochlear implant recipients.

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Introduction

Many factors including changes in the socioeconomic environment and progress in technical and information technology increase the standard of living of the population; on the other hand, the development and achievements in medicine offer the prolongation of human life. As a result of these changes, there is a continuing increase in the number of people over 60 years of age. In 1980, there were 370.8 million people in this age group worldwide. In 1985, this number increased to 415.6 million and, according to the forecasts of the Central Statistical Office of Poland (GUS), in 2025 this number will increase to 987 million.

In Poland, the proportion of people over 60 years of age exceeds 12% of the population, which is reflected by the fact that the coun-

try is among the top 30 representing the highest population of the aged. Furthermore, the proportion of the population aged over 60 years has grown from 15.7 to 16.8% (period 1994–2002) in the overall social structure. According to the forecasts of demographic aging of the Polish population, this trend will continue and will reach 19.4% of the population in the next 10 years [European Commission, 2011; Waligorska and Nowak, 2008]. In 2010, the Polish population was 38.2 million people, among whom 19% were in the pre-working age, 64% were in the working age and 17% were in the retirement age. As a result of improved quality of life, the life expectancy for a Polish individual has also increased. The life expectancy for males has increased by 2.4 years and for women by 2.6 years since 2000 to 2014. Demographic forecasts by the GUS indicate that by 2035, the average life expectancy will increase by about 8 years for men and by about 3 years for women. In addition, forecasts predict the overall decrease in population size, with the largest drop of approximately 1.2 million people expected to take place during the period 2015–2020. By 2035, the number of people of working age will decrease by 3.9 million, while the number of retired people, in the same period of time, will increase by 3.2 million. The quotient defining the relationship between the number of people in the retirement age and the number of people in the working age in Poland will increase from 26 per 100 in 2010 to 46 per 100 in 2035.

The extended life expectancy subsequently leads to more frequent emergence of diseases that previously were considered rare, as well as the appearance of new diseases. Hearing disorders are one such category of diseases that are increasing in incidence. In 2002, the World Health Organization recognized profound hearing loss and deafness as a social disease in developing countries. Hearing disorders are attributed mainly to noise trauma and as a consequence of aging. Hearing loss is the third most prevalent disease amongst adults, following cardiovascular disease and hypertension [Dung et al., 2003; Mathers et al., 2002; Waligorska and Nowak, 2008]. Due to the costs and effectiveness of medical intervention, there are different approaches to treating hearing disorders in the aging population. There are also differences in methods regarding the type of hearing loss, mixed or sensorineural (SNHL). Hearing aids are the most common treatment approach for SNHL. In many countries, the level of reimbursement allows purchasing hearing aids without significant financial burden. Another solution, which recently has gained more attention in the groups of patients with moderate-to-profound mixed or sensorineural hearing losses, consists of middle-ear implants, which are implants for the direct acoustic stimulation of the cochlea, and bone conduction devices. Indication criteria for the various treatment options vary and ultimately depend on the individual patient’s characteristics considered case by case, and the patient’s consent to the choice of treatment.

One challenge posed by the treatment of hearing loss associated with presbycusis relates to the need to consider the desire for preservation of low-frequency residual hearing thresholds in com-

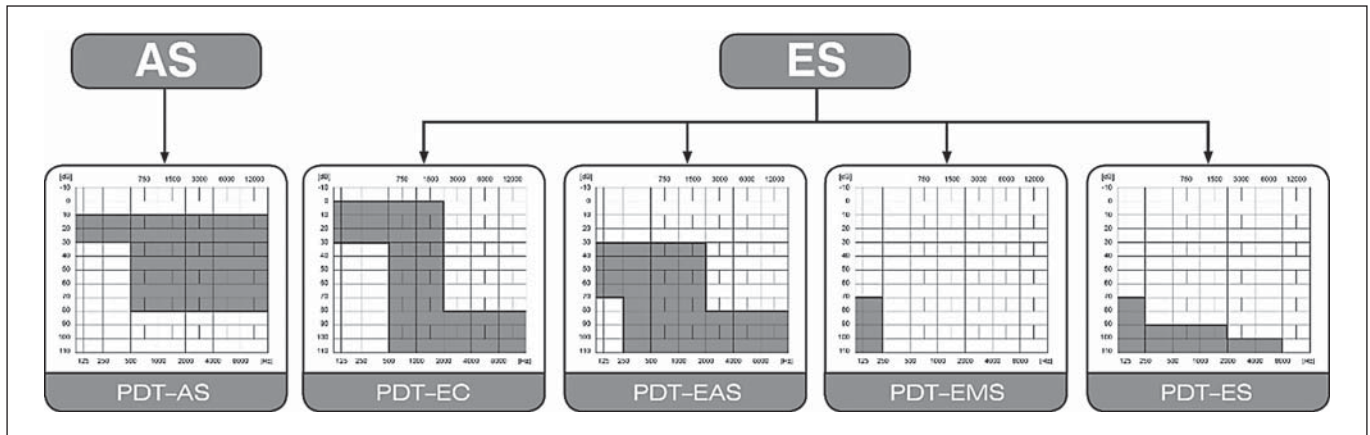


Fig. 1. The PDT concept.

