Online Session 5

Aural Hab: Child

Karen L. Anderson, PhD
Supporting Success for Children with Hearing Loss

This Week's Learning Objectives
You will be able to …

1. Describe the information that needs to be understood before cochlear implantation should be considered
2. Describe ways to address family assumptions about cochlear implant outcomes
3. Describe the work needed to develop auditory skills and benchmarks for performance
4. Describe red flags identifying issues with the cochlear implant
5. Describe issues with other implantable devices

Audiometric CI Candidacy

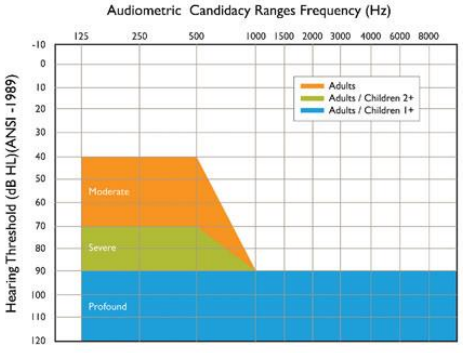


Table 1. FDA Guidelines for the Current Cochlear Implant Systems

Company	Age	Hearing Loss	Sentence Scores	Word Scores	Auditory Development	Hearing Aid Use
Advanced Bionics						
Harmony	12-23 months	Profound SNHL AU (90 db HL)			Lack of auditory development as indicated on IT-MAIS or MAIS	3 months
	2 years - 3 years, 11 months	Profound SNHL AU (90 db HL)		20% or less on MLNT (live voice)	Lack of auditory development as indicated on IT-MAIS or MAIS	6 months
	4- 17 years	Profound SNHL AU (90 db HL)	30% or less on HINT-C	12% or less on PBK		6 months
Cochlear Americas						
Freedom	12-23 months	Profound SNHL AU (90 db HL)			Lack of auditory development as indicated on IT-MAIS or MAIS	
	2 years - 4 years, 11 months	Severe to Profound SNHL AU (70 dB HL)		30% or less on MLNT (live voice)	Lack of auditory development as indicated on IT-MAIS or MAIS	
	5 - 17 years	Severe to Profound SNHL AU (70 dB HL)		30 % or less on LNT	Lack of auditory development as indicated on IT-MAIS or MAIS	
Med El						
Maestro	12 months - 4 years, 11 months	Profound SNHL AU (90 db HL at 1k Hz and above)		20% or less on MLNT	Lack of auditory development as indicated on IT-MAIS or MAIS	
	5 years to 17 years	Profound SNHL AU (90 db HL at 1k Hz and above)		20% or less on LNT	Lack of auditory development as indicated on IT-MAIS or MAIS	

Etiology Profile of CI Candidates

Pediatric Cochlear Implantation: Candidacy Evaluation, Medical and Surgical Considerations, and Expanding Criteria

Selena E. Heman-Ackah, MD, MBA[a], J. Thomas Roland Jr, MD[a], David S. Haynes, MD[b], Susan B. Waltzman, PhD[a,*]

Children's Implant Profile: Areas of Consideration Before Implantation

	Team impressions of factors important to implant use and success	No Concern	Mild to Moderate Concern	Great Concern
1	Chronological age			
2	Duration of Deafness			
3	Medical/Radiological			
4	Audiological Assessment			
5	Speech & Language Abilities			
6	Multiple handicap			
7	Family Structure & Support			
8	Educational Environment			
9	Availability of Support Services			
10	Expectations of Family/Child			
11	Cognitive Ability			
12	Learning Style			

Complications of CI

- **Complications occur in 10% of pediatric cases**
- **Complications breakdown:**
  - 50% infection in wound or OME
  - 20% hemotoma or sematoma (blood in tissues)
  - 10% CSF fistulas
  - 20% device failure

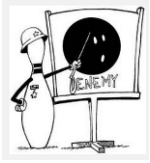
Expanding Candidacy

Implantation <12 months!

