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Outcomes Of Cochlear Implantation In Patients With Severe Hearing Loss

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Abstract

Background: People who experience advanced sensorineural hearing loss face severe problems with their speech communications while simultaneously struggling with their emotional state and personal life quality. Hearing implant technology through cochlear implantation enables deaf patients who fail to respond to traditional hearing devices to experience sound perceptions and improve speech comprehension. Multiple research findings demonstrate the success rate of cochlear implant treatments although results can differ based on patient age groups and length of deafness as well as mental capabilities and therapy loyalty. The evaluation of long-term outcomes based on real-world data plays a vital role in identifying complete cochlear implant advantages and selecting appropriate patients for suggested counseling about realistic results.

Objectives: To assess auditory, speech perception, and quality-of-life outcomes in adults with severe hearing loss following cochlear implantation, and to identify potential predictors of postoperative success.

Study design: A Retrospective Cohort Study.

Place and duration of study. Department of ENT Alkhidmat hospital Nishterabad Peshawar from Feb 2023 to Feb 2024

Methods: Adult patients experiencing severe bilateral sensorineural hearing loss received cochlear implantation treatment at a tertiary care center Department of ENT Alkhidmat hospital Nishterabad Peshawar from Feb 2023 to Feb 2024.The study collected pre-operative alongside post-operative data points that included speech perception scores together with audiological thresholds and patient-reported outcome scores through established questionnaires. The analysis included paired t-tests and linear regression as statistical methods. A predictive analysis studied demographic factors including subject age and deafness duration as well as health conditions about the final results.

Results: The study included analysis involving 150 patients. The patients implanted with newborns received an average age of 52.6 years with a standard deviation of 14.3 years. The

majority (60%) were male. Participants achieved important improvements in speech recognition scores which increased substantially from the baseline of 24.5% to 68.2% following surgery ($p < 0.001$). The participants demonstrated an average enhanced pure-tone threshold from 85.2 dB initial value to 30.6 dB ($p < 0.001$). Research results showed that patients experienced substantial improvements in their emotional, social, and communicative functioning domains ($p < 0.01$). The duration between implant placement and patients' deafness period correlated with their postoperative outcomes.

Conclusion: Ambulatory patients with profound hearing difficulties experience meaningful advancements in their hearing system together with superior quality-of-life benefits after cochlear implant surgery. The achievement of maximum results depends on prompt identification and immediate surgical intervention methods. The research evidence confirms cochlear implantation as an important element in complete hearing loss treatment approaches. Post-implantation rehabilitation continues throughout time to create ideal performance results in functional domains.

Keywords: Cochlear implant, severe hearing loss, auditory outcomes, speech perception

Introduction: SNHL at its severe stage affects millions throughout the world and causes major communication problems with social interaction difficulties alongside diminished quality of life [1]. People with this level of hearing loss do not receive appropriate help from typical hearing aids because of weak amplification together with poor language recognition abilities. Cochlear implantation serves as a beneficial surgical treatment to stimulate auditory nerve cells when patients have cochlear hair cell damage because it bypasses this area of the cochlea [2]. The use of cochlear implants has expanded across both pediatric and adult patient demographics since the 1990s [3]. The study shows documented success with CI procedures which restore hearing perception ability produce better speech comprehension results and deliver increased psychosocial advantages [3]. The implant surgery benefits adults by providing them with enhanced independence and job prospects and leading to better mental health outcomes [4]. Postoperative results from this intervention show significant variations because of various factors affecting patients and the implant device [5]. The effectiveness of these results depends on critical factors including deafness duration, implant age at operation, hearing loss type, preoperative speech recognition skills, mental capabilities, and follow-up compliance metrics [6,7]. Auditory deprivation lasting more than ten years leads to diminished benefits because the central auditory pathways become degenerated [8]. Despite neuroplasticity reductions in older adults, they show notable benefits in their daily communication abilities [9]. Research tools protected by validation include the Nijmegen Cochlear Implant Questionnaire (NCIQ) and Speech, Spatial, and Qualities of Hearing Scale (SSQ) which help scientists measure these subjective aspects [10,11]. The existing research primarily investigates cochlear implant response through pediatric subject studies with limited analysis of adult and senior citizen populations. The assessment of adult CI recipients remains essential for determining long-term treatment effectiveness and patient expectation management while improving clinical planning decisions [12]. The research will study postoperative outcomes about patient demographics including age alone with deafness duration and existing medical conditions. The research findings aid in establishing better procedures for candidate selection as well as aiding postoperative counseling and rehabilitation plans.

