

Cochlear Implant Surgery in Patients More Than Seventy-Nine Years Old

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Objectives/Hypothesis: To evaluate the surgical complications, auditory performance, and hearing handicap following cochlear implantation in patients greater than 79 years of age.

Study Design: Retrospective trial, tertiary referral center.

Methods: The study group was comprised of 21 patients implanted after 79 years of age from 1996 through 2006 with follow-ups past their 8th decade. Pre-op evaluation consisted of pure-tone audiometry and speech discrimination scores (Hearing in Noise Test and City University of New York sentence test). The results of these tests were compared to similar tests taken post-op. A validated hearing handicap questionnaire was used to evaluate the outcome.

Results: There were no permanent medical or surgical complications. However, two patients developed exacerbations of previous comorbid conditions (i.e., urinary retention and acute delirium). Implanted patients experienced a significant improvement in audiologic performance, post-op pure tone average, and post-op speech scores ($P < .001$). A majority of them were able to use the phone and reported that the cochlear implant was of great benefit to them. The post-op hearing handicap inventory for the elderly demonstrated a significant decrease of hearing handicap scores.

Conclusions: This is the first study to focus on a patient group this advanced in age. With increasing life expectancy, we should begin to stratify risk versus benefit of cochlear implantation in this age group. Cochlear implantation improved audiologic performance and the quality of life in patients older than 79 years old. There were no permanent medical or surgical complications. Chronic pain and temporary vertigo

were the most common complications reported in this elderly group.

Key Words: Cochlear implant, elderly patient, hearing handicap.

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INTRODUCTION

Due to improvements in preventative healthcare, the number of elderly patients in our community has risen dramatically. Quality-of-life issues are of particular importance to this subset of the population, and thus problems such as hearing loss and hearing handicaps must be treated adequately. It was previously thought that cochlear implantation in the elderly may not be beneficial because of age-related degeneration of both the central and peripheral auditory systems,¹ surgical risk, and overall cost to benefit ratio.² However, recent studies have shown that this procedure improves auditory performance, enhances self-confidence, and is well tolerated in the elderly.^{3–6}

Although these previous studies have explored the impact of cochlear implantation in the elderly (more than 65 years old), few have examined the effects of implantation on elderly patients greater than 79 years of age. This group deserves special attention because they are part of the largest growing segment of our society. The knowledge and experience they impart to younger generations is invaluable. In addition, these patients can experience significant deterioration in hearing sensitivity over the next 10 years of their lives.⁷ The purpose of this retrospective study is to evaluate the auditory performance, improvement of hearing handicap, and the risk of cochlear implantation in a group of patients greater than 79 years old.

MATERIALS AND METHODS

This is a retrospective study of 21 postlingual, profoundly hearing impaired elderly adults. All patients were greater than 80 years of age at the time of study, and greater than 79 years old at implantation. All patients were implanted at the same academic medical center after undergoing extensive medical evaluations to determine candidacy and medical clearance for cochlear implant surgery. Pre-op evaluation consisted of pure-tone audiometry and tests of speech recognition (Hearing in

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TABLE I.
Demographic Data and Postoperative Complications.

Patient	Sex	Current Age, y	Age at Implantation, y	Side Implanted	Device	Complications	Follow-up, mo
1	Male	89	88	R	Nucleus	Partial insertion, ossified cochlea	8.47
2	Male	92	89	R	Nucleus	None	13.30
3	Female	88	85	L	Nucleus	Chronic pain	21.80
4	Female	80	79	R	Nucleus	None	9.40
5	Male	90	85	L	Nucleus	Temporary vertigo	35.20
6	Female	82	79	R	Nucleus	None	6.00
7	Female	85	79	L	Nucleus	Temporary facial nerve weakness	68.13
8	Male	87	84	L	Nucleus	Hematoma	36.93
9	Female	91	89	R	Nucleus	None	7.50
10	Male	84	84	R	HIRIS 90K	Postoperative delirium	2.87
11	Female	84	80	R	Nucleus	None	38.73
12	Male	88	86	R	Nucleus	Urinary complications	6.53
13	Female	85	80	L	Nucleus	None	86.00
14	Male	89	82	R	Nucleus	Temporary vertigo, chronic pain	70.67
15	Female	87	80	R	Nucleus	Wound infection	69.10
16	Male	92	81	R	Nucleus	Chronic pain	112.23
17	Female	84	83	R	Nucleus	None	7.47
18	Male	83	81	L	Nucleus	None	13.97
19	Male	83	79	R	Nucleus	None	44.70
20	Male	89	79	R	Nucleus	Facial nerve stimulation, soft failure	114.27
21	Female	86	84	R	Nucleus	Temporary vertigo	23.90

Noise Test and City University of New York sentence test). This study was performed after approval from appropriate institutional research oversight committee.

Surgical outcome looked at the presence of any medical or surgical complication related to the implant surgery or to the age of these patients.