- **Speech perception testing at 9 years post-CI – scoring between 76-100%**
  - Implanted between 24-36 months = 20%
  - Implanted between 12-23 months = 38%
  - Implanted prior to 12 months = 100% (superior speech understanding!)
- **Also:**
  - R/E language skills growth similar to typically hearing
  - Receptive language growth exceeding CI at any subsequent age and commensurate with age peers.

Invisible Barriers

- **Any abnormal auditory system, even with the best technology will**
  - Not restore normal hearing levels (-10 to +10 dB)
  - Have greater speech perception, discrimination, speech processing and decreased comprehension in
    - NOISE
    - REVERBERATION
    - DISTANCE



Future of Cochlear Implants

As technology is refined,

- there [illegible] less audiological follow-up needed to p[illegible]
- H[illegible]A/CI tec[illegible]logy
- As [illegible] ch-language service[illegible] take advantage of natural lang[illegible]
- The educating o[illegible] will also change.
- will pr[illegible] teach[illegible] rather than t[illegible]
- Furt[illegible]
- [illegible]mplant centers to remain open for [illegible]ing

Automated and hea[illegible] DEVICES

Gene therapy / nerve regeneration

http://div9perspectives.asha.org/content/19/1/32.fu[illegible]

Cu[illegible]t Practices in Pediatric Cochlear Implantation, Tamala S. Bradham, Geneine [illegible] David Haynes

Make It Yours

Patient 1 - Bo: age 8 months, deaf in right ear, mild sloping to severe high frequency loss in left ear. Standard hearing aids since 6 weeks. Good family support.

Patient 2 - Sidney: age 3 years, same HL, inconsistent family support, limited language, behavior issues

2015: What could communication abilities be like?

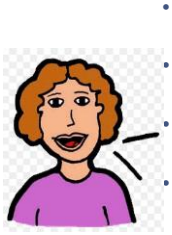
What are the hearing device options you would consider for these children?

2025: Considering the trends, what may be different about hearing device options?

How could the role of the audiologist be different?

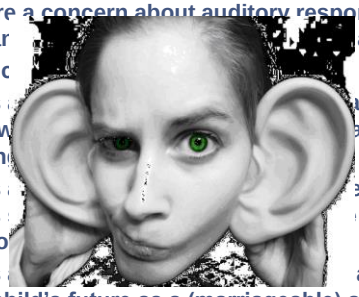
Parents are interested in CI because...

- **95% of children with hearing loss are born to families with no history of childhood HL**
- **They want the hearing loss to 'go away'**
- **They want 'the best' for their child**
- **At adulthood they want their child to be… highly educated, employable, marriable, etc.**
- **If their child is implanted, then he will be 'normal' and they won't have to do anything 'extra'**
- **'Like glasses only for ears'**



Listen for Intent

- Is there a concern about auditory response and lar aids?
- Is the c
- Is this and empow and is seekin
- Is this ent and is hard work o
- Is this about their child's future as a (marriageable) adult?
- Etc.



The Power of the Analogy

- Hearing loss is invisible
- "Language" is not inherently understood (other than i.e. "Spanish")
- Predicting language and learning delays because of this invisible barrier is often not really 'heard'
- Analogies can get effectively across the 'domino consequences' of hearing loss

think about an analogy….

- Everyone in your family for generations has been a talented skater. You believe that your child could go to the Olympics!
- You buy her skates. Will that be enough?
- You bring her to the ice rink and she puts on her skates once a month. Will that do it?
- You hire a coach with a really good reputation for training good skaters, but she misses a lot of the lessons.
- She doesn't have other people to skate with regularly or to consistently model and encourage her to use new skills.

For a child with hearing loss, getting the device is the easy part!

The Olympic Listener/Talker/Learner

Babies brains are designed to learn words, language and eventually reading. All they have to do is be exposed to speech. Babies with hearing loss need help to learn this. Lets think about an analogy….

