

ORIGINAL ARTICLE

Investigating the Impact of Cochlear Implants on Speech Perception and Quality of Life in Individuals with Profound Hearing Loss

IMRAN KHAN¹, AFTAB AHMAD², ASGHAR ULLAH KHAN³, IZZAH ISLAM⁴, MAQBOOL AHMED⁵, KAMRAN CHAUDHRY⁶^{1,2}Assistant Professor, ENT, Khyber Teaching Hospital Peshawar.³Associate Professor, ENT, Pak International Medical College and Peshawar Institute of Medical Sciences (PIMS) Hayatabad Peshawar⁴Senior Registrar, ENT, Rawal Institute of Health Sciences Rawalpindi⁵Associate Professor, ENT, Niazi Medical College Sargodha⁶Assistant Professor, ENT, Sahara Medical Collage NarowawalCorresponding author: Aftab Ahmad, Email: drtarand1979@gmql.com

ABSTRACT

Aim and objective: To investigate the impact of cochlear implants on speech perception and quality of life in individuals with profound hearing loss.

Materials and Method: The current prospective study was conducted at Niazi Medical college Sargodha and Sudais hospital Charsadda the ENT department in tertiary care hospital from March 2022 to September 2023 after approval from the institutional review board. A total of 66 participants were selected through the purposive sampling technique irrespective of their age. The SF-36 along with an NCIQ were utilized to collect information on health-related quality of life. Participants having CI were provided with a pair of copies of each HRQOL assessment and an explanation letter explaining the study goals. The first one catered to people in their before-CI state, whereas the second one catered to those who had already had CI. The HRQOL ratings, hearing evaluations, along with additional implant factors were analyzed.

Results: A total of 166 participants were selected for the study of which 27 (40.90%) were male and 39 (59.09%) were female. The present mean age of participants was 48.64 ± 12.7 years, while the age at the time of the implant was 44.23 ± 13.4 years, moreover, their period of deafness was 12.42 ± 8.2 years as well as, and their duration of the implant was 4 ± 1.9 years. More importantly, 87.87% of them were satisfied with cochlear implants. The primary sound sensation before CI was 16.5 (13.7) and after the CI was 69.8 (15.3), however, the production of speech before the CI was 50.5 (22.6) and after the CI was 82.7 (11.2), the advanced sound sensation pre-CI was 17.3 (15.6) and post-CI it was 68.2 ± 9.14 . Moreover, their social life interaction with the people was 34.2 (17.2), and after the CI was 69.2 (17.6).

Conclusion: The current study concluded that a cochlear implant is a safe and successful procedure. More importantly, 87.87% of them were satisfied with cochlear implants. This NCIQ showed a positive correlation with speech and quality of life measurements, as well as the ability to recognize the substantial impacts of cochlear implants on health-related quality of life.

Keywords: Cochlear implants, deafness, otosclerosis, HRQOL.

INTRODUCTION

Some of the many common persistent illnesses affecting older adults is a sense of hearing loss. It has serious medical, mental, as well as social repercussions and may significantly lower their overall quality of life (QOL). The Researchers have recently documented an established connection between loss of hearing as well as depression,^{1,2} whereas recent articles attest to this belief indicating a strong link between hearing impairment and cognitive deterioration³. The deterioration of the cerebral including peripherals acoustic channels with age, prolonged conductive hearing loss, cognitive decline, as well as diminished neurological plasticity were all viewed as unfavorable signs in cases of a cochlear implant in elderly individuals in recent years. Nevertheless, numerous subsequent clinical investigations have confirmed the clinical effectiveness of a CI treatment in older people, demonstrating advantages in auditory along with the perception of speech, enhancements in one's self plus quality of life, as well as typically displaying good tolerability. Consequently, considering a medical, sociological, and even socio-economic standpoint, evaluating the success of CI surgery in older individuals appears to be important^{4,5}. Hearing loss is a particularly common form of disability in the world. The World Health Organization predicts that in 2018, 466 million individuals around the world experienced severe to profound loss of hearing. By 2030, estimates suggest that the number might reach 630 million, whereas, by 2050, it could reach more than 900 million⁶. Hearing loss has a severe impact on a person's ability to communicate with others, and also on their mental health, societal life, and ability to provide for themselves financially. It can prevent a child from reaching his or her full potential in terms of speech as well as language improvement, which can lead to a lifetime of confined education along with occupational opportunities⁷. To restore

