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Sample Work

A comprehensive study of clinical efficacy in cochlear implant surgery among children and adults

Abstract

Background and Objective: Hearing loss, often known as hearing impairment, is the inability to hear in part or completely. Hearing loss affects around one in every eight persons globally. For this form of hearing loss, cochlear implants (CI) may be a feasible option to hearing aids. The current study's major goal was to conduct a comprehensive assessment of the clinical efficacy of CI surgery in pediatric and adult patients.

Methods: The current investigation was conducted as a systematic review in accordance with the PRISMA standards. We conducted a comprehensive search of the PubMed, MEDLINE, EMBASE, and Google Scholar databases for relevant literature on the clinical efficacy of CI surgery using the proper key phrases (MeSH). The following information was retrieved from the selected articles: author's name, journal name, research design, sample size and age, devices, findings, and outcomes.

Results: This review contained seventy-three papers that fulfilled the inclusion criteria. There were 19 papers on unilateral CI surgery in adults, 17 on bilateral (sequential-simultaneous) CI surgery in adults, 9 on unilateral CI surgery in children, and 28 on bilateral (sequential-simultaneous) CI surgery in children. The involving unilateral CI in adults shown a considerable increase in perceptual ability. In comparison to unilateral CI, bilateral CI provides advantages in sound localization and hearing in calm and condition. Age is not a decisive element in patients' performance of post-CI outcomes.

Conclusion: For the vast majority of patients with mild to severe hearing loss, CI is a helpful assistance in communication and speech perception. To create stronger evidence, more research with big databases, patient registries with long-term follow-up data, higher-quality reporting, and longer length are required.

Keywords: Clinical efficacy, cochlea nerve, meningitis, surgical technique, hearing in noise, progressive hearing loss

INTRODUCTION

Over 550 million people worldwide suffered from hearing loss. Around 60 million people have acute hearing loss or worse 1,2. Cochlear implants (CI) are one of the most significant advances in contemporary medicine. CI is a safe surgery that is used all over the world. Unilateral or bilateral CI is a well-defined and dependable surgical approach for rehabilitating hearing in individuals with moderate to severe sensorineural hearing loss 3. They are fundamentally different from hearing aids in that they function by turning sound into an electrical stimulation that bypasses the human cochlea's hair cells and directly stimulates the cochlear nerve. Over 300,000 people had gotten cochlear implants globally as of December 2012, with roughly 60,000 adults and 40,000 children implanted in the United States. 4 Many infants who have a CI before the age of 12 experience typical language development as a result of the procedure. 5. A variety of variables, including obtaining a CI at an earlier age, developmental delay, and aberrant anatomy, notably cochlea nerve (CN) hypoplasia/aplasia, have been linked to poor CI outcomes in patients. Previously, CI was mostly employed in deaf children. Recently, pediatric and adult patients with progressive hearing loss following a middle ear procedure, severe sensorineural hearing loss, and progressive hearing loss have been identified as potential candidates for CI 6.

The prevalence of CI in the pediatric population has risen considerably since the early 1990s. Although some surgeons feel that CI is more difficult in children than in adults, there is no evidence to support this claim. 7Although CI surgery is a relatively low-risk technique, internal implantation surgery with the CI device is not fully risk-free and may result in problems that necessitate revision surgery. 8 According to studies, around 45% of persons had dizziness after implantation. 6 These problems are due to device failure, foreign body insertion, or surgical technique. 3 Minor problems are managed conservatively with medical procedures such as non-auditory stimulations and wound infection. Major complications of CI surgery include meningitis, electrode failure, problems such as infection of middle air needed revision surgery due to flap necrosis, infection of the skin at the implant site, and severe sequelae such as permanent facial paralysis 9.

Numerous research studies on the clinical efficacy of CI surgery in paediatric and adult patients have been widely published 10-12. A comprehensive review of these research, however, has been revealed to be quite limited in number 13,14, and these investigations were conducted roughly 10 years ago.

Furthermore, no systematic studies have been conducted to far regarding the clinical efficacy of CI surgery in both juvenile and adult patients. An updated systematic evaluation of the clinical efficacy of CI surgery is required to bridge this knowledge gap and boost research on CI surgery. Thus, the primary goal of this study was to compare the clinical efficacy of unilateral CI and bilateral CI with unilateral CI plus bimodal stimulation procedures in pediatric and adult patients.

MATERIALS AND METHODS

2.1 Study Design

For this systematic review, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) standards were followed 15. The databases PubMed, Ovid, Google Scholar, EMBASE, Scopus, and Medline were thoroughly searched. The bibliographic sources for the selected papers were also reviewed.