- Everyone in your family for generations has been a talented talker. You want your child to get a good education.
- You get her hearing aids or a CI. Will that be enough?
- The hearing devices are puts on once a month. Will that do it? A couple of hours a day? All waking hours a day!
- You have an early intervention teacher with a really good reputation for working with families of children with hearing loss. YOU are people who will teach your baby to listen!
- Language is learned through overhearing and interaction!.

For a child with hearing loss, getting the device is the easy part!

Make It Yours

- Think of another analogy that would get across
  - the 'domino effect' of not addressing the hearing loss in a timely way, or
  - Why a CI isn't a 'quick fix' to the hearing world
- Be creative! There are many types of families (interests, age, ethnicity, family goals for child, etc). One analogy isn't enough.

After the CI…..

2009

Long-term predicted outcome after implantation

A. Auditory verbal/oral communicator (25%)

- children implanted under the age of three years
- developed awareness of sound within the first few weeks of implant, association of sound with events by three months, single word use with understanding and emerging phrases by one year post-implant, and use of spoken intelligible language to express needs and feelings by 24 months post-implant.
- these children became auditory verbal/oral communicators and learners within 3 years of implantation
- generally entered the mainstream for education with continued speech/language support services.

After the CI…..

Long-term predicted outcome after implantation

B. Both, auditory /oral communicator with visual assist (46%)

- encountered difficulty developing auditory and verbal/oral skills (intensive speech/language therapy & auditory training.
- association of sound with events did not develop until 6 -10 months, single-word use with understanding and emerging phrases developed by 12 -18 months, spoken intelligible language to express wants/needs by 36 months post-CI.
- became auditory verbal/oral communicators but required considerable visual assistance for learning (speechreading)
- subtle to moderate difficulties with speech and/or language development, making additional therapy necessary.
- entered a modified mainstream for education.

After the CI…..

Long-term predicted outcome after implantation

C. Complementary, auditory verbal/oral skills assist primary visual communication (29%)

- After three years of CI use, 70% maintained performance at the projected slower language development.
- Many peaked in their performance at a key word-acquisition stage and could use stereotypical phrases.
- 15% performed at B expectations. 15% became non-users
- Awareness of sound by 4 months post-CI, association of sound 6-14 months, understanding/emerging phrases around 3+ years post-CI
- CI provides added quality to life
- Benefit from DHH classes with ASL as primary mode

After the CI…..

Long-term predicted outcome after implantation

D. Does not benefit from implant

- Some children who are deaf are not CI candidates
- Usually manifest other factors as their primary impediment to learning
- Parents should be advised to weigh risk vs benefit of CI
- If such children are implanted, they should use a visual learning system as a primary teaching method.

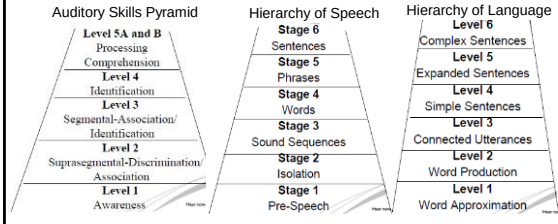
Each child must always be viewed as a unique individual.

Expected Educational Outcomes

- Many parents have a goal of full mainstreaming
- Many B candidates may require intense support services for academic support
- It is appropriate to mainstream when the child can comprehend information auditorilly and express needs and thoughts verbally.
- Mainstream can be considered 2-3 years post-CI for A candidates
- Mainstreaming is most effective when initiated in grades PS, K, 1, with kindergarten being ideal
- Specific expectations for Total Communication users vs Auditory/Oral

Specifics of What is Worked on…

- **Auditory milestones**
- **Pre-Speech, Speech, Speech Intelligibility**
- **Language** **Hierarchies!**



Expectations … Only with Teaming!