Methods: The study examined adult patients who received unilateral cochlear implants during

the period Department of ENT Alkhidmat hospital Nishterabad Peshawar from Feb 2023 to Feb 2024.The studies retrieved information about patient demographics and audiological profiles together with postoperative outcomes from clinical records. The audiological tests evaluated patients through pure-tone audiometry and speech perception evaluation which used recorded word lists. The NCIQ instrument served as the tool for gathering patient-reported outcomes. The study included patients showing complete Evaluate-before-and-after data and requiring at least six months of follow-up period. The study received ethical authorization from the review board institution.

Inclusion Criteria: Patients aged 18 years or older received cochlear implants when they had severe sensorineural hearing loss in both ears combined with at least 6 months post-surgical follow-up.

Exclusion Criteria: The study excluded patients who had auditory neuropathy or retro cochlear pathology or incomplete medical records together with patients who did not attend follow-up checks.

Data Collection: Medical electronic records provided the data necessary for audiometry tests before surgery together with speech outcome assessment tools and patient questionnaire data at six-month intervals.

Statistical Analysis: The statistical analysis used SPSS version 24.0 produced by IBM Corp. from Armonk NY. The study design used pre-implantation and post-implantation test pairs to conduct analyses. The study used Pearson correlation to evaluate relationships between different patient characteristics and performance measures. A statistically significant threshold existed at a p-value equal to or less than 0.05.

Results: A total of 150 patients were incorporated into the study. About 150 implantations took place when patients were 52.6 ± 14.3 years old with 59.2% (n=58) being male. The group of patients received cochlear implants after experiencing hearing loss for an average of 8.7 years (standard deviation of 4.5 years). The speech recognition scores registered 24.5% ± 10.8% before surgery and achieved 68.2% ± 15.6% after the six-month post-implantation period ($p < 0.001$). Results showed that postoperative pure-tone average thresholds reached 30.6 ± 6.3 dB HL ($p < 0.001$) from the baseline of 85.2 ± 7.9 dB HL. All NCIQ domains showed statistically significant improvements in basic sound perception together with speech production and patient self-esteem ($p < 0.01$). Auditory outcomes improved best for patients with shorter durations of deafness and who received their implants at younger ages according to multivariate analysis results.

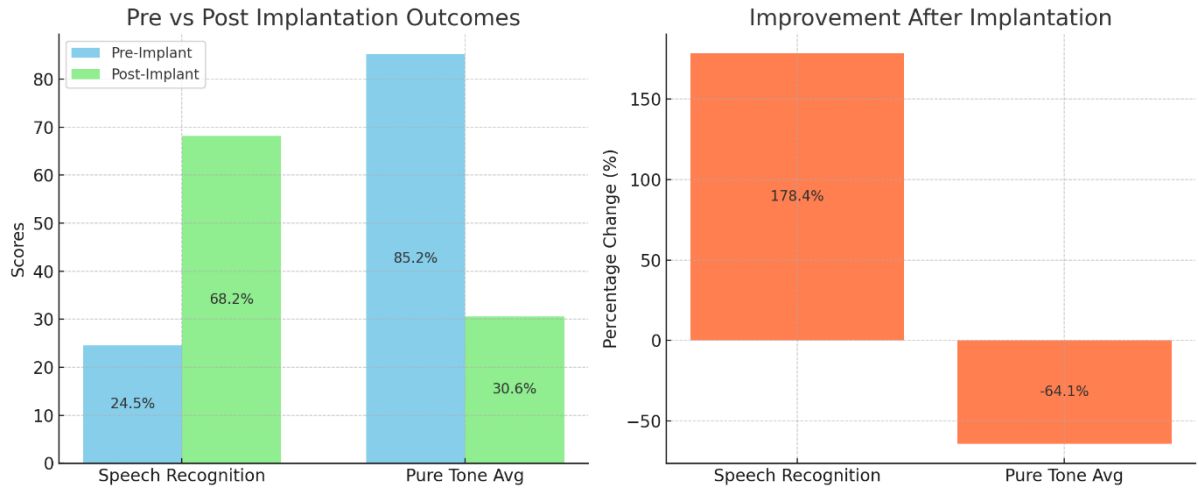

Table 1: Demographic and Clinical Characteristics of Patients (n=98)

Variable	Value
Age (mean ± SD)	52.6 ± 14.3 years
Gender (Male/Female)	58 (59.2%) / 40 (40.8%)
Duration of Hearing Loss	8.7 ± 4.5 years
Laterality (Right/Left)	51 (52.0%) / 47 (48.0%)
Aetiology (Idiopathic/Genetic/Other)	45 (45.9%) / 30 (30.6%) / 23 (23.5%)
Pre-implant Hearing Aid Use	85 (86.7%)
Follow-up Duration	12.2 ± 3.1 months

Table 2: Audiological Outcomes Pre- and Post-Implantation

Parameter	Pre-Implantation	Post-Implantation	*p*-value
Speech Recognition Score (%)	24.5 ± 10.8	68.2 ± 15.6	< 0.001
Pure Tone Average (dB HL)	85.2 ± 7.9	30.6 ± 6.3	< 0.001