2.2 Search Strategy

A literature search was conducted using the appropriate key phrases (MeSH) in the following databases: PubMed MEDLINE, Scopus, and Cochrane. We were primarily seeking for studies on the clinical efficacy of CI surgery. Different keyword combinations and medical subject headings (MeSH) were used to generate two subsets of citations: one for "Cochlear Implant", using MeSH and terms like "unilateral", "bilateral", "bimodal stimulation", and the other for its management, using terms and MeSH like surgery, resection, bypass, and so on. To search additional databases, the key phrases were adjusted according to the searching methodology of each database, including cochlear implant surgery in kids, cochlear implant surgery in adults, cochlear implant surgery in children, unilateral cochlear implant surgery, and bilateral cochlear implant surgery.

2.3 Inclusion and exclusion criteria

This study covered all original research publications published in English between the years 2000 and 2020 on the clinical efficacy of CI surgery. Exclusion criteria were (a) provided abstracts, letters to the editors, comments, systematic review or meta-analysis papers, and (b) the absence of the complete text of the study. Non-English studies published prior to 2000 were also omitted.

2.4 Strategy to assess the quality of studies

The paper screening procedure and eligibility evaluation were carried out separately by two writers. In the event of a disagreement amongst the authors, the decision was decided by an unbiased third party. The publications were originally vetted based on their titles, then on their abstracts. Because the article titles and abstracts were unrelated to the current inquiry, they were removed from the secondary screening.

2.5 Data extraction

An initial literature search yielded 2086 publications on the clinical success of Cochlear Implant surgery. Following the application of the eligibility criteria, relevant articles were picked for full-text screening. The first screening papers were evaluated for full-text screening to determine the current study's eligibility criteria. The full-text examined papers were also omitted due to a lack of data on the clinical efficacy of Cochlear Implant surgery. The authors' names and years of publication, as well as the title, journal name, research design, sample size and age, devices, findings, and outcomes, were collected from the selected papers.

2.6 Outcome measure

The clinical effectiveness of cochlear implant surgery (i.e., language and communication results and audiological results) is the primary outcome measure of the current study, followed by the type of cochlear implant surgery (i.e., unilateral, bilateral) and patient categorizations (i.e., adults, paediatrics).

3 RESULTS

3.1 Eligible studies

A total of 2086 papers were found through a literature search in different databases such as Google Scholar, Ovid, PubMed, and Science Direct, of which 1574 were discarded at the outset owing to duplication and irrelevance. After analyzing the titles and abstracts at the first screening stage, 358 articles were eliminated from the total of 512. A total of 154 prospective relevant publications were chosen for full-text assessments, of which 81 were further discarded as research linked to cost-effectiveness analysis (n= 42), full texts were unavailable (n=7), and review, systematic review, and meta-analysis articles (n= 32). Finally, as shown in the figure, 73 articles on CI surgery in paediatric and adult patients were considered in our current systematic review analysis in the PRISMA flow chart (Fig.1) .

3.2 Study characteristics

The current systematic review included 73 articles, 19 on unilateral CI surgery in adult patients, 17 on bilateral (sequential-simultaneous) CI surgery in adult patients, 9 on unilateral CI surgery in pediatric patients, and 28 on bilateral (sequential-simultaneous) CI surgery in pediatric patients. The sample size for adult unilateral CI surgery varied from 3 to 358 cases, for a total of 1604 people. The sample size of adult patients undergoing bilateral (sequential-simultaneous) CI surgery varied from 7 to 164, for a total of 536 subjects. The sample size for pediatric unilateral CI surgery varied from 3 to 47 cases, for a total of 168 patients. The sample size for bilateral (sequential-simultaneous) CI surgery on pediatric patients varied from 9 to 88, for a total of 991 individuals. The total sample size of the research covered is 3299. Tables 1, 2, 3, and 4 provide an overview of the selected papers.

3.3 Unilateral CI surgery in adult patients

A total of 19 papers on unilateral CI surgery in adult patients were chosen (Table 1). All of the examined trials demonstrated a substantial improvement in perceptual ability following CI surgery. Several investigations 16-19 found that perception in older individuals is poorer than in younger people. Labadie et al. 20 discovered no statistically significant variations in results for younger and older people. Various studies 21-25 show that persons of all ages have enhanced speech perception following a unilateral CI.

According to the findings of the research included in the study, senior age is not a contraindication to the CI surgery. Orabi et al. 26 found statistically significant increases in the quality of life of older individuals in their investigation. In contrast, Park et al. 27 found that quality of life improved significantly across all age categories, albeit not statistically significantly. According to Roberts et al. 19, a hearing loss family history has been linked to a trend toward greater speech recognition. According to Dillon et al. 28, CI might provide considerable increases in quality of life in situations of severe unilateral hearing loss (UHL). Various research utilized different cut-offs for age. Obviously, age disparities have an effect on results. Dixon et al. 29 recently demonstrated clinically substantial improvement in individuals with Tinnitus Handicap Inventory (THI). Nucleus, MED-EL, and Clarion were the most widely employed processing strategies/types of implant in unilateral CI surgery in adult patients (Fig.2).