AuSpLan (Auditory Speec

Summary of a guide to expectations and aud goals for a child with a cochlear implant

Early Amplification: What to Expect

EDUCATIONAL AUDIOLOGISTS AND COCHLEAR IMPLANTS

(Approved by the Board of Directors of the Educational Audiology Association May 18, 2005)

The Educational Audiology Association believes that educational audiologists are uniquely qualified to serve as active members of cochlear implant teams during the assessment, programming, and management stages of cochlear implantation for children considering or using this device in educational programs. Children who receive cochlear implants spend a great deal of time in a structured learning environment, i.e., the formal school setting. Therefore, it is imperative that appropriate staff in the child's school system be involved from the beginning of discussions addressing the use of a cochlear implant as an option for current or prospective students. The educational audiologist is in a pivotal position to facilitate the exchange of information between the educational setting and the implant center. This collaboration is essential for making informed decisions, developing an individualized education program or family service plan that includes an emphasis on auditory skill development, and, ultimately, helping to ensure optimal use of a cochlear implant in all learning environments.

Outcomes must be monitored

Because of ongoing assessment and diagnostic therapy, the team is able to constantly monitor progress through established benchmarks.

Areas of concern or "**red flags**" may arise during this monitoring. If red flags are identified, the team may

- recommend reprogramming the device
- an integrity check of the internal equipment
- utilize behavior charts to increase the amount of time the child is wearing the device
- incorporate different therapy strategies
- increase the amount or type of therapy being provide
- add sensory modalities
- consult with colleagues or referring to other professionals.

Model of Child Aural Habilitation

Assessment

Define the impact of the hearing loss on life function
Under what situations is the child's ability to function impaired?
When/how will participation be restricted?
Talk about abilities not dB

Personal Factors – Skills
- Language use/communication
- Socialization skills
- Psychosocial/self-concept
- Additional Learning Challenges

Environmental Factors
- Speech perception under varying conditions
- Ability to attend / fatigue
- Speechreading benefit
- Accommodations currently in various environments

Get the Data

Red Flags – Abilities to Assess

Does s/he demonstrate:

- Poor speech perception of soft speech (35 dB), conversational (45-50 dB) or loud speech (70 dB)
  - Perception at 70dB should be 12% better than 50 dB
- Poor speech recognition for either/or single words and sentences (can have poor word/high sentence or vice versa)
- Inconsistent wear of technology (pops off the head piece)
- Reliance on visual cues (average cognition)
- Slow development of audition, speech, language
- Turning up volume/sensitivity (complaining of not hearing)
- Vocalization (amount/loudness) doesn't change when CI is in use (voice is quiet or whispered)

Iowa Medial Consonant Test

- Worth the time! Doing the Ling sounds and WDS te… NOT in… the cor… the chi… percep…
- Admini… from 10 feet to a friend wearing earplugs. How long did it take to do?

Also age-appropriate speech perception tests:
Age 3-5 years: NU-CHIPS (open set)
Age 6-8: PBK words
Age 9+: W-22 words
HINT Sentences, etc

Collaboration – A Necessity!

INFORMATION EXCHANGE:
Supporting the Child with a Cochlear Implant

Parent • CI Center • School • Therapist • Early Interventionist • Physician

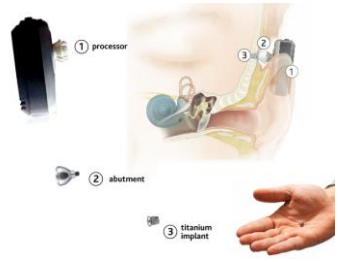
Make It Yours

Actual issue:

