

**Department of Hearing & Speech Sciences
Vanderbilt University Medical Center
Clinical Protocol**

Protocol Title: Cochlear Implant Evaluation and Programming

Providers: ASHA-Certified and state licensed audiologists

I. Policy Statement:

In cases when hearing aid amplification is unable to provide adequate benefit to patients with impaired hearing, audiologists evaluate the patient's hearing sensitivity and speech comprehension to determine candidacy for a cochlear implant (CI). If the patient is determined to be a candidate, they undergo cochlear implantation by an Ear, Nose, and Throat (ENT) surgeon then return to the audiologist for programming of the implant and evaluation of aural (re)habilitation status. The audiologist works with a multidisciplinary team to accurately program the CI and support the patient's journey toward better speech understanding and quality of life.

II. Equipment and Supplies:

Include but are not limited to:

1. Audiometer
2. Headphones and/or insert earphones
3. Speaker
4. Visual reinforcement audiometry (VRA) system
5. Games for pediatric assessment
6. Speech recognition testing materials
 - a. Word recognition testing
 - i. Consonant Nucleus Consonant (CNC) monosyllabic words¹
 - ii. Lexical Neighborhood Test (LNT)²
 - iii. Multisyllabic Lexical Neighborhood Test (MLNT)²
 - iv. Northwestern University-Children's Perception of Speech (NU-CHIPS)³
 - v. Word Intelligibility by Picture Identification (WIPI)⁴
 - b. Sentence recognition testing
 - i. AzBio sentences⁵
 - ii. BabyBio sentences⁶
 - iii. Hearing in Noise Test (HINT) sentences⁷
 - iv. Bamford-Kowal-Bench Speech in Noise (BKB-SIN)⁸
 - c. Sentence recognition testing in noise, +5 dB SNR or 0 dB SNR
 - i. AzBio sentences⁵
 - ii. BabyBio sentences⁶
 - d. Other tests
 - i. Early Speech Perception (ESP) Test⁹
7. Sound level meter
8. Tympanometer
9. Otoacoustic emissions system
10. Computer
11. Hearing aids
12. Real ear measurement system (i.e., Verifit)
13. CI programming equipment
14. CI programming software
15. Questionnaires

- i. Speech Spatial Qualities (SSQ12)¹⁰
- ii. Cochlear Implant Quality of Life (CIQOL)¹¹
- iii. Vanderbilt Fatigue Scale (VFS)¹²
- iv. Tinnitus Handicap Inventory (THI)¹³
- v. Parents' Evaluation of Aural/Oral Performance of Children (PEACH)¹⁴
- vi. Auditory Skills Checklist (ASC)¹⁵
- vii. LittleEars¹⁶

16. Patient/family/caregiver education materials

III. Protocol(s):

1. The referral containing an audiogram less than one year old is received and reviewed by a senior CI audiologist to ensure appropriateness for scheduling.
2. If approved, patient is scheduled for a CI candidacy evaluation, imaging, speech-language evaluation (if appropriate), and consult with the implanting surgeon.
3. CI candidacy evaluation is completed.
4. If the patient is deemed to be a candidate and wishes to proceed with surgery, prior authorization is obtained from insurance and the patient is scheduled for surgery.
5. The patient returns for activation of their external speech processor approximately two weeks after surgery.
6. The patient then attends approximately three to five more appointments with the audiologist for programming and evaluation of aural rehabilitation.
7. After the programming is optimized and the patient is making adequate progress, they are monitored annually or biannually depending on patient's age and need.

IV. Procedure(s):

Cochlear Implant Candidacy Evaluation

1. A thorough chart review is completed, and a case history is collected from the patient and/or accompanying caregivers.
2. A comprehensive audiologic evaluation is conducted. Elements of the evaluation may include, but are not limited to:
 - a. Otoscopy
 - b. Tympanometry
 - c. Acoustic reflex testing
 - d. Distortion Product Otoacoustic Emissions (DPOAEs)
 - e. Pure tone air conduction
 - f. Pure tone bone conduction
 - g. Speech recognition threshold
 - h. Unaided word recognition testing
3. The patient's hearing aids are verified using real ear measurements. If a good match to NAL-NL2 targets for 60 dB SPL speech input is not obtained, clinic stock hearing aids are programmed to target for the purposes of aided testing during the appointment.
4. Aided speech recognition testing to evaluate aural (re)habilitation is completed. This is conducted using recorded stimuli presented at 60 dB SPL for measures presented in quiet and 65 dB SPL for measures presented in background noise. Calibrated stimuli is presented from a speaker positioned three feet in front of the listener. The patient is instructed to repeat the words and sentences they hear and to guess when necessary. This portion of the evaluation may include the following measures:
 - a. Word recognition testing
 - b. Sentence recognition testing in quiet

- c. Sentence recognition testing in noise
 - d. Questionnaires
- 5. The remainder of the appointment is spent counseling the patient and accompanying caregivers. Counseling topics may include but are not limited to the following topics:
 - a. Results of the assessment
 - b. Realistic expectations regarding cochlear implantation outcomes
 - c. Plan for surgery and follow-up appointments
 - d. Device manufacturers and options for selecting the CI
 - e. Discussion of other recommended services such as speech-language therapy and classroom accommodations
- 6. If the patient is determined to be a candidate for cochlear implantation, insurance prior authorization is obtained, and the patient is scheduled for surgery.