3.4 Unilateral CI surgery in pediatric patients

A total of nine papers on unilateral CI surgery in pediatric patients were chosen (Table 3). Two studies 45,46 found that patients' speech recognition improved in loud environments. Two studies 45,47 revealed an improvement in localization abilities in children with unilateral CI. Hopyan-Misakyan et al. 48 discovered that children with right CIs could detect facial effects but not affective speech prosody when compared to controls. Deep et al. 49 recently reported a substantial increase in word recognition scores (WRS) in the CI-alone condition, suggesting that CI in this self-selected cohort is a feasible treatment option for paediatric Single-Sided Deafness (SSD). According to Scarabello et al. 10, a longer term of CI usage, a younger age after surgery, and greater output of auditory speech processing influenced performance in verbal and receptive oral language. Nucleus and MED-EL were the most often employed processing strategies/implants in unilateral CI surgery in young patients (Fig.4).

4 DISCUSSION

Cochlear implants (CIs) have shown to be an effective means of delivering hearing to the deaf. Speech recognition algorithms used in cochlear implants have advanced in recent years, which is notably noticeable in quiet speech comprehension in both paediatrics and adults 44. The results showed that implanted children and adults outperformed their non-implanted peers in linguistic competency, reading abilities, and expressive language 38,66,67. The present systematic review's major goal is to evaluate the clinical efficacy of CI Surgery in pediatric and adult patients. The included studies on unilateral CI in adults demonstrated a considerable increase in perceptual ability after CI surgery. Our findings are consistent with the findings of a recent systematic analysis by Gaylor et al. 68, who indicated that unilateral CI considerably enhanced hearing ability in adult patients. In this investigation, aged individuals had worse perceptive findings than younger ones. Similarly, Roberts et al. 19 found that older patients' speech perception skill was considerably worse than that of younger adult patients.

According to the findings of the research included in the study, senior age is not a contraindication to the CI surgery. Similarly, numerous types of study have indicated that CI benefits older persons, with increases in both quality of life and hearing ability 20,69,70. As a result, age is neither a predictor or limiting factor in patients' post-CI results. Similarly, Lachowska et al. 24 found that age is not a limiting factor in post-CI outcomes in older patients. When compared to unilateral CI, bilateral CI in adult patients delivers improvements in hearing in a silent environment, sound localization, and hearing in noise, according to this current systematic study. According to the study findings, which are consistent with the earlier systematic review by Forli et al. 14, bilateral CI gives several advantages in pediatric patients, including hearing in loud and calm environments, as well as sound localization, over unilateral CI.

There are certain limitations to the current systematic review. The eligible studies in this systematic review on the clinical efficacy of CI surgery employed a variety of processing algorithms and implant kinds. This difference demonstrated the lack of standardized, uniform, and accepted therapy for persons with hearing loss difficulties. This review did not analyze the possibility of bias since the majority of the research used different study designs. Despite these limitations, this revised systematic review provides an evidence-based assessment on the clinical efficacy of CI surgery in juvenile and adult patients.

5 CONCLUSION

Hearing loss is a widespread issue caused by hereditary factors, disease, aging, birth problems, and noise. CI has long been a routine technique for persons with moderate to severe hearing loss. Without an implant, people may still be dependent on others in even ordinary day-to-day tasks. As a result, cochlear implants are a viable therapy option for people with hearing loss.

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APPENDIX: A

Mesh terms: (“Unilateral”[All Fields] OR ("Cochlear Implant"[MeSH Terms] AND "bilateral"[All Fields]) OR ("Cochlear Implant"[MeSH Terms] AND "adults"[All Fields]) OR ("Cochlear Implant"[MeSH Terms] AND "paediatrics"[All Fields] OR " Cochlear Implant " [MeSH Terms]) AND ("bimodal stimulation"[All Fields] OR "Cochlear Implant"[MeSH Terms] ("2000/01/01"[PubDate] : "2020/06/15"[PubDate]).

