Cochlear implantation for children with cochlear nerve deficiency: mapping characteristics

Disclosures

• Lisa Park and Margaret Dillon: research grant through Med El
• Kevin Brown: surgical advisory board for Med El
Background

• More and more children with cochlear nerve deficiency (CND) are being implanted
• A variety of electrodes and surgical techniques are available for implanting more challenging anatomy
• Very little is known about mapping techniques or optimal parameters for this population
Methods

• Retrospective review of 56 ears with CND
• CND was diagnosed using both MRI and CT scans
• Mapping characteristics were analyzed (as applicable by brand)
  • Disabled electrodes
  • Pulse width
  • Pulse rate
  • Maxima
  • Strategy
  • Map law compression
  • Input characteristics
• Characteristics were compared to default settings recommended by manufacturers
• Most recent mapping information was used
Patient Demographics

- All three manufacturers
  - 80% Cochlear; 16% Med El; 4% Advanced Bionics
- Children were implanted from 0-18 years of age
- Use of implant >6 months

<table>
<thead>
<tr>
<th>Nerve Status</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Absent</td>
<td>15</td>
</tr>
<tr>
<td>Hypoplastic</td>
<td>17</td>
</tr>
<tr>
<td>Questionable</td>
<td>28</td>
</tr>
</tbody>
</table>
Disabled Electrodes

- On average, children with CND have 27% of their array disabled
- 23% have over half of their array disabled
- Most common reason for disabling electrode is lack of sound perception on that electrode
- 25% of children have extracochlear electrodes
Malformation and disabled electrodes

- It is not uncommon for children with CND to also present with cochlear malformations.
- Of the population in this study, 65% presented with cochlear malformation as well as CND.
- Malformation of the cochlea may affect how or why electrodes are disabled.
- Extracochlear electrodes were found to be a result of cochlear malformation rather than related to CND.

[Graph showing CND vs CND + Malformation]
Manufacturer defaults used

• Cochlear:
  • Pulse width: contoured arrays=25; slim straight arrays=37
  • Pulse rate: 900
  • Maxima: 8
  • Strategy: ACE

• Med El:
  • Pulse rate: use maximal available stimulation rate
  • Map Law Compression: 500
  • Strategy: FS4, FSP

• Advanced Bionics
  • Pulse width: APWII
  • Strategy: any HiRes strategy
Mapping Characteristics

- 91% of children with CND have at least one mapping characteristic adjusted from default settings
- Three most common changes found to be: pulse rate, pulse width, and strategy
Cochlear Recipients

• N=45
• 82% wider pulse width
• 73% slower pulse rate
• 22% change in strategy
• 36% adjusted maxima
• 82% have at least one electrode disabled
• 18% have over half of their array disabled
Med El Cochlear Implants

- N=9
- 33% change in strategy
- 22% reduced pulse rate
- 33% change in map law
- 44% have at least one electrode disabled
- 0% have more than half their array disabled
Advanced Bionics Recipients

• N=2
• 100% wider pulse width
• 50% change in strategy
• 50% have at least one electrode disabled
• 0% have more than half their array disabled
Conclusion

• No consistent “CND” map
• Mapping characteristics will be variable and are likely to differ from manufacturer’s defaults

• When mapping patients with CND:
  • Consider a slower pulse rate and/or wider pulse width
  • Check for sound perception across electrode array

• Changes made:
  • Improve audibility
  • Attempt to increase speech perception abilities
    • Trend of improvement noted
  • For patient comfort
  • Due to compliance concerns
UNC Cochlear Implant Team

Physicians
• Kevin Brown, MD, PhD
• Matthew Dedmon, MD, PhD
• Lauren Kilpatrick, MD
• Brendan O’Connell, MD
• Harold Pillsbury, MD
• Carlton Zdanski, MD

Adult Audiologists
• English King, AuD
• Andrea Bucker, AuD
• Ellen Deres, AuD
• Sarah McCarthy, AuD
• Adrienne Pearson, AuD
• Kristen Quinones, AuD
• Allison Young, AuD

Research
• Emily Buss, PhD
• Margaret Dillon, AuD
• Douglas Fitzpatrick, PhD
• John Grose, PhD
• Lisa Park, AuD
• Meredith Rooth, AuD

Pediatric CI Audiologists
• Melissa Auchter, AuD
• Erika Gagnon, AuD
• Elizabeth Preston, AuD
• Jennifer Woodard, AuD

Pediatric Audiologists
• Danielle Doyle, AuD
• Shana Jacobs, AuD
• Sarah Martinho, AuD
• Marisa Marsteller, AuD
• Laurel Okulski, AuD
• Jill Ritch, AuD
• Patricia Roush, AuD
• Kaylee Watson, AuD
• Molly Widney, AuD

NIH T-32 Research Fellow
• Michael Canfarotta, MD

Neurotology Fellows
• Nofrat Schwartz, MD
• Morgan Selleck, MD

Speech-Language Pathologists
• Hannah Eskridge, MSP
• Maegan Evans, PhD
• Sandra Hancock, MS
• Lillian Henderson, MSP
• Christine Kramer, MS
• Erin Thompson, MS

Research Assistants
• Kaylene King, BA
• Margaret Richter, BA
• Madeleine Barclay, BA

Coordinators
• Joshua Light, BS
• LeSonia Mason
Thank you

16th International Conference on Cochlear Implants and Other Implantable Technologies
March 18-21, 2020

www.ci2020orlando.org
#CI2020International