TITLE: Cochlear Implants for Children Aged Two Years and Younger: Comparative Clinical Effectiveness and Guidelines

DATE: 10 December 2015

RESEARCH QUESTIONS

1. What is the clinical effectiveness of unilateral or bilateral cochlear implantation in pediatric patients, aged two years and younger, with hearing impairment, compared with unilateral or bilateral cochlear implantation in pediatric patients older than two years?

2. What are the evidence-based guidelines regarding cochlear implantation in pediatric patients aged two years and younger?

KEY FINDINGS

One systematic review and eight non-randomized studies were identified regarding the clinical effectiveness of cochlear implantation in pediatric patients, aged two years and younger, with hearing impairment, compared with cochlear implantation in pediatric patients older than two years. No evidence-based guidelines were identified.

METHODS

A limited literature search, with main concepts appearing in the title, the keyword field or as a major subject heading, was conducted on key resources including Ovid Medline, PubMed, The Cochrane Library, University of York Centre for Reviews and Dissemination (CRD) databases, ECRI Institute, Canadian and major international health technology agencies, as well as a focused Internet search. Methodological filters were applied to limit retrieval to health technology assessments, systematic reviews, meta-analyses, randomized controlled trials, non-randomized studies and guidelines. Where possible, retrieval was limited to the human population. The search was also limited to English language documents published between January 1, 2010 and November 27, 2015. Internet links were provided where available.
The summary of findings was prepared from the abstracts of the relevant information. Please note that data contained in abstracts may not always be an accurate reflection of the data contained within the full article.

**SELECTION CRITERIA**

One reviewer screened citations and selected studies based on the inclusion criteria presented in Table 1.

<table>
<thead>
<tr>
<th>Table 1: Selection Criteria</th>
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<tr>
<td><strong>Population</strong></td>
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<td><strong>Intervention</strong></td>
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<td><strong>Comparator</strong></td>
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<td><strong>Outcomes</strong></td>
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<td><strong>Study Designs</strong></td>
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**RESULTS**

Rapid Response reports are organized so that the higher quality evidence is presented first. Therefore, health technology assessment reports, systematic reviews, and meta-analyses are presented first. These are followed by randomized controlled trials, non-randomized studies, and evidence-based guidelines.

One systematic review and eight non-randomized studies were identified regarding the clinical effectiveness of cochlear implantation in pediatric patients, aged two years and younger, with hearing impairment, compared with cochlear implantation in pediatric patients older than two years. No health technology assessments, randomized controlled trials, or evidence-based guidelines were identified.

Additional references of potential interest are provided in the appendix.

**OVERALL SUMMARY OF FINDINGS**

A systematic review of the literature, published in 2011,\(^1\) reported that children who received cochlear implants within the first year of life and many of those receiving implants before 18 months of age, attained a learning advantage over those who were implanted later in life. It also reported that sequential bilateral implantation, with a short interval between interventions, was advantageous.

Eight non-randomized studies were identified, and are summarized in Table 2. All studies except two\(^2,8\) indicated that children receiving cochlear implants by two years of age experienced better outcomes over time than children receiving cochlear implants at later ages.
<table>
<thead>
<tr>
<th>First author, Year</th>
<th>Intervention and Comparator</th>
<th>Outcomes</th>
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</thead>
<tbody>
<tr>
<td>Dunn, 2014⁴</td>
<td>Implantation at &lt; 2 years versus between 2 and 3.9 years</td>
<td>Impact on outcomes after 7 to 13 years of implantation. The effect on skills such as language and reading diminishes over time.</td>
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<tr>
<td>Liu, 2014³</td>
<td>Implantation at &lt; 2 years versus &gt; 2 years in children with auditory neuropathy spectrum disorder</td>
<td>Impact on outcomes after 12-84 months of implantation. Children receiving implants at &lt; 2 years of age acquired better auditory and speech skills than those implanted at &gt; 2 years of age.</td>
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<tr>
<td>Ramos-Macias, 2014⁵</td>
<td>Sequential bilateral implantation at &lt; 2 years (with interplant period of ≤ 4 years) versus implantation between 3 to 5 years;</td>
<td>Impact on outcomes at 12 years of age. Audiology, language development, and linguistic competence were better for the younger group.</td>
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<tr>
<td>Geal-Dor, 2013⁵</td>
<td>Implantation at &lt; 2 years versus between 2 and 6 years</td>
<td>Time of outcome measurements not reported in abstract. Younger children achieved auditory milestones later than children implanted in the older group.</td>
</tr>
<tr>
<td>Guerra-Jimenez, 2013⁶</td>
<td>Sequential bilateral implantation at &lt; 2 years (with interplant period of ≤ 4 years) versus &gt; 2 years</td>
<td>Impact on outcomes at 12 years of age. Better verbal discrimination for the children implanted at &lt; 2 years, with interplant period of ≤ 4 years.</td>
</tr>
<tr>
<td>Tobey, 2013⁷</td>
<td>Implantation at &lt; 2.5 years versus between 2.5 and 5 years</td>
<td>Impact on outcomes after 4, 5, and 6 years of implantation. Higher levels of performance with earlier implantation group; after 6 years of implantation language outcomes associated with the 2 groups were variable.</td>
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<tr>
<td>Szagun, 2012⁸</td>
<td>Implantation at &lt; 2 years versus between 2 and 3.5 years</td>
<td>Impact on outcomes after 12, 18, 24, and 30 months of implantation. No overall effect of age at implantation; children with early implantation showed marked progress early, while those with later implantation progressed later on.</td>
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<tr>
<td>Colletti, 2011⁹</td>
<td>Implantation at 2 to 11 months versus 12 to 23 months versus 24 to 35 months</td>
<td>Impact on outcomes after 12 to 36 months of implantation. Youngest group had better auditory performance than the older groups. Impact on outcomes after 5 and 10 years of implantation. Youngest group had significantly better grammar skills and cognitive performances than the older groups.</td>
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</table>
REFERENCES SUMMARIZED

Health Technology Assessments
No literature identified.

Systematic Reviews and Meta-analyses

   PubMed: PM22287820

Randomized Controlled Trials
No literature identified.

Non-Randomized Studies

   PubMed: PM24231628

   PubMed: PM25194855

   PubMed: PM25455526

   PubMed: PM24063769

   PubMed: PM24148805

   PubMed: PM23448124


Guidelines and Recommendations
No literature identified.

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APPENDIX – FURTHER INFORMATION:

Systematic Reviews – Uncertain Comparator


Non-Randomized Studies – Alternate Comparator


Non-Randomized Studies – Safety


Non-Randomized Studies – Additional Considerations


Guidelines and Recommendations – Methodology not Specified


Additional References