FIGURE 1: PRISMA flow chart

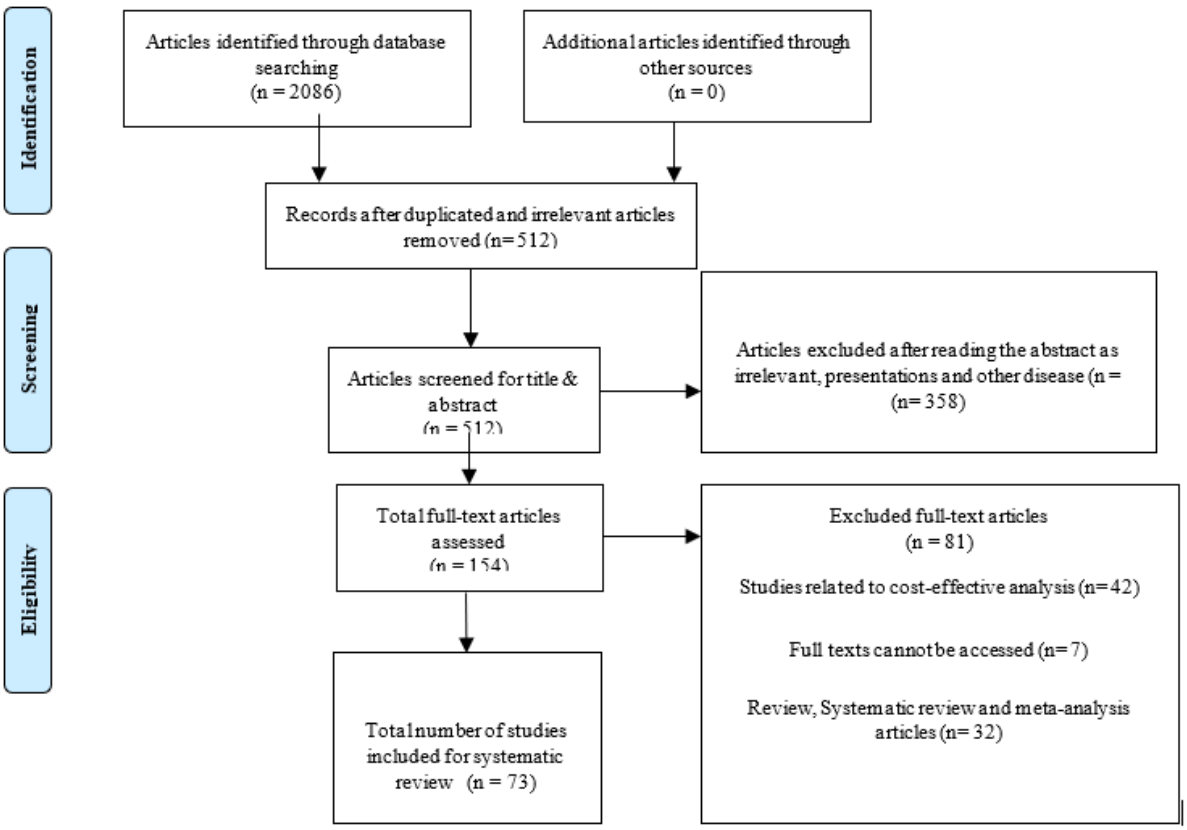

FIGURE 2: Type of implant/processing strategies used for adult patients with unilateral CI

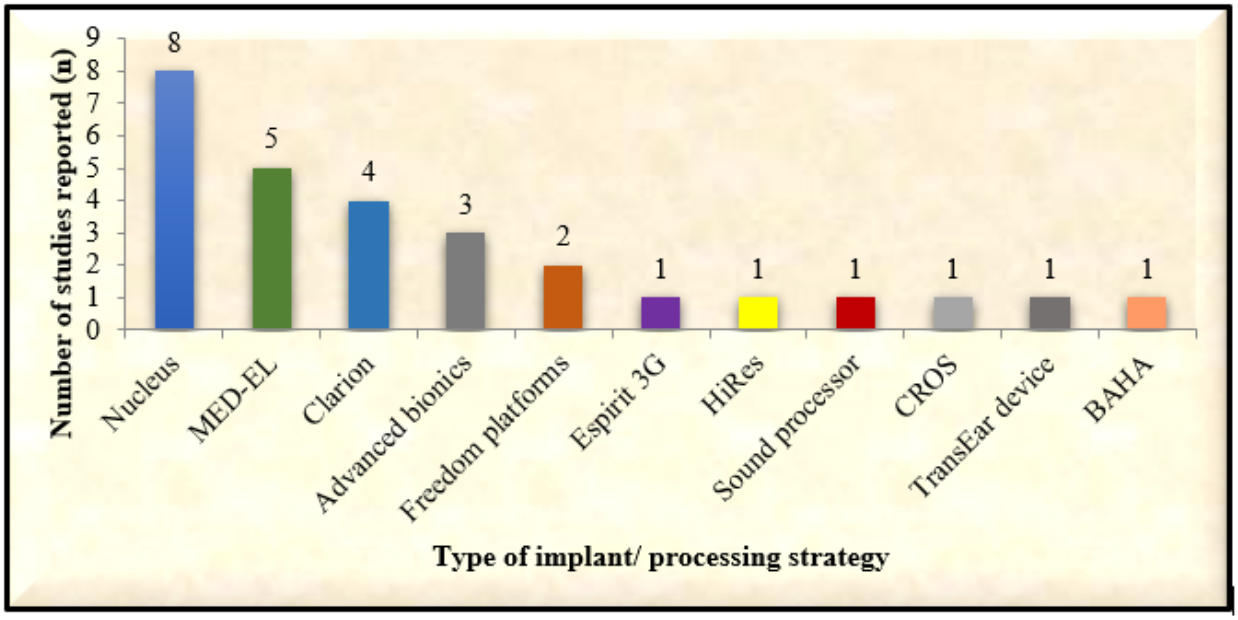

FIGURE 3: Type of implant/processing strategies used for adult patients with bilateral (sequential-simultaneous) CI vs. unilateral CI and vs. bimodal stimulation