We have had a few students complaining about difficulties hearing their peers once FM was introduced. After researching this with Cochlear, it turns out that using the Cochlear N5 with DAi (either ML14i or euro-adapter with MLxi), raises the Threshold Sound Pressure Level (TSPL) of the CI from 25 to 35 dB. This means that the dynamic range is reduced by 10 dB. I inquired with Cochlear as to whether avoiding the DAI via the use of a MyLink would maintain the 25 dB TSPL. The answer was that the use of the MyLink changes the Instantaneous Input Dynamic Range (IIDR) to 30 which means that the TSPL is raised to 35. This makes the FM of benefit only during teacher instruction and a true barrier peer-to-peer speech. Cochlear's recommendation is to remove the receivers when the FM is not in use or when the student will rely on that 10 dB. (e.g. during quiet or distance speech using CI only). Our rep checked the repair code associated with the DAI port and there is no indication of any high repair volume related to the repeated in and out of the receivers *(meaning folks don't know to do this)*.

Whether you were an audiologist working at the schools or the CI center, what collaboration/teaming would need to occur to come up with a solution to this issue? What are some things you would need to know about the students' capabilities? Educational support? Etc.

Implantable Bone Conduction System



Bone Anchored Hearing Aids (BAHA)

- **For treatment of mixed and conductive hearing loss**
  - Air-bone gap of at least 30 dB HL
- **As with CI, it is important that the patient have realistic expectations.**

Device	BC Average (at 0.5, 1, 2, and 3k Hz.)
BAHA 3 (BP100)	≤ 45 dB HL
BAHA 3 Power (BP110)	≤ 55 dB HL
BAHA Cordelle II	≤ 65 dB HL

Candidacy

- **Conductive hearing loss**
- **Mixed hearing loss**
- **Unilateral sensorineural hearing loss (SSD)**

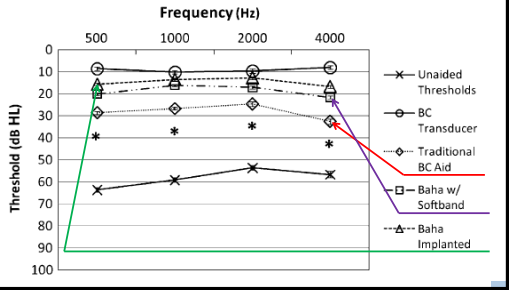
- **Can be used in younger children (under age 5) when they are too young for the surgery.**
- **Can be used with any patient if surgery is not an option or if patient isn't sure.**

Complications

- **In Europe the BAHA has been implanted successfully in children less than 3 years old however, the fixture (titanium implant) has a higher rate of fixture loss.**
- **Fixture failure rates of children < 5 years is 40%**
- **Fixture failure rates of children 5–10 years is 8%**
- **Children over the age of 10 years have 1% fixture loss**

Hearing Level and BAHA

- 2010 Arkansas study of 10 children; 6m – 16 yrs
- Figure 5. Mean threshold as a function of frequency for the unaided

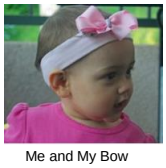


Challenge – Retention!

Hearing Henry Headband

www.hearinghenry.com
www.silkawear.com
www.meandmybow.com
www.forwerd.net

Slikawear CI Band



Me and My Bow

Forwerd

Make It Yours

- You have a mom and her active 16 month little boy come in. He is a CI user and the headpiece is continually popping off. What can you options/strategies can you suggest to mom?

Summary

- KNOW CI candidacy and red flag issues
- Use analogies to clarify understanding about cochlear implants not being a miracle fix
- Recognize the effort required to develop audition, speech, language, literacy – the CI is the easy part. Be able to pull out hierarchies!
- Be prepared to provide information to families about possible outcomes (A, B, C)
- Collaborate – you DO need to know how the child is progressing in order to validate the CI
- Support families with children – BAHA users

Consistent use of devices that provide optimal speech perception is the foundation of all auditory learning

Preview for Next Week

Working with Multicultural Families

- impact of multicultural influences on and strategies for working with families of children with hearing loss
- appropriate expectations for and use of language translators and sign language interpreters