An Overview of Candidacy Consideration for a Cochlear Implant
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Introduction
A cochlear implant (CI) is a device that changes sound from sound waves or vibrations into electrical pulses. The sound is sent directly to the inner ear to stimulate the auditory nerve and allow the recipient the possibility of perceiving sound. By transforming sound energy into electrical energy, this becomes a substitute for the function of the middle ear, cochlear motion, and sensory cells. One part of the device (cochlear implant) is surgically inserted inside the inner ear and the other part (the processor) is worn behind the ear and connects to the internal part via a magnet set in the skull.

History
In 1980, Dr William House fitted the first child, a ten year old boy, with a cochlear implant. In the last 30 years, numerous in-depth research studies have refined the candidacy criteria and continue to explore the pros and cons. Cochlear implants have evolved from a single-channel device to highly advanced microprocessor devices.

Cochlear implants are regulated by the U.S. Food and Drug Administration (FDA) and prior to commercial distribution, the procedure and equipment is evaluated for safety and efficacy in arduous and highly monitored clinical trials. As of 2000, there are four companies involved in the manufacturing of CI equipment for the use in the United States:

1. The AllHear Cochlear Implant (AllHear, Inc., Aurora, OR)
2. The Clarion Multi-Strategy Cochlear Implant System (Advanced Bionics Corporation, Sylmar, CA)
4. The Nucleus Multichannel Cochlear Implant System (Cochlear Corporation, Englewood CO)

Not all of the above mentioned devices have been FDA approved to use in the U.S. at the writing of this article. All cochlear implant systems have basically the same features in common, but may differ in how those features are designed. Further information can be obtained directly from the manufacturers.

As of December 2010, approximately 219,000 people worldwide have received cochlear implants; in the U.S., roughly 42,600 adults and 28,400 children are recipients. {1}
Criteria for Candidacy for a Child

Implant candidacy guideline criteria are continuously being examined and refined due to new technology and research outcomes. The following 2011 candidacy criteria for children are:

- **Age 12 months to 18 months old**
  - Bilateral profound hearing loss
  - Limited benefit with appropriate fit hearing aids
  - Lack of progress in auditory skill development
  - No physical contraindications for placement of the device
  - Medically cleared to undergo surgery
  - Realistic parental expectations and commitment to follow-up appointments

- **Age 18 months old and up**
  - Bilateral severe-profound hearing loss
  - Limited benefit with appropriate fit hearing aids
  - Lack of progress in auditory skill development
  - No physical contraindications for placement of the device
  - Medically cleared to undergo surgery
  - Realistic parental expectations and commitment to follow-up appointments

While these are the FDA recommended ages for implantation, they are not legally binding and some hospitals and centers in clinical trials are completing the procedure earlier based on predicted expectations of improved outcomes.

The implant centers may have additional requirements for the timeline for the use of hearing aids. Some centers will waive the extended hearing aids trial in the interest of early implantation when it is clear the child will perceive more of the sounds for speech with the implant than with a hearing aid. Also if a child is using an appropriately fitted hearing aid and has been involved in therapy to support development of listening and spoken language skills, but is not making progress at the rate expected if she or he were using an implant, then this child may be considered for implantation even if hearing levels are not profound.

There is no specific way to measure parent expectations and commitment. In general, cochlear implant teams look for families who understand that the surgery is just the beginning of a long-term process that mandates a commitment from the whole family (a sound foundation). Most centers make a concerted effort to educate the parents to understand the need to commit to necessary follow-up that includes multiple and ongoing mapping appointments, speech, language and listening habilitation appointments and an educational and home environment that is supportive of maintenance and care of the device and development of auditory access and use of speech.
Potential Benefits

Cochlear implantation is an option for those children who meet the criteria listed above, however CIs are not to be considered a cure for hearing loss, but instead a device which may give the wearer access to sound that they would not be able to access with tradition hearing aids.

- Benefits of cochlear implantation for aiding in speech perception, speech production and spoken language development of children who are pre-lingually deaf have been extensively documented.
- Another recently described disorder that has been shown to respond well to cochlear implant electrical stimulation is auditory neuropathy.

Factors That Affect Potential Benefits

Research has shown that the following factors may have an impact on the level of success a child with a CI will have:

- The right age for a child to be implanted. Information on neural plasticity and critical periods to learn speech sounds support implanting as early as possible. If auditory pathways are not stimulated early then the brain tends to reorganize and may not be able to make sense of the incoming signals.
- Children who have lost their hearing as a result of bacterial meningitis may develop calcification in the cochlear which impedes the wire from going into the cochlea space.
- Children who have used hearing aids prior to implantation tend to do better than children who have not consistently worn hearing aids before. Even if there was not functional use of hearing with hearing aids the auditory nerve maybe receiving stimulation which will support stimulation from the implant.
- Lack of follow-up and/or lack of availability of appropriate therapy and/or an education program that will support the development of listening and spoken language can have an impact on the child’s ability to use spoken language and listening. Most implant centers recommend wearing the CI for all waking hours as soon as possible and intensive post-implantation therapy to help young children to acquire speech.
- While risks related to surgery are statistically small, there are some potential risks for developing bacterial infections, suffering partial facial paralysis during surgery or complications from the anesthesia.

References


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