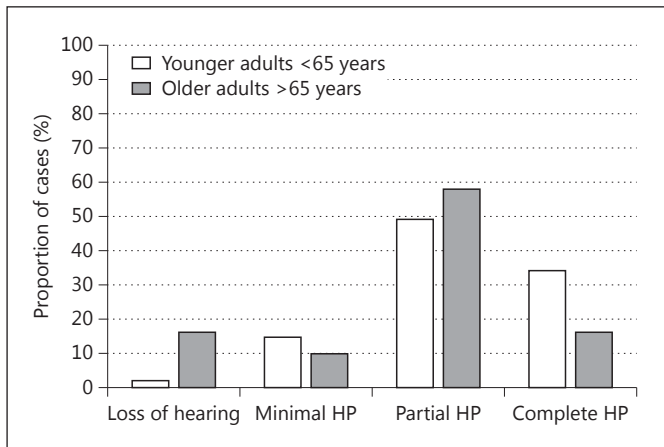


Fig. 2. Hearing preservation categories per implanted group of >65-year-olds (n = XX) and <65-year-olds.

combination with the provision of electric stimulation for the high-frequency hearing range. Our routine clinical algorithm applied to the management of hearing-impaired individuals divides patients into 4 groups, where different treatment strategies can be applied using the partial deafness treatment (PDT). The PDT is a clinical management concept that divides patients into subgroups based on their hearing loss configuration and their subsequent hearing treatment needs (see fig. 1). The four groups are electric complement (PDT-EC), electric-acoustic stimulation (PDT-EAS), electric stimulation (PDT-ES) and electric modified stimulation (PDT-EMS) [Skarzynski et al., 2010]. Due to the characteristics of hearing loss in the aging population, the PDT-EC group is relatively dominant in our clinic.

In the PDT-EC group, the suggested solution is the application of an electrode inserted into the cochlea to a minimum depth of 20 mm. Sometimes, under special conditions (i.e. some genetic disorders, progressive hearing loss, cochlea size), deep insertion is required [Skarzynski et al., 2011, 2012]. This approach allows the potential for effective hearing preservation in the low-frequency

Table 1. The HEARRING* group's hearing preservation (HP) classification system [Skarzynski et al., 2013]

| Percent of residual hearing preserved | Classification |
|---------------------------------------|----------------------------|
| >75% | complete HP |
| >25–75% | partial HP |
| 0–25% | minimal HP |
| No measurable hearing | loss of hearing/no hearing |

range and, depending on the individual patient's low-frequency hearing thresholds, may permit additional listening benefit when combined with electric stimulation via the implant, with or without the use of conventional acoustic amplification.

The aim of this retrospective study was to assess and compare the hearing preservation outcomes for two populations of adult CI recipients implanted with the Nucleus CI422 (SRA), younger and older than 65 years.

Methods

The study population included 62 patients implanted from January 2011 through December 2013 in the World Hearing Center in Kajetany, Poland. All patients met the criteria of the PDT-EAS group [Skarzynski et al., 2010]. The surgical technique was applied according to the six-step strategy [Skarzynski et al., 2012; Skarzynski, 2012]. It consists of antromastoidotomy, posterior tympanotomy with visualization of the round window niche, gentle puncture and incision of the round window membrane, insertion of the electrode into the scala tympani, fixation of the electrode, and fixation of the internal part of the device. Accordingly, in the PDT-EAS group, electrode insertion depth was adjusted from 20 to 25 mm. The degree of hearing preservation was assessed following the hearing preservation classification [Skarzynski et al., 2012, 2013] (table 1). The hearing loss was then converted to preservation by calculating 100% minus relative change yielding a percent value (S) that is more easily compared among different hearing loss populations:

$S = [1 - ((PTA_{\text{post}} - PTA_{\text{pre}}) / (PTA_{\text{max}} - PTA_{\text{pre}})) \cdot 100]$ (%)
where S is preservation numerical scale.

PTA_{max} , derived from the limits of an audiometer at varying test frequencies, is calculated individually according to frequencies from 125 to 8,000 Hz. The numerical scale is converted into a categorical scale (minimal, partial, complete) for ease of reporting.

Results

The complete HP group is represented by 34.15% of younger than 65 years cases and 16.13% of older than 65 years cases. In the partial HP group, this proportion is different, 49.27 and 58.06%, respectively. This difference is not as large as in the complete HP group. Minimal hearing loss was observed in 9.67% of older adults and in as many as 14.63% of younger adults. Worth noting is that older adults over 65 years lost hearing in 16.12% of cases postoperatively, while it was only in 1.95% in the younger adults.

Conclusions

These results demonstrate that a greater degree of hearing preservation was achieved in the younger population (fig. 2). Similar differences in results have also been observed in clinical studies with the use of the Nucleus CI422 (SRA) cochlear implant electrodes [Skarzynski et al., 2012]. Despite our evaluations showing relatively reduced levels of hearing preservation in the implanted elderly population, we observed that the aging population is becoming increasingly active in the society, and that often hearing aids do not provide sufficient benefits for individuals with severe-to-profound hearing loss. This is highlighted by the finding that only 1 in 5 people who could benefit from a hearing aid actually wears one [Natalizia et al., 2010]. Depending on the type and severity of hearing loss, in many cases electrical stimulation is indispensable in achieving an adequate level of speech understanding for verbal communication. This consideration and treatment approach is very important for the elderly, in particular, in view of the potential impact upon psychological factors. More recently, more clinical attention has been devoted to the possible relationship between depression and hearing loss for the hearing-impaired elderly group. It has been reported that individuals with mild-to-moderate hearing describe significant emotional, negative reactions to communication difficulties experienced as a consequence of significant hearing loss [Murlow et al., 1990]. Experience and a systematic approach to the clinical management of different groups of patients with varying degrees of residual hearing, when applied to the aging population classified as requiring PTD via cochlear implant, have demonstrated good hearing performance and lifestyle benefits for these individuals.

Disclosure Statement

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

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