Evaluation by audiology team at the time of the last exam included the assessment of compliance, satisfaction of the patient, daily use, phone use, and overall benefit to the patient.

A validated hearing handicap inventory questionnaire was used to evaluate outcome and daily usage. All patients and immediate family members were contacted by phone and asked the questions on the questionnaire in the same order that they appear. An English-speaking male coinvestigator asked the patients the questions and recorded their responses.

These variables were analyzed using descriptive statistic and Student *t* test ($P < .01$).

RESULTS

Complications

There were no intraoperative complications in this group of very elderly individuals. There were no permanent medical complications reported. Chronic pain and temporary vertigo were the most common complications reported ($n = 3$ for each of them). The temporary vertigo was not correlated with the pre-op morbidities of the affected patients and was resolved within a few days in post-op for all cases. The chronic pain was present in the site of surgery from 1 to 6 months; it was not correlated with surgical technique as all patients had the same minimal retroauricular skin incision technique. During the follow-up after surgery, one transient-incomplete facial nerve weakness was found, one post-op

delirium, and one patient with urinary retention. All of them were temporary and managed with no difficulty. One patient had soft failure and one had facial nerve stimulation (Table I).

Pure Tone Average

The mean pre-op pure tone average (PTA) and the mean post-op PTA are presented in the Table II. When compared to the post-op PTA, there was a significant difference ($P < .001$), such that the post-op PTA was significantly lower than the pre-op.

TABLE II.
Descriptive Statistics.

Sex	
Male	11
Female	10
Mean age at implantation, y	82.6 (3.5)
Mean age currently, y	86.1 (3.7)
Side implanted	
Right	15
Left	6
Mean pre-op PTA, right	93 (11.4)
Mean pre-op PTA, left	89 (11.7)
Mean pre-op speech, right	5.2 (10.4)
Mean pre-op speech, left	2.3 (5.3)
Mean post-op PTA	22 (9.1)
Mean post-op speech, HINT	78 (20.6)
Mean post-op speech, CUNY	89 (18.4)

op = operative.
Standard deviation in parentheses.

Speech Scores

The best pre-op speech score was compared to the post-op Hearing in Noise Test (HINT) and City University of New York (CUNY) speech scores. There was a significant difference between the pre-op speech score and both the HINT and CUNY post-op scores ($P < .001$). Both HINT and CUNY post-op scores were higher than pre-op best speech scores.

Audiologist's Assessment and Quality of Life

On post-op assessment, the majority of patients reported that they were very happy/doing well ($n = 16$). Most patients were continuing to improve ($n = 11$). At the last audiologic assessment, seven patients were already experiencing maximized benefit and three were experiencing declining performance (Fig. 1).

All patients reported that they always use their implant. From the data available in their chart, a majority of the patients that responded to our post-op detail questionnaire said that they use the phone ($n = 9$), whereas some either do not use the phone ($n = 3$) or do not use it well ($n = 2$). Many of the patients reported that the cochlear implant was of great benefit to them ($n = 11$). Others reported that there was a small benefit ($n = 2$), but none of the patients reported that there was no benefit from the implant. When asked about whether or not they would recommend a cochlear implant to a friend, 11 reported that they would and two reported that they would not (Fig. 2).

Hearing Handicap Inventory for the Elderly

We tried to contact all of the 21 patients or their immediate family to execute the Hearing Handicap Inventory for the Elderly (HHIE) questionnaire. However, we were able to get in touch with only 13 of them. When hearing handicap was compared between on and off cochlear implants, there was a significant difference in scores such that patient's scores were higher when the implant was off ($P < .001$). Impairment was severe for all patients when the implant was turned off. When the implant was turned on, a majority of patients reported no impairment, whereas two reported mild/moderate impairment (Fig. 3).

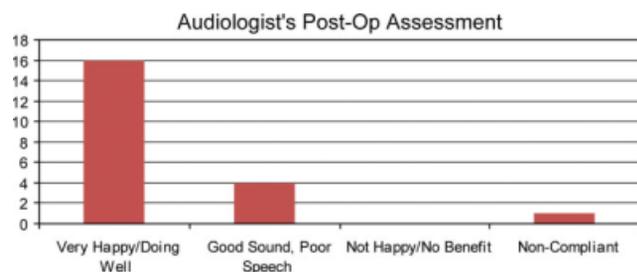


Fig. 1. Audiologic assessment in post-op. The majority of patients reported that they were very happy/doing well ($n = 16$). Most patients were continuing to improve ($n = 11$). Seven patients were already experiencing maximized benefit, and three were experiencing declining performance at the last audiologic evaluation. [Color figure can be viewed in the online issue, which is available at www.interscience.wiley.com.]

