Impact of Cochlear Implants on Cognition in Older Adults

Richard K. Gurgel, MD, University of Utah Otolaryngology
Disclosures

• Surgical advisory board for Med-El

• Research funding from the American Otological Society, Cochlear Corporation, Advanced Bionics
• AD accounts for 60-70% of all dementia
• Memory loss
• Language, disorientation, mood swings, depression, self care, behavior
The Problem

Brain Atrophy in Advanced Alzheimer’s Disease

Normal

AD
• Incidence of Alzheimer's disease is rapidly increasing:
  • 2010: 4.7 million
  • 2050: 13.8 million
• Genetics: APOE-ε4, Trisomy 21
• Cardiovascular
• Head Injury
• Depression
• Hearing loss?
• Hearing loss is one of the most prevalent sensory neurologic deficits in the elderly
  – 25-40% in adults above 65 years old
  – >80% in people older than 85 years
Central Auditory Dysfunction as a Harbinger of Alzheimer Dementia

George A. Gates, MD; Melissa L. Anderson, MS; Susan M. McCurry, PhD; M. Patrick Feeney, PhD; Eric B. Larson, MD, MPH

Hearing Loss and Cognition in the Baltimore Longitudinal Study of Aging

Frank R. Lin
Johns Hopkins University

Luigi Ferrucci, E. Jeffrey Metter, Yang An, Alan B. Zonderman, and Susan M. Resnick
National Institute on Aging, Baltimore, Maryland

ONLINE FIRST

Hearing Loss and Cognitive Decline in Older Adults

Frank R. Lin, MD, PhD; Kristine Yaffe, MD; Jin Xia, MS; Qian-Li Xue, PhD; Tamara B. Harris, MD, MS; Elizabeth Purchase-Helzner, PhD; Suzanne Satterfield, MD, DrPH; Hilsa N. Ayonayon, PhD; Luigi Ferrucci, MD, PhD; Eleanor M. Simonsick, PhD; for the Health ABC Study Group
**Relationship of Hearing Loss and Dementia: A Prospective, Population-Based Study**

*Richard Klaus Gurgel, *Preston Daniel Ward, †Sarah Schwartz, †‡§Maria C. Norton, ||Norman L. Foster, and †§JoAnn T. Tschanz

- Cache County Study on Memory, Health, and Aging
- Began in 1995
- ≥ 65 years old
- 90% of residents enrolled
Results

• 4,463 subjects
  – 836 with hearing loss (HL)

• Subjects with HL
  – 16.3% developed dementia vs. 12.1% without HL (p<0.001)

• Mean time to dementia
  – 10.3 years HL vs. 11.9 years without HL (p<0.001)
Straining to Hear and Fend Off Dementia

By KATHERINE BOUTON
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Alzheimer’s Disease and Dementia ARE YOU AT RISK?

Have you noticed a change in your ability to remember?
Neuro-biological

Cognitive Overload

Psychosocial
Overall Goal:

• Is hearing loss a *remedial* risk factor for dementia?

• Hearing loss may be one of the few late-life modifiable risk factors
Practical Application

• If you had an older patient with hearing loss and you could intervene, you may make a difference in their cognition.

• Possibility to change practice and policy
  – President’s Council of Advisors on Science and Technology Report on hearing loss and hearing technologies, July 2015.
• Evaluating the cognitive impact of cochlear implantation in older adults
University of Utah: 150 per year, ~30% in >65 years old
Differential Cochlear Implant Outcomes in Older Adults

Daniel S. Roberts, MD, PhD; Harrison W. Lin, MD; Barbara S. Herrmann, PhD; Daniel J. Lee, MD
Cochlear Implantation in the Octogenarian and Nonagenarian

Matthew L. Carlson, Joseph T. Breen, Rene H. Gifford, Colin L. W. Driscoll, Brian A. Neff, Charles W. Beatty, Anna Mary Peterson, and Amy P. Olund