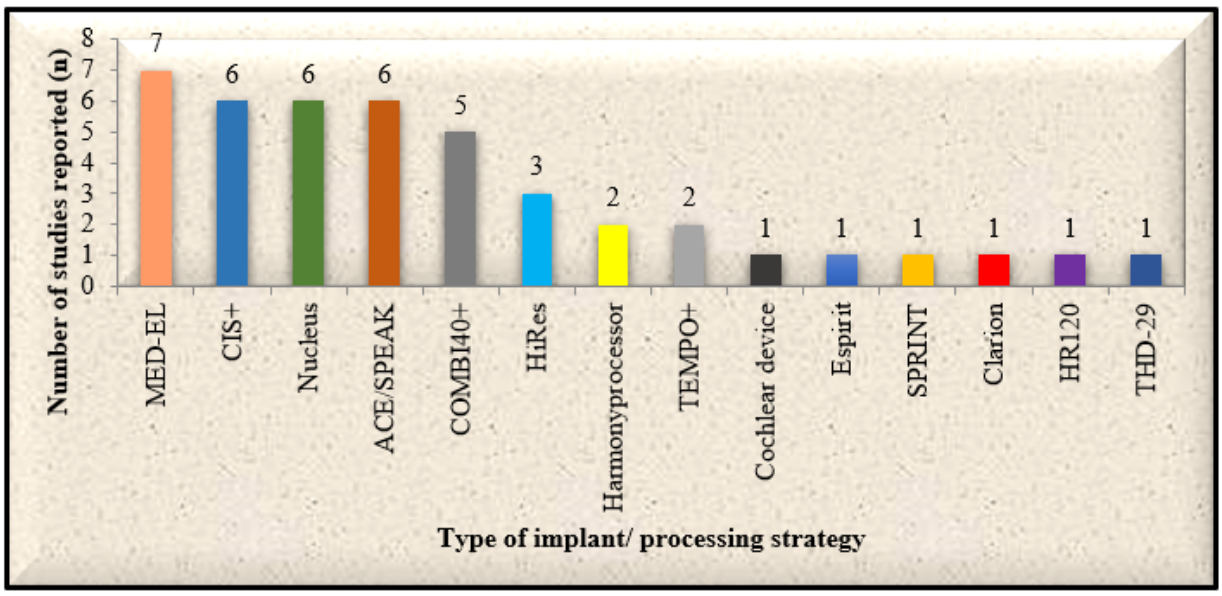

FIGURE 4: Type of implant/processing strategies used for pediatric patients with unilateral CI

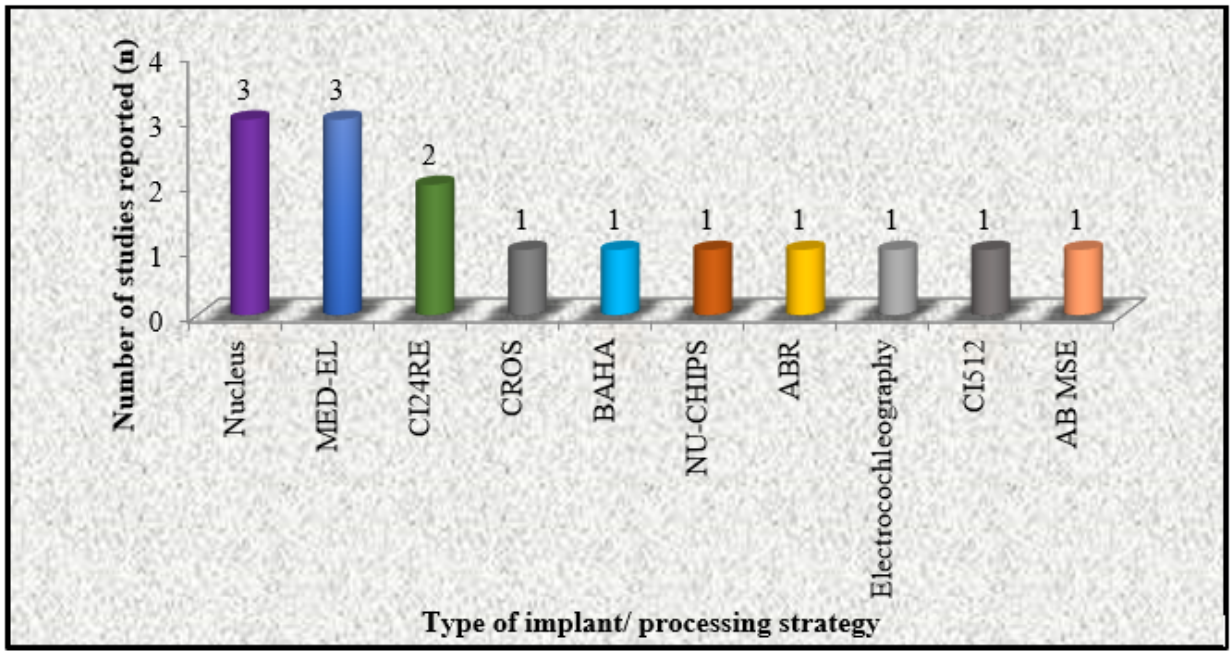

FIGURE 5: Type of implant/processing strategies used for pediatric patients with bilateral (sequential-simultaneous) CI vs. unilateral CI and vs. bimodal stimulation