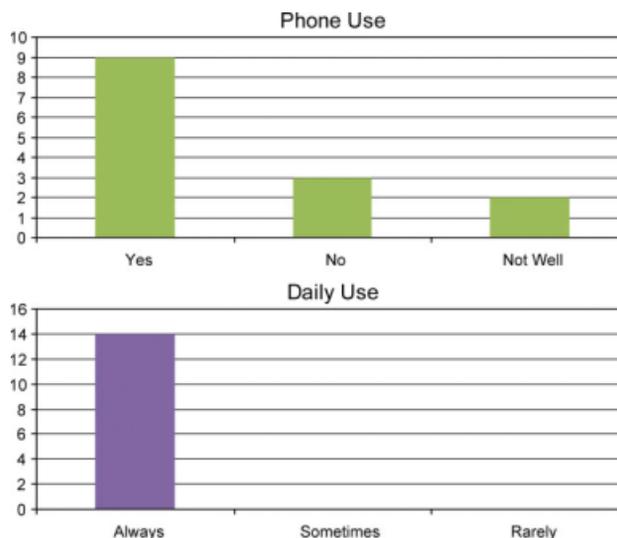


Fig. 2. All patients reported that they always use their implant. A majority of patients said they use the phone. [Color figure can be viewed in the online issue, which is available at www.interscience.wiley.com.]

DISCUSSION

Cochlear implantation in the elderly poses special considerations because of age-related degeneration of the

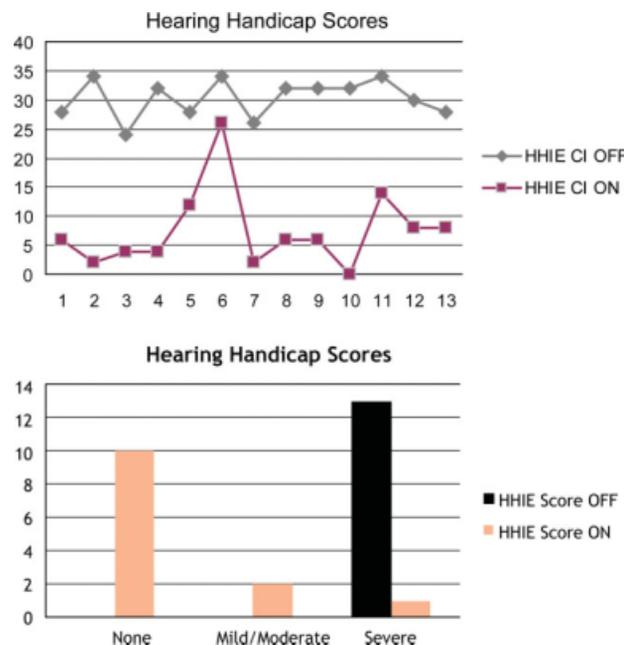


Fig. 3. (A) The horizontal axis corresponds to the 13 patients that responded to our questionnaire. (B) The vertical axis represents the number of patients scored in each category of the Hearing Handicap Inventory for the Elderly. Patients scoring 0 to 8, 10 to 24, and 26 to 40 are not likely, moderately likely, and very likely to have a hearing handicap, respectively. Impairment was severe for all patients when the implant was turned off. When the implant was turned on, a majority of patients reported no impairment, whereas two reported mild/moderate impairment. [Color figure can be viewed in the online issue, which is available at www.interscience.wiley.com.]

spiral ganglion cells and the deficits in central auditory pathways. However, the results of this study show that patients greater than 79 years old experience a significant improvement in auditory performance and a significant decrease of hearing handicap following cochlear implantation. These results are similar to those observed in previous studies, in which cochlear implantation in the elderly was investigated in patients older than 65 years old. In these studies, the operative time, anesthesia time, and length of hospitalization between elderly patients and those less than 65 have shown no significant difference between the two groups.⁴ The current study did not focus on operative time, but noted that the surgical procedure was well tolerated overall by these older patients with no permanent medical complication. However, two patients developed exacerbations of previous comorbid conditions, including urinary retention and acute delirium; both acute episodes resolved.

Social activity and confidence also increased in the elderly group, and hearing handicap was significantly decreased according to this study. In fact, the HHIE, devised by Ventry and Weinstein, has been commonly used by audiologists for its sensitivity and specificity in screening the elderly for significant hearing loss.^{8,9} The HHIE survey targets emotional and social losses secondary to a hearing handicap, and also serves as an accurate measure of the impact of treatment and rehabilitation (i.e., hearing aids).^{10,11}

CONCLUSION

Cochlear implantation results in patients greater than 79 years old demonstrate that this subgroup of the elderly population with profound hearing loss obtain significant benefits from cochlear implantation despite possible age-related auditory processing problems.

Cochlear implantation improved audiologic performance and the quality of life in this age group. The post-

op hearing handicap inventory for the elderly demonstrated a significant decrease of hearing handicap score in this extreme age group of cochlear implant patients.

There were no permanent medical or surgical complications. However, there are different types of complications than those seen in younger implanted patients, such as chronic pain (1–6 months) and temporary vertigo (less than 1 week).

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