hearing in those with significant hearing loss, cochlear implants (CI) have been a standard treatment option in recent years⁸. There is no age restriction for CI, and secondary impairments are not anymore, a reason to rule out CI⁷. The placement of cochlear implants has a profound effect on every individual's interpersonal relationship, actions, and sense of self-worth in addition to improving their sense of hearing, speech output, along with the perception of speech. The standard of living life of these individuals can be evaluated using a number of different questions⁹. The application of quality of life (QoL) metrics as a means of conducting a more comprehensive analysis of the result is gaining momentum. When evaluating CI recipients, it is important to take into account not only the social and psychological consequences of hearing loss but also the practical effects, such as generating speech¹⁰. Their NCIQ, or the Nijmegen Cochlear Implant Questionnaire, is nowadays the gold standard for measuring the QoL of people who have received a cochlear implant. Most studies showed statistically significant gains in both the overall and individual components that comprise the NCIQ¹¹. The current study aimed to use the novel particular to a disease NCIQ along with the standard measure Short-Form 36 [SF-36] to investigate the effect of implantation of cochlear implants on health-related quality of life profound deaf participants. Both HRQOL measures, as well as speech perception scores, were evaluated and associated. HRQOL outcomes along with audiology test results were also examined in relation to demographic factors (age, period of hearing loss, and amount of time following cochlear implant).

Aim and Objective: To investigate the impact of cochlear implants on speech perception and quality of life in individuals with profound hearing loss.

MATERIALS AND METHOD

The current prospective study was conducted at Niazi Medical college Sargodha and Sudais hospital Charsadda the ENT

Received on 03-10-2023

Accepted on 02-12-2023

department in tertiary care hospital from March 2022 to September 2023 after approval from the institutional review board. A total of 66 participants were selected through the purposive sampling technique irrespective of their age. Those who went through their implants for a year or more were singled out. From medical charts, we gathered every individual's age at present, treatment age, along with operation time. The SF-36 along with an NCIQ were utilized to collect information on health-related quality of life. Participants having CI were provided with a pair of copies of each HRQOL assessment and an explanation letter explaining the study goals. The first one catered to people in their before-CI state, whereas the second one catered to those who had already had CI. The nonparametric Wilcoxon test for two separate observations was used to examine variations between variables before- and after-CI values of information. The HRQOL ratings, hearing evaluations, along with additional implant factors were analyzed.

RESULTS

A total of 166 participants were selected for the study of which 27 (40.90%) were male and 39 (59.09%) were female. The present mean age of participants was 48.64 ± 12.7 years, while the age at the time of the implant was 44.23 ± 13.4 years, moreover, their period of deafness was 12.42 ± 8.2 years as well as, and their duration of the implant was 4 ± 1.9 years. More importantly, 87.87% of them were satisfied with cochlear implants. The most common type of CI implanted was CI 24 contour 15 (27.27 %). Table 2 highlights the cause etiology of deafness in 16(24.2%) had a hereditary cause, 11(16.6%) had a congenital cause, 10 (15.1%) had otosclerosis, furthermore, 9 (13.6 %) had a trauma.