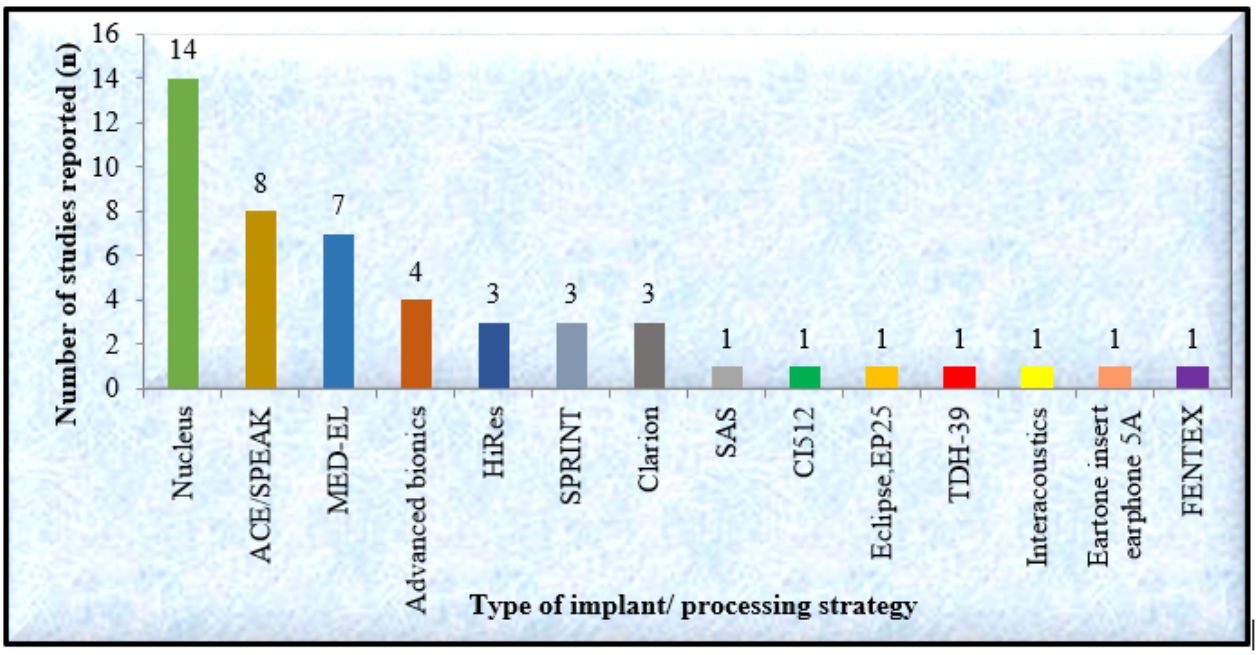

TABLE 1: Summary of the included studies adult patients with unilateral CI

S. No	Authors	Title	Journal name	Study design	Sample size and Age	Follow-up	Type of implant/ processing strategy	Results evaluated	Conclusions/opinions
1	Labadie et al., [20]	Cochlear implant performance in senior citizens	Otolaryngology – Head and Neck Surgery	Retrospective study	N 36, Younger 20; Mean age: 46.9 years, Older 16; Mean age: 71.5 years.	NR	Devices: Clarion Multi Strategy	Recognition of sentences (CID) and bi-syllable words (CNC). Evaluation of perceptive abilities.	There were no statistically significant differences in the outcomes for the two groups.
2	Chatelin et al., [16]	Cochlear Implant Outcomes in the Elderly	Otology Neurotology	Retrospective study	N 65 Age: > 70 years N 101 Age: < 65 years.	3-6-12 months	Clarion and Nucleus CI Devices	Verbal perception test with CNC, CID and HINT.	Elderly groups also benefited significantly from the CI procedure, but the results were slightly lower than those achieved by younger patients (statistically significant test CNC)
3	Orabi et al., [26]	Cochlear implant outcomes and quality of life in the elderly: Manchester experience over 13 years	Clinical Otolaryngology	Retrospective study	N 34, Age: 65-80 years	9 and > 21 months	IC Nucleus CI24/Nucleus CI22/Nucleus CI24 Contour/ Medel C40+/ Medel C40.	Functional outcome measures: self-reported measures of the social, psychological and emotional aspects of quality of life, Glasgow Health Status Inventory Questionnaire (GHSI), Glasgow Benefit inventory (GBI), expectation profiles. Audio logical performance outcomes for isolated words, words in sentences in quiet and noise	A marked improvement in postoperative scores for open set auditory tests compared with pre-operative scores. Questionnaire responses from patients showed increase of quality of life. They compared the results with those of a database for implanted adults < 65 yrs. and there were no statistically significant differences.
4	Chan et al., [21]	Performance of older adult cochlear implant users in hong kong	Ear Hear	Retrospective study	N 28 (Older adult CI users 14, Age: 56-77 years, Adults 14, Age: 18-53 years)	0 to 6 months, 0 to 12 months, and 0 to 24 months	Not specified	Test of verbal perception. Hong Kong Speech Perception Test Manual.	Similar benefit reported in both patient groups, regardless of age; on implant. Duration of deafness is reportedly more important
5	Poissant et al., [17]	Impact of Cochlear Implantation on Speech Understanding, Depression, and Lonelines s in the Elderly	Journal of Otolaryngology – Head & Neck Surgery	Clinical study	N 26 (CI users 9, Age: ≥70 years, CI users 8, Age: ≤60 years, HA users 9, Age: ≥70 years,)	NR	Devices: Clarion, Nucleus, Mede	Speech understanding scores in indicators of silence and noise and quality of life, (Geriatric Depression Screening Scale, UCLA Loneliness Questionnaire)	For the three tests there were no statistically significant differences between patients implanted before and after 70 years of age. Patients undergoing CI after 70 years of age show an development in depression and loneliness

