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ABSTRACT

Introduction: Objective of this study is to evaluate the quality of life, effect on tinnitus distress and spatial hearing in patients with Single Sided Deafness (SSD) or Asymmetric Hearing Loss (AHL) treated with a cochlear implant(CI). In addition, we sought to determine if there is a correlation between cause of hearing loss, duration of hearing loss, sex, and age with improvement in quality of life (QOL) measures.

Methods: This is a retrospective cohort study of adult patients undergoing CI for SSD or AHL. Data from CI performed for SSD/AHL from September 2020 to September 2023 were used for analysis. Speech, Spatial and Qualities Hearing Scale (SSQ), Health related Quality of Life (HRQOL), Cochlear implant – Quality of life measure (CI – QOL),Tinnitus Handicap Inventory (THI) were utilized before and after implantation.

Results: 27 patients that had preoperative and postoperative testing completed during a 12-month follow-up were included. All patients improved in speech and spatial testing after CI. Quality subsection of the SSQ measure did not improve. No difference was noted between age groups in SSQ subsections after CI. A majority of patients improved with HR QOL testing post CI. No difference was noted between young and older age groups. THI improved in a majority of patients (n=14). But, no difference was noted between age groups. No gender differences were noted in the SSQ (n=13), HRQOL (n=15) or THI (n=18) after CI. No difference in SSQ and THI testing noted between SSD and AHL patient groups after CI. However, a significant difference was noted in HRQOL testing pre and post CI between SSD and AHL groups (p=0.0253, n=15). No significant difference was noted in any testing conditions based on side of implant or duration of hearing loss (<24 months vs >24 months).

Conclusions: CI leads to improvement in speech and spatial testing, HR QOL, and improvement in tinnitus distress. No differences were noted between SSD and AHL in SSQ and THI testing. HRQOL was noted to be better in patients with SSD who underwent CI.

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INTRODUCTION

A cochlear implant is a cost- effective treatment for bilateral profound hearing loss. It's a well-established treatment for bilateral severe to profound hearing loss since the early 1980s.¹ Single-sided deafness (SSD) and Asymmetric hearing loss (AHL) can be debilitating conditions. They can have significant impact on patients' quality of life, lead to tinnitus distress, trouble with hearing in noise, and problems with spatial hearing. Traditional use of CROS hearing aids and bone anchored hearing devices have had limited success in these conditions.² Previous studies have shown that CI in SSD and AHL patients can improve speech recognition, tinnitus distress, and quality of life. Unfortunately, many of these studies have been limited by small sample size and utilization of inconsistent auditory testing measures.²⁻⁵ Many existing studies are limited by the varied and inconsistent audiometric tests, quality of life measures, and tinnitus distress measures used to evaluate patient outcomes. Furthermore, there is a concern that the brain will have difficulty in distinguishing between acoustic and electrical signals and that the cochlear implant electric signals may interfere with acoustic hearing in the better hearing ear or the only hearing ear or that the acoustic hearing may interfere with hearing in the implanted ear.⁶⁻⁸

This is a pilot study of a single institution experience with CI for SSD/AHL. The aim is to evaluate QOL, tinnitus distress,& spatial hearing in patients with SSD or AHL treated with a cochlear implant. We hypothesize that CI in this patient population (SSD/AHL) improves quality of life, reduces tinnitus distress, and have an improved spatial awareness

The secondary objective is to determine patient related factors and its effect on hearing after cochlear implantation. Specifically, we sought to determine if there is a correlation between types of hearing loss, duration of hearing loss, sex, and age with improvement in QOL measures and spatial testing.

