Bilateral cochlear implants: first CI under 12 months

A/Prof Catherine Birman MBBS PhD FRACS GAICD
Medical Director SCIC
SCIC: Australia’s largest CI program
A whole of life hearing implant program
Disclaimer

• Trial device safety committee member- Cochlear Pty Ltd (not relevant to presentation)

• Research funding and support as Primary Investigator at SCIC-NHMRC, GPRWMF, Cochlear Pty Ltd (not relevant to presentation)
Acknowledgements: SCIC team, patients and their families; co-authors- Drs Nadia Ashraf, Halit Sanli
SCIC the first 3 decades 1984-2014: (n=4009 CIs)
First side CI. Changing demographics

Children receive their cochlear implant at an earlier age over each decade.
The reason for CI in young children

- Neural plasticity for the auditory pathway wains over time
- Yoshinago-Itano (1998) access to language under 6 months, gave better language outcomes

→ early access to hearing language the better through CI

www.edinformatics.com
Lochi study 5 year outcomes

N=104 CI patients (350 HL patients in study)

TYC Ching et al 2017

TABLE 4 Group With CIs

<table>
<thead>
<tr>
<th>Age at CI Activation</th>
<th>Estimate and 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 → 12</td>
<td>-10.8 (-22.3 to 0.8)</td>
</tr>
<tr>
<td>12 → 18</td>
<td>-6.2 (-9.3 to -3.1)</td>
</tr>
<tr>
<td>18 → 24</td>
<td>-4.4 (-8.6 to -0.1)</td>
</tr>
</tbody>
</table>

The estimated effect size and 95% CI in the mean global language score associated with the stated change in the age at intervention (e.g., "compared with CI activation at 6 mo, activation at 12 mo" is expressed as “6 → 12”), if the other predictor variables are constant.
Lochi study 5 year outcomes

N=104 CI patients (350 HL patients in study)

TYC Ching et al 2017
Lochi study 5 year outcomes

N=104 CI patients (350 HL patients in study)

TYC Ching et al 2017
For babies- objective assessment of functional hearing with hearing aids: aided cortical testing

- **HEARLab**- developed by Australian Hearing
  - Aided cortical assessment
  - Cortical threshold estimation

- Four speech stimuli with low (/m/), medium (/g/), high (/t/) and very high (/s/) frequency presented at 55, 65 and 75 dB SPL
Bilateral input is best

Binaural summation

Better hearing in noise
Bilateral input is best

Removes the head shadow effect

Sound localisation
Bilateral CI recipients who received the first CI at ≤12 months’ of age

C.S Birman, N. Ashraf, H. Sanli

- Database and chart review prior to 2017 for children receiving their first CI ≤12 months of age, and either simultaneous or sequential second side CI
- Variable numbers who have had each test
- In Australia we have Federally funded hearing aids for all children under 26- so the contralateral ear had a hearing aid, before the sequential CI.

- N= 147
  - 71 simultaneous CI
  - 76 sequential CI
- F n=65 (44%), M n=82 (56%)
- No developmental delay or CMV or syndrome= 117 (80%)
- Developmental delay or CMV or syndrome= 30 (20%)
- Years between implants:
  - Mean= 2.6 (SD 2.8)
  - Median 1.4 (LQ 0.6, UQ 3.4)
Age at first implant- for both simultaneous and sequential groups

Distribution of AGE_at_Implant_Months_
No statistical difference
Preschool Language Score V - receptive - over time

No significant difference
Preschool Language Score V - receptive- sequential, simultaneous, developmental delay groups

No significant difference
Preschool Language Score- expressive- sequential vs simultaneous

No significant difference
Preschool Language Score - expressive-3 groups

No significant difference
@5 years old: Preschool Language Score V receptive

$r_s = -0.15$
$p = 0.32$
$n = 46$
@5 years old: Preschool Language Score V expressive

$r_s = -0.09$

$p = 0.56$

$n = 47$
Manchester Junior Word scores at 5 years- first ear & second ear

<table>
<thead>
<tr>
<th></th>
<th>1st</th>
<th>2nd</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>19</td>
<td>16</td>
</tr>
<tr>
<td>Mean</td>
<td>77%</td>
<td>66%</td>
</tr>
</tbody>
</table>

No statistical significance
CNC/ CVC word scores at 5 years-
simultaneous; sequential- first ear& second ear

<table>
<thead>
<tr>
<th></th>
<th>1st</th>
<th>2nd</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>n</strong></td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td>67%</td>
<td>59%</td>
</tr>
</tbody>
</table>

No significant difference
BKB sentence scores at 5 years simultaneous; sequential first and second ear

<table>
<thead>
<tr>
<th></th>
<th>1st</th>
<th>2nd</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>17</td>
<td>11</td>
</tr>
<tr>
<td>Mean</td>
<td>87%</td>
<td>76%</td>
</tr>
</tbody>
</table>

No significant difference
Speech perception @5 years

5 year outcomes for first and second ears
## Diagnostic Evaluation of Articulation and Phonology

### Mean Scores

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simultaneous @ 5 years</td>
<td>8</td>
<td>70</td>
</tr>
<tr>
<td>Sequential @ 5 years</td>
<td>19</td>
<td>66</td>
</tr>
<tr>
<td>Sequential @ 9 years</td>
<td>7</td>
<td>76</td>
</tr>
<tr>
<td>Delay group @ 5 years</td>
<td>5</td>
<td>42</td>
</tr>
<tr>
<td>Delay group @ 9 years</td>
<td>1</td>
<td>18</td>
</tr>
</tbody>
</table>
5 years old - Peabody Picture Vocabulary Test-IV

$r_s = -0.29$
$p = 0.08$
$n = 38$
SSQ for parents n=43

Speech
- Mean: 6.8, 95%CI [6.3,7.3]
- Time between implants: $r_s = -0.01$, $p = 0.9$

Spatial
- Mean: 6.2, 95%CI [5.5,7.0]
- Time between implants: $r_s = -0.13$, $p = 0.38$

Quality
- Mean: 7.5, 95%CI [7.1,7.9]
- Time between implants: $r_s = 0.01$, $p = 0.9$

$r_s = $ Spearmann correlation coefficient
SSQ for parents
Conclusions

- Receiving a CI under 12 months, affords great protection ensuring good language learning.
- Sequential CIs were often provided within a few years of the initial CI.
- In Australia we have Federally funded hearing aids for all children under 26-so for most children the contralateral ear had a hearing aid, before the sequential CI.
- No statistical significance between the simultaneous and sequential language outcomes at 5 years.
- Developmental delay affects language outcomes, but the data may not show this fully as more delayed children could not perform the tests.
- Limitations- some tests had limited data points; Limited numbers only in more recent decades have bilateral implants been able to be provided.
Thank you
Thank you