Cochlear Implants in Children

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Hearing Impairment

- There are 28 million hearing impaired individuals in the United States

- Severe to Profound Hearing Impairment affects 500,000 to 750,000 Americans

- 33 babies are born with some form of hearing loss every day, one third of these are profoundly deaf

Source: Project HOPE, Policy Analysis Brief, April, 2000
Hearing Impairment

- 4500 infants are born each year **profoundly** deaf in the US (1/1000)
- 37,000 (6/1000) infants have significant hearing loss (>55dB)
- 90% of children with congenital hearing loss have parents with **normal** hearing
- 60% genetic, 25% environmental, 15% unknown causes
Hearing Loss

- Types of Hearing Loss
  - Conductive
  - Sensorineural
  - Mixed
  - Neural
Hearing Loss

- Degrees of Hearing Loss
  - Mild
  - Moderate
  - Severe
  - Profound
Hearing Loss

- National Institutes of Health, the American Academy of Otolaryngology/Head and Neck Surgery, and the American Academy of Pediatrics have recommended that hearing loss in infants be identified, and when possible treated, prior to 6 months of age.

- Based on studies that have shown that children identified with hearing loss prior to 6 months of age have a better chance of developing skills equivalent to their peers by the time they enter kindergarten.

- Children not identified until later (children identified at age 2 to 3 years) may ultimately suffer from irreversible and permanent impairments in speech, language, and cognitive abilities when compared to their peers.
Hearing Loss

• Infant hearing screening programs – now law in 36 states
• Simple, quick, painless and reliable
• Referral rate = ~2%
• Once identified, quality treatment and devices can be available to babies to alleviate hearing loss
  – Medical and surgical interventions
  – Hearing aids and cochlear implants
Cochlear Implants
What is a cochlear implant?

- A cochlear implant is a “TOOL” for hearing

- For adults and children who receive little to no benefit from hearing aids

- For children, a cochlear implant on its own will not allow the child to develop normal speech and language

- Family support and therapeutic intervention are vital for allowing an implanted child to hear and talk
What is a cochlear implant?

- A prosthesis which is surgically implanted into the inner ear
- External equipment for sound processing
- Components
  - Receiver/stimulator internal device
  - Speech processor
  - Microphone
  - Transmitting coil
  - Cables
  - Batteries
Internal Device

- **Receiver/ stimulator**
  - Computer chip = “The Brain”
  - Receiving coil

- **Electrode Array**
  - Number of electrodes is dependent on device/processing strategy

- **Magnet**
External Devices

- Microphone
- Transmitting Coil
- Speech Processors
  - Converts acoustical signal into a “code”
  - “Code” is transmitted to internal device
  - Based on the code, the appropriate electrodes are stimulated to represent the acoustical signal
How it works...
Cochlear Implants

Med-El

Advanced Bionics

Cochlear
“Which one is the “best” implant?”
Candidacy Criteria

- Pure Tone Audiogram Guidelines
- Adults/Children (2-17 yrs.): Severe to Profound SNHL
- Children (12-24 mos): Profound SNHL

Decibels vs. Frequency (Hz)

- 250, 500, 1000, 2000, 3000, 4000, 6000, 8000 Hz
- 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120 dB
Candidacy Criteria

- **Pediatrics**
  - Bilateral severe to profound sensorineural hearing loss
  - Appropriate amplification
  - No progress or plateau in therapy
    - Progress notes from therapist
    - No documented progress on questionnaires
  - Strong oral/auditory based communication is stressed
  - Highly motivated family with strong family support
  - No medical contraindications
  - Viable auditory nerve
Surgery
Surgery

- Uses common surgical techniques
  - “Seat” for receiver/stimulator
  - Mastoidectomy
  - Cochleostomy
  - Electrode Insertion
- General anesthesia
- Smaller incisions used for some cases
- Surgery usually less than 2 hours
- Minimal trauma and risks
- Facial nerve monitoring
Programming & Follow-up
Programming

- Routine follow-up is necessary to ensure proper functioning of cochlear implant.

- Programming entails connecting speech processor to a computer and programming interface.

- Current levels are adjusted based on each child’s individual needs.

- Children are taught to make a conditioned response to sound to let programmer know if they hear.
Therapy

- Auditory based intervention is the KEY to ensuring that an implanted child learns to hear and talk.

- Use of sign language can inhibit the development of spoken language in implanted children.

- Children should be enrolled in speech therapy/auditory training, auditory verbal therapy or oral education classroom.
Outcomes

- Many factors affect outcomes of CI’s in children
  - Age at implantation
  - Family support
  - Therapeutic and educational intervention
  - Communication methodology
  - Length of deafness
  - Age at identification
  - Etiology of hearing loss