Table 1: Demographic Characteristics of Participants

Gender	Number	Percentage
Male	27	40.90 %
Female	39	59.09 %
Years	Mean and St deviation	Range
Age	48.64 ± 12.7 y	20-70
Age during implant	44.23 ± 13.4 y	21-74
Period of deafness	12.42 ± 8.2 y	1-28
Duration of implant	4 ± 1.9 y	1-9
Satisfaction	58	87.87%
Type of implant	Number	Percentage
CI 24 Contour 15	18	27.27 %
CI 24M	11	16.66%
C40+	16	24.24 %
CI22	9	13.63 %
Pulsar	7	10.66 %
Freedom	5	7.57%

Table 2: Etiology of Deafness

Etiology	Number	Percentage
Meniere	3	4.5%
Hereditary	16	24.2%
Congenital	11	16.6%
Mumps	6	9%
Meningitis	7	10.6%
Otosclerosis	10	15.1%
Ototoxic drugs	4	6%
Trauma	9	13.6%

Table 3 summarized the Nijmegen Cochlear Implant Questionnaire (NICQ) score, in terms of their health-related quality of life (HRQOL) before and after CI in the patients with mean and standard deviation and p-value less than 0.001. The primary sound sensation before CI was 16.5 (13.7) and after the CI was 69.8 (15.3), however, the production of speech before the CI was 50.5 (22.6) and after the CI was 82.7 (11.2). the advanced sound sensation pre-CI was 17.3 (15.6) and post-CI it was 68.2 (14.2). moreover, their social life interaction with the people was 34.2 (17.2), and after the CI was 69.2 (17.6). Table 4 indicates the Short-Form 36 [SF-36] to investigate the effect of implantation of cochlear implants on health-related quality of life before and after with profound deaf participants. The physiological functions before

the CI were 80.7 (25.2) and after the CI it was 70.8 (29.2). Their level of pain before was 82.94 (29.4) while after the CI it was 69.4 (30.7), consequently, their social role become better after the CI implant, before 30.4 (26.3) and after it was 72.6 (32.3). Mental health score before it was 54.4 (22.4) and after the CI was 72.2 (21.3). moreover, their emotional role performance before the CI was 68.5 (39.7), and after the CI 72.1 (43.9). The overall mental score of the participants improved after the CI implant as before it was 37.6 (10.4) and after 51.9 (8.9).

Table 3: Before and After NICQ Score (mean and St deviation with p less than 0.001)

HRQOL Score	Before CI	After CI
Total	33.4 (16.1)	70.5(12.4)
Primary sound sensation	16.5 (13.7)	69.8(15.3)
Advanced sound sensation	17.3(15.6)	68.2(14.2)
Production of speech	50.5(22.6)	82.7(11.2)
Level of self-esteem	31.7(13.4)	59.1(16.9)
Activity	30.7(15.8)	66(18.5)
Interaction with people	34.2(17.2)	69.2(17.6)

Table 4: Short Form-36 Score among before and after CI patients (mean and St deviation with p less than 0.001)

SF-36	Before CI	After CI
Physiological functions	80.7(25.2)	70.8(29.2)
Role performance	71.3(37.4)	60.4(38.5)
Usual health perception	64.6(22.6)	68(23.6)
Pain	82.4(29.4)	69.4(30.7)
Social role	30.4(26.3)	72.6(32.3)
Emotional role performance	68.5(39.7)	72.1(43.9)
Mental health	54.4(22.4)	72.2(21.3)
Overall Physiological score	49.2(9.23)	44.3(10.3)
Overall Mental score	37.6(10.4)	51.9(8.9)

