Return of Sounds at almost 100 Years of Age: Which will be the Limit?

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Abstract

Introduction: Cochlear implant (IC) is the standard treatment for profound deafness in children and adults. In the elderly, this indication is becoming more common every day.

Aims and objectives: To describe the medical and the surgical approaches to be considered while operating a cochlear implant in an elderly patient.

Materials and methods (clinical case): An approach to cochlear implants in the elderly is described, using as a common thread, the case of a 98-year and 9-month-old woman with severe bilateral gradually progressive sensorineural hearing loss who did not benefit from her hearing aids. She underwent comprehensive multispecialty medical evaluation including otolaryngology neurology, cardiology, and anesthesiology. She underwent cochlear implantation under local anesthesia and sedation.

Results: No intra- or postoperative complications occurred. Recovery was quick and she was discharged on the second postoperative day. The device was activated at 1 month post-surgery and all electrodes were active. Free field thresholds for pure tones were 25 dB HL PTA 4 and discrimination in silence with IC in left ear and hearing aid in right ear for sentences were 76% and for familiar words 100%.

Conclusion: Cochlear implantation resulted in an adequate alternative for this elderly patient, possibly the oldest or one of the oldest implanted individuals in the world. Cochlear implantation should be considered a reasonable alternative for elderly patients with profound hearing loss. The surgical decision should focus more on the general health conditions than on the chronological age.

Keywords: Aging and hearing loss, Anesthesia for the elderly, Cochlear implants in the elderly, Oldest person with cochlear implant.


Introduction

Aging is a physiological process in which the structure and functional capacity of the different organs—including hearing organs—gradually deteriorate over time. Thirty percent of individuals over 65 years of age and 70% of persons older than 75 have some degree of sensorineural hearing loss.1,2 The effects of hearing loss can be devastating and can potentially translate in communication and integration problems that can lead to isolation and eventually to loneliness, cognitive decline, and even dementia.3,4 Life expectancy has improved and the percentage of elderly persons has increased. At 2020, adults over 65 years are 16% of the population in the United States and 21% in Europe and this number will continue growing in the next decades in developed countries.1,2 Therefore, hearing loss will gradually become a crucial issue for these aging individuals.

Hearing aids and a rehabilitation program will suffice in most people with hearing loss; however, there will be individuals for whom hearing aids are insufficient and will require a cochlear implant. Cochlear implants are currently the standard of treatment in children and adults with severe-to-profound sensorineural hearing losses, and older adults are potential candidates for this treatment.5-7 The purpose of this study is to describe the clinical case of a 98-year and 9-month-old woman with severe-to-profound hearing loss who no longer benefited from her hearing aids and who underwent cochlear implant.

Materials and Methods

M.R. is a woman born in 1919, diagnosed with a slowly progressive symmetrical hearing loss 20 years ago, and for which she used hearing aids successfully. Her hearing and discrimination gradually deteriorated to the point that hearing aids were insufficient for adequate communication. The patient requested a cochlear implant in late 2017. Her audiograms are shown in Figures 1 and 2.

Medical Background

Stable arterial hypertension and use of cardiac pacemaker. She owns and successfully manages a farm and is socially very active.

In presenting the patient with the risks involved in the surgical procedure, she was emphatic in saying that “she preferred the risk...
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of dying rather than becoming a living dead person isolated from the world. The neurological examination showed no focal defects. She underwent a cognitive evaluation with an abbreviated mini-test for older adults and it was normal.

After preoperative evaluation considering different domains, the patient had stable hypertension without other important comorbidities, normal nutritional and functional status with independence in basic and instrumental activities of daily living, normal cognitive function, and adequate social support. Considering frailty screening evaluation by Risk Analysis Index with local Modifications (M-RAI), the patient was robust and so the procedure was unanimously approved. Due to her age, local anesthesia and sedation were decided for the surgical procedure.

The patient was implanted in the left ear on March 2018. Local anesthesia with 2% carbocaine with epinephrine (1/100,000) and sedation with propofol were used. The procedure lasted 2 hours and was done without any variations in our usual surgical technique with general anesthesia. All intracochlear electrodes were inserted through the round window without inconvenience or setbacks. The implant used was a Cochlear Nucleus C124RE Nucleus Freedom straight.

RESULTS

The procedure was well tolerated by the patient and was without intra- or postoperative complications. She was discharged on her second postoperative day. The patient walked without help and had no pain, nausea, or vertigo.

To date, she has over 2 years post-surgery and during this time she became 100 years old. After activation of the sound processor, and gradually thereafter, the patient has noticed hearing improvement with a good functional gain, as described in Figure 3. The patient has preferred a bimodal system, that is to say, cochlear implant in the left ear and hearing aid in the right.