6	Noble et al., [22]	Younger and older age adults with unilateral and bilateral cochlear implants: speech and spatial hearing self-ratings and performance	Otology & Neurotology	Retrospective and Prospective study	N 202 (Retrospective: CI 68, CI + CI 36, and CI + HA 38, Age: < 60 years. Prospective: CI 30, CI + CI 18, and CI + HA 16, Age: > 60 years	Test administered 2 months before CI and > 1 year after CI	Not specified	Hearing Handicap Questionnaire, Hearing handicap Inventory for the Elderly, Speech Spatial and Quality of Hearing Scale (SSQ), sound field localization test and word recognition	After implantation all groups of patients show significant benefit. There were no statistically significant differences in both groups of patients (in terms of age)
7	Williamson et al., [71]	Auditory Performance After Cochlear Implantation in Late Septuagenarians and Octogenarians	Otology & Neurotology	Retrospective study	N 28 (Group A 13, Age: 75-89 years), (Group B 15, Age: 65-78 years)	1 year	CI Nucleus devices (n=27), Esprit 3G, Freedom platforms, CI Clarion (n=1).	HINT, CNC, questionnaire for satisfaction. Comparison between results (questionnaire on pre- and post CI satisfaction and verbal perception).	Scores were significantly better postoperatively in both groups with no significant differences according to age.
8	Friedland et al., [18]	Case-control Analysis of cochlear implant performance in elderly patients	Archives of Otolaryngology–Head & Neck Surgery	Case-control retrospective study	N 56 (28 patients Age: ≥ 65 years at CI. And 28 younger implanted pts (control group)	1 year	Not specified	Test of verbal perception: HINT-Q, HINT-N, CNC	Improvement showed in both groups. In HINT-Q and CNC, elderly patients obtain lower results when compare with youngers (Statistically significant)
9	Park et al., [27]	Postlingually Deaf Adults of All Ages Derive Equal Benefits from Unilateral Multichannel Cochlear Implant	Journal of the American Academy of Audiology	Retrospective study	N 161, (Age: <50, Male 23, Female 38, Age: 51-65 years, Male 19, Female 31, Age: <65, Male 20, Female 30)	2 year	Unilateral multichannel cochlear implant	Speech recognition: HINT, Quality of life: HHI	Significant improvement showed in speech recognition (HINT). Quality of life improved markedly in all age groups (HHI). (No statistically significant)
10	Amodi et al.,[23]	Results With Cochlear Implantation in Adults With Speech Recognition Scores Exceeding Current Criteria	Otology and Neurotology	Retrospective study	N 27, 14 male 13 female, Age: 26 to 89 years	12 months	Advanced Bionics Corp, Nucleus-Cochlear, and MedEl AG-Innsbruck	Speech recognition: HINT	Significant postoperative improvement showed in the study group for all outcome measures. Significant improvement of all patients perceived hearing-related disabilities. (Statistically significant)