METHODS

This is a retrospective cohort study of patients undergoing cochlear implantation (CI) at a large comprehensive medical center. Patients over 18 years old with SSD or AHL were identified and offered cochlear implant surgery after FDA approval of cochlear implantation in this patient population. Data from CI performed for SSD/AHL from September 2020 to September 2023 were used for analysis. Quality of life measure were utilized before and after implantation: Speech, Spatial and Qualities Hearing Scale (SSQ), Health related Quality of Life (HRQOL), Cochlear implant – Quality of life measure (CI – QOL), and Tinnitus Handicap Inventory (THI). Spatial evaluation was performed by using SSQ Spatial hearing questionnaire. Effect of Age (<65 y/o vs >65 y/o), sex, side of implant, duration of hearing loss on QOL and spatial hearing was evaluated. Chi square and paired T tests were used for analysis

Table 1: Characteristics of Hearing loss Patients undergoing Cochlear Implantation (N=27)

Patients with SSD, n (%)	19 (70.4)
Patients with ASNHL, n (%)	8 (29.6)
Males, n (%)	16 (59.3)
Females, n (%)	11 (40.7)
Age at CI (yr), Mean, (range)	65 (29-80)
Duration of Hearing loss (n=26) (months), Mean, (range)	40.8 (5-144)
Cause of Hearing loss	Meniere's -1 Iatrogenic -1 Labyrinthitis -1 Autoimmune -1 Sudden /Idiopathic -15 ASNHL/Mixed -8
Side of Implantation	Right - 15 (55.6%) Left - 12 (44.4%)
Number of patients tested at first Postop visit; 2 nd visit; 3 rd visit	27; 15; 6
Time after CI until 1 st testing (weeks), median (range)	10.5 (4-56)
Time after CI until 2 nd testing (weeks), median (range)	26 (8-52)
Time after CI until 3 rd testing (weeks), median (range)	46 (42-51)

Table 2: Quality measures before and after cochlear implantation

	Preop- median (range)	1 st Postop	P-value	Ave. Postop	P-value
SSQ Speech (n=13)	4.6 (1.4-7.4)	5.1 (2.6-8.3)	0.31		
SSQ Spatial (n=11)	3.3 (.1-7.5)	5.0 (2.3-8.5)	0.008		
SSQ Quality (n=11)	6.0 (3-8.1)	6.1 (4.9-7.8)	0.91		
THI (n=21)	37.5 (0-92)	22.1 (0-82) (n=15)	0.002	4.0 (0-18) (n=7)	0.001
HR QOL – CI QOL (n=15)	44.5 (30-70)	47.0 (30.3-61.0)	0.58		

RESULTS

- SSQ test:** All patients improved in speech and spatial testing after CI. No difference between age groups in Speech, Spatial or Quality subsections after cochlear implantation. However, quality did not improve as expected.
- HR QOL :** majority of patients improved after CI but no difference was noted between the young (n=5) and older age (n=10) groups.
- THI:** Majority of patients (n=14) improved vs 5 patients who did not improve post CI. No difference between the age groups.
- No gender differences noted in the SSQ, HRQOL or THI testing before and after cochlear implantation [(n=13), HRQOL (n=15), THI (n=18)].
- No difference noted in SSQ testing pre and post between the SSD and AHL patient groups.
- No difference was noted in THI testing pre and post between SSD and AHL groups (n=18).
- A significant difference was noted in HRQOL testing pre and post CI between SSD and AHL groups (p=0.0253, n=15)
- No significant difference was noted in the any of the QOL measures and SSQ based on implant side, sex, age, duration of hearing loss (<24 months vs >24 months)

DISCUSSION

This study shows that Cochlear implant for Single sided deafness and ASNHL can improve spatial measurements on SSQ testing but has no impact on speech or quality measures. In addition, CI for SSD/AHL patients has a positive impact on tinnitus distress as measured on THI. This has been noted in several previous studies on tinnitus benefits after cochlear implantations. Meanwhile, no improvement in HRQOL was noted after cochlear implantation for all SSD/AHL patients tested. However, a significant difference in HRQOL was uncovered between the SSD and AHL groups. But no difference was noted between the two groups in SSQ testing or on results of Tinnitus evaluation. Furthermore, duration of hearing loss prior to CI had no impact on any QOL measures tested in this study.

CONCLUSIONS

- Cochlear implantation leads to improvement in speech and spatial testing
- CI leads to improvement in tinnitus distress.
- HRQOL was noted to be better in patients with SSD who underwent CI.
- No differences were noted between SSD and AHL in SSQ and THI testing.
- This study is limited by the small number of patients who completed all postop testing.
- It is also limited by its retrospective nature and that all patients had to have completed all testing within an artificial 12 month time limit set on our IRB proposal.

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