Intraoperative Cochlear Implant Testing

- 1. Audiologist is present in the operating room while the patient is implanted.
- 2. Audiologist tests the device in the box to ensure that the device was not damaged during shipment.
- 3. Once implanted, the audiologist measures electrically-evoked compound action potentials to ensure that the device is functioning and the auditory nerve is responding to stimulation prior to waking the patient from anesthesia.

Cochlear Implant Evaluation & Programming

- 1. Prior to the activation appointment, the audiologist will review the surgical report and intraoperative imaging if available to verify that the implant electrode was appropriately placed¹⁷ and that there were no surgical complications.
- 2. The audiologist will complete otoscopy to assess status of the post-surgical ear.
- 3. The audiologist will program the CI. The programming portion of the appointment is highly variable based on patient needs and test results obtained during the evaluation of aural rehabilitation portion of the appointment. Programming may include the following tasks:
 - a. Measure lower stimulation levels to ensure appropriate audibility of soft sounds.
 - b. Measure upper stimulation levels to ensure that the dynamic range is maximized.
 - i. Upper stimulation levels can be measured using loudness scaling or electrically evoked stapedial reflex threshold (ESRT) testing. ESRTs are best practice.
 - c. Fit electric acoustic stimulation (EAS) component if appropriate.
 - d. Fit and/or adjust hearing aid on the contralateral ear for bimodal patients using real ear measurements and research-based fitting targets.
 - e. Adjust other programming parameters as needed.
- 4. The patient will undergo evaluation of aural rehabilitation status to assess outcomes of their CI. Evaluation varies based upon patient age and ability level. Procedures for evaluation follow the Minimum Speech Test Battery (MSTB)¹⁸ or the Pediatric Minimum Speech Test Battery (PMSTB)¹⁹. The patient is assessed in the CI alone and best-aided conditions using recorded speech materials presented from a calibrated speaker in the sound field. Evaluation may include but are not limited to the following tasks:
 - a. Aided detection testing using frequency modulated warble tones
 - b. Word recognition testing
 - c. Sentence recognition testing
 - d. Sentence recognition testing in noise
 - e. Questionnaires

5. Patient and accompanying caregivers are counseled regarding the results, and recommendations for aural rehabilitation are made. This may include but is not limited to the following topic areas:
 - a. CI processor wear time^{20,21}
 - b. Self-guided aural rehabilitation exercises
 - c. Classroom accommodations
 - d. Speech-language evaluation/therapy
 - e. Equipment explanation/troubleshooting
 - f. Referrals to other specialties

**See Holder et al., 2022²² for greater detail regarding specific procedural guidelines*

V. Required Clinician Education/Supervision to Ensure Competency:

All new clinicians or clinicians new to cochlear implants are required to complete at least two weeks of training with a senior clinician. The senior clinician will work with the clinician to establish competency.

The audiologist must have appropriate training and demonstrate competency prior to completing CI appointments without supervision. Competency is established when the supervised clinician demonstrates the following:

1. Confident patient counseling skills and ability to build patient rapport
2. Accurate selection and administration of auditory assessments
3. Evidence-based CI programming logic
4. Integration of results with information obtained from case history and patient interview to provide overview of current level of hearing status and appropriate recommendations to support patient in achieving optimal hearing and quality of life outcomes
5. Thorough and accurate documentation
6. Timely communication and referral to other members of care team

When the supervisor determines these criteria are met, the supervised clinician is deemed competent to complete independent CI evaluation and programming appointments. If the clinician does not demonstrate competency, the supervising clinician offers feedback for methods of improvement, then they continue with supervision until the supervising audiologist feels that competency has been met. If this is not achieved within the one month of focused evaluation, the supervisor may choose to remove the clinician from this service or continue with supervised training to develop competency.

Annual competency is maintained through participation in continuing education specific to CIs, chart review, and/or direct observation by supervisor or peer.

VI. Documentation:

Results are interpreted and documented in a written report in the medical record.

Documentation may include but is not limited to the following:

1. Case history including pertinent medical, developmental, and academic history and related, ongoing services
2. Purpose of visit

3. List of equipment patient currently uses
4. Subjective observations and patient reports
5. Audiogram
6. Speech recognition testing results
7. Assessment of CI candidacy
8. Description of CI programming completed during the appointment
9. Details about program the patient uses to listen
10. Recommendations for aural rehabilitation
11. Summary of counseling completed during the appointment
12. Referrals to other providers
13. Plan for future care and follow-up

Billing/Coding:

1. CPT codes include but are not limited to:
 - a. 92567, Tympanometry
 - b. 92557, Comprehensive Audiometry
 - c. 92587, Otoacoustic Emissions
 - d. 92550, Tympanometry & acoustic reflex thresholds
 - e. 92626, Evaluation of Aural Rehabilitation
 - f. 92652, Auditory Evoked Potentials
 - g. 92603, Initial Activation > 7 years of age
 - h. 92601, Initial Activation < 7 years of age
 - i. 92604, Subsequent Reprogramming > 7 years of age
 - j. 92602, Subsequent Reprogramming < 7 years of age
2. ICD-10 codes:
 - a. H90.3, Sensorineural hearing loss, bilateral
 - b. Other ICD-10 codes may apply depending on hearing loss configuration

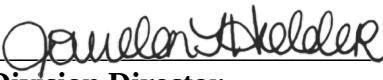
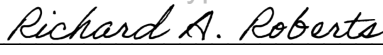
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VIII. Approval:

 _____ Division Director	<u>7/25/2022</u> Date
Type text here  _____ Vice Chair, Clinical Operations	<u>07/25/2002</u> Date