11	Firszt et al.,, [72]	Auditory Abilities after Cochlear Implantation in Adults with Unilateral Deafness: A Pilot Study	Otology and Neurotology	Pilot Study	N 3, Male, Age: 56,57 and 62.	NR	Nucleus System 5, Frequency-modulated (FM), earphones	Subjective reports, temporal and spectral discrimination and Localization of CI	The CI recipients with unilateral deafness obtained open-set speech recognition, improved localization, improved word recognition in noise, and improved perception of their ability to hear (Statistically significant)
12	Roberts et al., [19]	Differential cochlear implant outcomes in older adults	Otology Neurology	Retrospective study	N 113, (Younger adults: 46, Male 25: Female 21, Age: <65 years, Elder adults: 67, Male 37, Female 30, Age: >65 years)	5 months	Nucleus CI512/Contour Advance, Cochlear Freedom/Contour, AB HiRes 90K/HiFocus 1j, AB HiRes 90K/HiFocus Helix	Speech perception ability, CNC, family history of hearing loss on CI performance, history of noise exposure, and duration of hearing loss	Speech perception ability in CI users over 65 years of age was substantially lower than in younger adults. A hearing loss family history has been related to a trend towards better recognition of speech (No statistically significant)
13	Lachowska et al., [24]	Benefits of Cochlear Implantation in Deafened Adults	Audiology and Neurotology	Retrospective study	N 30, (17 males,13 females), Mean age: 76 years	2.74 years	Sound processor	Audio logical evaluation: Free-field audiometry, pure tone audiometry, and speech audiometry. Speech perception tests	All patients have shown hearing benefits after implantation. There were no associations between post-implant results and age or pre-implant hearing levels and voice audiometry. Age in deafened elderly patients is not a deciding or restricting factor for the success of post-CI outcomes.
14	Castiglione et al., [73]	Cochlear implantation outcomes in older adults	Hearing, Balance and Communication	Retrospective study	N 30, (16 males and 14 females), Age: 65 to 79 years	NR	Not specified	Speech perception: Speech Detection Threshold (SDT) and Speech Recognition Threshold (SRT). Threshold evaluation: pure tone average (PTA)	Cochlear implantation is a safe procedure even for the elderly, who can benefit significantly from improvements in hearing threshold and speech perception
15	Franko-Tobin et al., [74]	Outcomes of Cochlear Implantation in Adults with Asymmetric Hearing Loss	Otology and Neurotology	Retrospective study	N 35, Mean age: 61.5 years	6 to 12 months	Devices: Med-El , Advanced Bionics, Cochlear	Sentence recognition, phoneme and Post-implantation word. Preoperative unaided pure-tone averages (PTA), and Consonant Nucleus Consonant (CNC) words and sentence recognition scores were obtained	Asymmetric hearing patients and moderate low frequency hearing loss performed significantly better on speech recognition measures than our patients with severe to deep hearing loss or worse.

16	Sharpe et al., [25]	Effects of Age and Implanted Ear on Speech Recognition in Adults with Unilateral Cochlear Implants	Audiology and Neurotology	Retrospective study	N 96, younger adults: 35 (11 male, 24 female), mean age: 38.3 years, older adults: 61 (33 male, 28 female), mean age: 72.3 years	1 year	Device: Cochlear Americas, MED-EL, Advanced Bionics	Word and sentence recognition: HINT, CNC-W and CNC-P.	All ages adults experience improved perception of speech after an unilateral CI.
17	Lenarz et al., [75]	Patient-Related Benefits for Adults with Cochlear Implantation: A Multicultural Longitudinal Observational Study	Audiology and Neurotology	Prospective study	N 291 (Male 128, Female 163), Age: 13-81 years	2 months	Nucleus Freedom CI24RE (CA), Nucleus CI422, Nucleus CI512, Nucleus 24, Contour Advance and Nucleus Hybrid-CI24REH.	Health Utilities Index Mark 3 (HUI3) and Speech, Spatial, and Qualities of Hearing Scale (SSQ)	High significant improvements for all outcome indicators were observed. The HUI3 and SSQ showed substantial improvements in health-related quality of life and real-life hearing after group implantation
18	Dillon et al., [28]	Effect of Cochlear Implantation on Quality of Life in Adults with Unilateral Hearing Loss	Audiology and Neurotology	Prospective study	N 20, Age:23-66 years	1, 3, 6, 9, and 12 months	CROS HA, Trans Ear device and BAHA	Abbreviated Profile of Hearing Aid Benefit (APHAB), and the Tinnitus Handicap Inventor. Speech, Spatial, and Qualities of Hearing Scale (SSQ),	CI can deliver significant improvements in quality of life in cases of serious UHL. At the pre- and postoperative intervals, the UHL cohort reported less perceived difficulties than the conventional CI and EAS cohorts. Each group had a significant advantage in the quality of life at APHAB with CI use.
19	Dixon et al., [29]	Predicting Reduced Tinnitus Burden After Cochlear Implantation in Adults	Otology and Neurotology	Retrospective study	N 358, Male 170, Female 188, Mean age: 63.2 years	1 year	Not specified	HINT, Tinnitus Handicap Inventory (THI), 36-Item Short-Form Health Survey (SF-36), a generic measure of health-related quality of life (HRQoL)	Clinically significant improvement was reported in patients with Tinnitus Handicap Inventory (THI). Worse residual hearing and greater baseline hearing and tinnitus disability are associated with higher probabilities of tinnitus improvement. Strong independent predictors of resolution were among adult patients with tinnitus and bilateral severe-to - profound hearing loss, worse residual hearing and worse pre-implant THI score