DISCUSSION

Cochlear implantation is now recognized as the therapy most commonly used in the modern era for patients with significant to substantial hearing impairments who cannot be adequately addressed by traditional hearing equipment¹³. Numerous research investigations have demonstrated that not only younger people but also elderly people can get significant audiological benefits from this¹⁴. Turunen-Taheri examined the management of 1076 elderly people with significant to substantial hearing impairment at an average age of 70.6¹⁵. A number of studies have shown that elderly people require a longer period to acclimatize to a novel acoustic signal as well as do not achieve the same level of speech understanding in noise as younger ones, but overall, the hearing benefits associated with speech comprehension in silence are fairly comparable among different ages¹⁶. In the current study period of deafness was 12.42 ± 8.2 years as well as, and the duration of the implant was 4 ± 1.9 years. More importantly, 87.87% of them were satisfied with cochlear implants. The most common type of CI implanted was CI 24 contour 15 (27.27 %). Table 2 highlights the cause etiology of deafness in 16(24.2%) had a hereditary cause, 11(16.6%) had a congenital cause, 10 (15.1%) had otosclerosis, furthermore, 9 (13.6 %) had a trauma. However, a similar study conducted by Rasmussen KM et al there have been 14 various causes described, with the most common being an unknown cause (36%), subsequent to later-onset gradual inherited hearing impairment (23%), inherited congenital (8%), an unexplained congenital cause (5%), along with otosclerosis (5%). The rest of the 27% was explained by a total of nine alternative causes¹⁷. In terms of perception of speech abilities, the average postoperative open-set word identification score in quietness was 82.97% (range: 30–100) for the first category, 75.9% (range: 30–100) for group 2 as well as 75.7% (range: 10–100) for category 3. For the final group, the speech recognition score reached 75.7% (range: 10–100). It was determined that there was no statistically significant variance among the three groups (p was greater than 0.05). The afterward speech perception result with noise from the surroundings was, on average, 52.14% (ranging from 0 to 100) for

the first group, 45.0% (ranging from 0 to 85) for group 2, and 34.2% (ranging from 0 to 75) for the third group. The differences that could be seen between groups One and Three were scientifically significant ($p < 0.05$), however, the differences that could be seen between groups One along with 2 as well as among groups 2 and 3 were without scientifically meaningful ($p > 0.05$) [18]. In the present study, most importantly, 87.87% of them were satisfied with cochlear implants, the primary sound sensation before CI was 16.5 (13.7), and after the CI was 69.8 (15.3), however, the production of speech before the CI was 50.5 (22.6) and after the CI was 82.7 (11.2), the advanced sound sensation pre-CI was 17.3 (15.6) and post-CI it was 68.2 (14.2). moreover, their social life interaction with the people was 34.2 (17.2), and after the CI was 69.2 (17.6). In another comparable study conducted by Wick CC et al, 55 of the 70 respondents (79%) exhibited substantial gains with respect to the many-aspects scores, 51 of 70 respondents (73%) demonstrated a substantial increase in the auditory domains, whereas 25 of 70 individuals (36%) revealed a significant increase in the language domain¹⁹.

CONCLUSION

The current study concluded that a cochlear implant is a safe and successful procedure. More importantly, 87.87% of them were satisfied with cochlear implants. This NCIQ showed a positive correlation with speech and quality of life measurements, as well as the ability to recognize the substantial impacts of cochlear implants on health-related quality of life.