The patient has achieved a good control of the intensity of her voice and her communication in a quiet environment with one or two interlocutors is optimal. She has again “found” important sounds for her like the noise of the sea. Currently, she can discriminate 76% in sentences and 100% in known words, in a quite environment without lip reading. This has allowed her to remain connected with her environment, and basically to continue to be the independent person that she has been throughout her life.

All intracochlear electrodes that were inserted through the round window were in place (Fig. 4).

DISCUSSION

Aging is a physiological process in which the structure and functional capacity of the different organs—including hearing organs—gradually deteriorate over time. This process is influenced by many factors, among them, lifestyle, genetics, socioeconomic factors, and disease.

In the older adult, these functional disabilities are compensated in a delicate balance; however, when a response is required outside the routine or in stressful situations, such as, surgery, some of these disabilities become manifest.

Although at our institution we implant older adults and we currently have six implanted patients over 85 years old, this case of a patient with an advanced age is exceptional. According to a recent literature review, this patient would be the oldest or at least one of the oldest persons that has been implanted in the world.

In this case, her good health and mood predisposition, added to family support, were important factors in the surgical decision.
Despite the fact that conventional surgery for cochlear implants with general anesthesia is safe for older adults, the discussion regarding the risks of general anesthesia is always present. It has been reported that older adults can be operated upon without risk or undue pain under local anesthesia and sedation, and our case confirms this.

Despite older adults have increased risks of postoperative complications, such as, acquired infections, thromboembolic events, dehydration, and less nutrient consumption, new knowledge has emerged in the past years regarding that frailty is a better predictor than chronological age. Frailty is a clinical state in which individual has an increased vulnerability for developing dependency and/or mortality when exposed to a stressor. Frailty increases with age, being 3% at age 65–70 years old and reaching 25–30% over 85 years old. Nevertheless, not every very old patient is frail and older adults may have different physiological and chronological ages thus in this group of patients, frailty should be evaluated previous to surgery. Frailty evaluation not only will help optimize patient previous to surgery but can also avoid stopping surgery only because of age in robust patients that can well tolerate it and benefit in their quality of life like this patient. A recent article evaluating preoperative frailty and surgical outcomes across diverse surgical subspecialties (where 8% were otolaryngology surgeries) showed frailty correlated with major morbidity, readmission, and mortality risks that can be diminished by multimodal prehabilitation and restoring mobility and autonomy as soon as possible in the postoperative period.

Currently, the anesthetic challenge is not limited to the intraoperative period, but it extends to the perioperative period as a whole. The most feared complication is the postoperative cognitive deterioration, which is associated with different frequencies according to the different types of surgery.

Several risk factors related to the appearance of postoperative cognitive decline (POCD) are recognized. These can be intrinsic or extrinsic. The intrinsic risk factors are those specific to each patient, the most important being age, previous cognitive deterioration, decreased functional capacity, low educational level, medication abuse, and frailty. Extrinsic risk factors have to do with the characteristics of the surgery, the magnitude and duration, and the physiological management of anesthetic drugs during surgery.

Seemingly, the most important risk factor is the inflammatory response caused by the surgical procedure.

Anesthetic depth has been associated with a higher incidence of neurocognitive impairment, thus, continuous monitoring of anesthetic depth is recommended. Permanent monitoring is essential for physiological homeostasis (e.g., blood gases, electrolytes, urinary output, depth of sedation, and brain oxygenation).

Based on this background, we organized a short surgical procedure associated with a localized and moderate inflammatory process, done under local anesthesia and propofol in continuous infusion, and this allowed us to maintain stable physiological parameters. Other simple postoperative strategies as nursing in quiet environment, ideally in the presence of family members, adequate hydration, and early mobilization can diminish the risk of POCD.

The improvement in the quality of life, anxiety, social isolation, stress, depression, and self-esteem that elderly patients experience after a cochlear implant is a widely accepted fact by many authors. Even if these are subjective data, this was clearly noted in our patient. Hearing improvement in patients over 60 years old results in a persistent improvement in the quality of life, independent of the quality of hearing, and this was also observed in our patient. The current focus is in the relationship between the hearing loss, dementia, and cognitive decline. Moreover, Mosnier et al. showed that the average cognitive performance in implanted patients improved at 6 months. In fact, beyond the chronological age itself, the focus should be on the biological age of our patients in relation to their general conditions more than to their chronological age. For this reason, we suggest that more focused studies be carried out on “very old” patients (over 85) to provide evidence for these suggestions.

**Conclusion**

Cochlear implantation resulted in an adequate alternative for this elderly patient, possibly the oldest implanted individual in the world. Cochlear implantation should be considered a reasonable alternative for elderly patients with profound hearing loss. The surgical decision should focus more on physiological than on the chronological age.
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References