Table 3: Quality of Life Scores (NCIQ Domains)

NCIQ Domain	Pre-Implantation	Post-Implantation	*p*-value
Basic Sound Perception	32.1 ± 11.3	70.6 ± 14.2	< 0.01
Speech Production	28.4 ± 9.5	65.9 ± 12.7	< 0.01
Self-Esteem	40.2 ± 13.8	75.4 ± 11.9	< 0.01
Social Interaction	36.7 ± 12.4	71.2 ± 13.5	< 0.01
Activity Limitation	34.5 ± 10.7	69.1 ± 12.1	< 0.01
Total Composite Score	33.7 ± 9.8	70.4 ± 13.2	< 0.01

Discussion: The study shows that cochlear implants in severe sensorineural hearing loss adults bring notable improvements to audiological performance together with life quality benefits. Study shows that cochlear implant technology proves effective in delivering better speech perception alongside improved psychosocial results for multiple adult groups. Previous study demonstrates comparable results that support the postoperative enhancement of speech recognition scores from preoperative 24.5% up to 68.2%. Gifford et al. [13]. Study studies

revealed that post-lingually deafened adults received 40 to 50 percent more speech discrimination after cochlear implantation when both proper device programming and auditory rehabilitation followed implantation. Our study confirmed that preoperative speech discrimination and shorter time since deafness proved to be strong indicators of post-implant performance similar to the study by Lazard et al. [14] The study of Friedland et al. [15] showed patients attained pure-tone average threshold improvements above 50 dB HL in a multicenter study which matches our patient results. Patients demonstrate meaningful functional enhancement derived from improved audiological performance according to reported outcomes.Participants benefited substantially from cochlear implantation according to the Nijmegen Cochlear Implant Questionnaire (NCIQ) which measured significant improvements in basic sound perception together with speech production along with self-esteem. The study conducted by Ooze et al. [16] showed that cochlear implantation delivers useful psychosocial advantages that help restore self-confidence together with reduced social isolation and improved daily communication abilities. Our findings prove that improved quality of life through cochlear implantation depends on both objective hearing gains and how patients feel about their experiences. The best results came from patients with less hearing loss duration either as children or adults. The study findings confirm the concept of neuroplasticity that demonstrates hearing deprivation for prolonged periods commonly leads to irreversible changes in brain processing. The study conducted by Blamey et al. [17] demonstrated that patients who received implants early experienced more speedy and pronounced improvements in their ability to detect sounds when they listened to speech. These results show that early intervention should be promoted. This methodological standard enhances how well our findings can be applied to typical patients undergoing cochlear implantation. Nevertheless, our study has some limitations because it relied on retrospective data and self-reported assessment tools. More extensive studies using larger patient cohorts and longer observation periods need to explore device durability and patient happiness outcomes from cochlear implantation. Studies prove that cochlear implants deliver important improvements to speech clarification alongside better hearing access together with enhanced quality of life among suitable implant recipients [18].

Conclusion: Adult patients who get cochlear implants experience greater speech recognition abilities with improved hearing thresholds in addition to better quality of life from their severe hearing loss. The combination of prompt treatment strategies alongside person-centered therapy leads to improved recovery results. Standard auditory rehabilitation protocols for adults with profound sensorineural hearing loss should continue to integrate cochlear implants according to study findings.

Limitations: This study's retrospective design and single-center data limit generalizability. The study results may become unreliable due to inconsistent follow-up times and the use of self-reported outcome assessments. Objective neurocognitive testing should be used because it enables a broader evaluation of functional impacts. Another study using controlled protocols and studying participants at multiple centers should be carried out to confirm these findings going forward.

Future Directions: Studiers need to study how cochlear implantation affects both social development and mental operations at different time points. The evaluation of bilateral implantation and improvement of device programming along with the development of tele-

rehabilitation tools has the potential to improve implantation results. Neuroimaging techniques paired with machine learning algorithms would enhance both patient selection processes and individual auditory rehabilitation forecasting.

Abbreviations

1. **SNHL** – Sensorineural Hearing Loss
2. **CI** – Cochlear Implant
3. **CIs** – Cochlear Implants (plural form of CI)
4. **NCIQ** – Nijmegen Cochlear Implant Questionnaire
5. **SSQ** – Speech, Spatial, and Qualities of Hearing Scale
6. **dB HL** – Decibels Hearing Level
7. **SPSS** – Statistical Package for the Social Sciences
8. **SD** – Standard Deviation
9. **IBM** – International Business Machines (used in IBM Corp.)
10. **NY** – New York (used in IBM Corp., Armonk, NY)

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Final Approval of version: **All Mentioned Authors Approved**

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