REFERENCES

- Fortunato S, Forli F, Guglielmi V, De Corso E, Paludetti G, Berrettini ST, Fetoni AR. A review of new insights on the association between hearing loss and cognitive decline in ageing. *Acta Otorhinolaryngologica Italica*. 2016 Jun;36(3):155.
- Li CM, Zhang X, Hoffman HJ, Cotch MF, Themann CL, Wilson MR. Hearing impairment associated with depression in US adults, National Health and Nutrition Examination Survey 2005-2010. *JAMA otolaryngology-head & neck surgery*. 2014 Apr 1;140(4):293-302.
- Amieva H, Ouvrard C, Giulioli C, Meillon C, Rullier L, Dartigues JF. Self-reported hearing loss, hearing aids, and cognitive decline in elderly adults: A 25-year study. *Journal of the American Geriatrics Society*. 2015 Oct;63(10):2099-104. Amieva H, Ouvrard C, Giulioli C, Meillon C, Rullier L, Dartigues JF. Self-reported hearing loss, hearing aids, and cognitive decline in elderly adults: A 25-year study. *Journal of the American Geriatrics Society*. 2015 Oct;63(10):2099-104.
- Castiglione A, Benatti A, Girasoli L, Caserta E, Montino S, Pagliaro M, Bovo R, Martini A. Cochlear implantation outcomes in older adults. *Hearing, Balance and Communication*. 2015 Apr 3;13(2):86-8.
- Cloutier F, Bussi res R, Ferron P, C  t   M. OCTO "Outcomes of cochlear implant for the octogenarians: audiologic and quality-of-life". *Otology & Neurotology*. 2014 Jan 1;35(1):22-8.
- World Health Organization. (2018). Addressing the rising prevalence of hearing loss.
- Kotby MN, Tawfik S, Aziz A, Taha H. Public health impact of hearing impairment and disability. *Folia Phoniatrica et Logopaedica*. 2008 Jan 31;60(2):58-63.
- Holden LK, Finley CC, Firszt JB, Holden TA, Brenner C, Potts LG, Gotter BD, Vanderhoof SS, Mispagel K, Heydebrand G, Skinner MW. Factors affecting open-set word recognition in adults with cochlear implants. *Ear and hearing*. 2013 May;34(3):342.
- Cosetti MK, Lalwani AK. Is cochlear implantation safe and effective in the elderly?. *The Laryngoscope*. 2015 Jun;125(6):1279-81.
- Loefer C, Aschendorf A, Burger T, Kroeger S, Laszig R, Arndt S (2010) 'Quality of life measurements after cochlear implantation'. *Open Otorhinolaryngol J* 4:47-54
- Hinderink B, Krabbe F, Van Den Broek P (2000) 'Development and application of a health-related quality-of-life instrument for adults with cochlear implants: the Nijmegen cochlear implant questionnaire'. *Otolaryngol Head Neck Surg* 123(6):756-765
- H  u ler SM, Knopke S, Wiltner P, Ketterer M, Gr  bel S, Olze H. Long-term benefit of unilateral cochlear implantation on quality of life and speech perception in bilaterally deafened patients. *Otology & Neurotology*. 2019 Apr 1;40(4):e430-40.
- Lenarz M, S  nmez H, Joseph G, B  chner A, Lenarz T. Cochlear implant performance in geriatric patients. *The Laryngoscope*. 2012 Jun;122(6):1361-5.
- Olze H, Gr  bel S, F  rster U, Zirke N, Huhnd LE, Haupt H, Mazurek B. Elderly patients benefit from cochlear implantation regarding auditory rehabilitation, quality of life, tinnitus, and stress. *The Laryngoscope*. 2012 Jan;122(1):196-203.
- Forli F, Lazzerini F, Fortunato S, Bruschini L, Berrettini S. Cochlear implant in the elderly: results in terms of speech perception and quality of life. *Audiology and Neurotology*. 2019 Jul 19;24(2):77-83.
- Turunen-Taheri SK, Ed  n M, Hellstr  m S, Carlsson PI. Rehabilitation of adult patients with severe-to-profound hearing impairment-why not cochlear implants?. *Acta Oto-Laryngologica*. 2019 Jul 3;139(7):604-11.
- Rasmussen KM, West NC, Bille M, Sandvej MG, Cay  -Thomasen P. Cochlear implantation improves both speech perception and patient-reported outcomes: A prospective follow-up study of treatment benefits among adult cochlear implant recipients. *Journal of Clinical Medicine*. 2022 Apr 18;11(8):2257.
- Forli F, Lazzerini F, Fortunato S, Bruschini L, Berrettini S. Cochlear implant in the elderly: results in terms of speech perception and quality of life. *Audiology and Neurotology*. 2019 Jul 19;24(2):77-83.
- Wick CC, Kallogjeri D, McJunkin JL, Durakovic N, Holden LK, Herzog JA, Firszt JB, Buchman CA, CI532 Study Group. Hearing and quality-of-life outcomes after cochlear implantation in adult hearing aid users 65 years or older: a secondary analysis of a nonrandomized clinical trial. *JAMA Otolaryngology-Head & Neck Surgery*. 2020 Oct 1;146(10):925-32.

This article may be cited as: Khan I, Ahmad A, Khan AU, Islam I, Ahmed M, Chaudhry K: Investigating the Impact of Cochlear Implants on Speech Perception and Quality of Life in Individuals with Profound Hearing Loss.. *Pak J Med Health Sci*, 2023; 17(12): 109-111.