FIG. 3. Preoperative and postoperative (≥6 mo) audiometric results using AzBio (A), CNC (B), and BKB-SIN testing (C) among patients between the ages of 18 and 79 years (black) compared with those 80 years or older (gray).
Original Investigation

Improvement of Cognitive Function After Cochlear Implantation in Elderly Patients

Isabelle Mosnier, MD; Jean-Pierre Bebear, MD; Mathieu Marx, MD, PhD; Bernard Fraysse, MD; Eric Truy, MD; Geneviève Lina-Granade, MD; Michel Mondain, MD, PhD; Françoise Sterkers-Artières, MD; Philippe Bordure, MD; Alain Robier, MD; Benoît Godey, MD, PhD; Bernard Meyer, MD; Bruno Frachet, MD; Christine Poncet-Wallet, MD; Didier Bouccara, MD; Olivier Sterkers, MD, PhD

Published online March 12, 2015.
- 94 patients
- Ave. age 72, range, 65-85 years; median, 71 years
- Neurelec, 29 patients MED-EL, 26; Cochlear, 23; and Advanced Bionics, 17
<table>
<thead>
<tr>
<th>Cognitive Test</th>
<th>Before, Mean (SD)</th>
<th>Group (No.)</th>
<th>6-mo Mean (SD)</th>
<th>Differences, Mean (95% CI)</th>
<th>P Value(^b)</th>
<th>12-mo Mean (SD)</th>
<th>Differences, Mean (95% CI)</th>
<th>P Value(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMSE</td>
<td>22.1 (3.4)</td>
<td>Abnormal (13)</td>
<td>25.8 (2.7)</td>
<td>3.7 (0.6 to 6.8)</td>
<td>.02</td>
<td>26.3 (2.7)</td>
<td>3.8 (1.0 to 6.6)</td>
<td>.01</td>
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<tr>
<td></td>
<td>27.8 (1.7)</td>
<td>Normal (81)</td>
<td>27.9 (1.8)</td>
<td>0.04 (-0.4 to 0.5)</td>
<td>.85</td>
<td>28 (1.8)</td>
<td>0.2 (-0.3 to 0.6)</td>
<td>.45</td>
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<tr>
<td>FWT(^c)</td>
<td>8.2 (3.2)</td>
<td>Abnormal (22)</td>
<td>9.6 (0.1)</td>
<td>1.4 (0.5 to 2.3)</td>
<td>.004</td>
<td>9.4 (0.7)</td>
<td>1.3 (0.6 to 1.9)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>10.0 (0.0)</td>
<td>Normal (72)</td>
<td>9.7 (0.1)</td>
<td>-0.4 (-0.6 to -0.1)</td>
<td>.002</td>
<td>9.7 (0.8)</td>
<td>-0.7 (-0.7 to -0.2)</td>
<td>.002</td>
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<tr>
<td>Clock-drawing test(^d)</td>
<td>2.5 (0.6)</td>
<td>Abnormal (4)</td>
<td>3.3 (0.6)</td>
<td>0.7 (-0.8 to 2.1)</td>
<td>.018</td>
<td>4 (2.6)</td>
<td>1.3 (-6.3 to 9.0)</td>
<td>.53</td>
</tr>
<tr>
<td></td>
<td>6.1 (0.9)</td>
<td>Normal (90)</td>
<td>6.1 (1.0)</td>
<td>0 (-0.3 to 0.3)</td>
<td>1.0</td>
<td>6.3 (0.9)</td>
<td>0.2 (0.03 to 0.4)</td>
<td>.046</td>
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<td>d2 Test (errors)(^e)</td>
<td>27.7 (9.0)</td>
<td>Abnormal (11)</td>
<td>21.0 (14.5)</td>
<td>-6.6 (-18.3 to 5.0)</td>
<td>.23</td>
<td>9.4 (7.1)</td>
<td>-18.3 (-25.3 to -11.9)</td>
<td>&lt;.001</td>
</tr>
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<td>6.2 (4.7)</td>
<td>Normal (80)</td>
<td>6.2 (6.2)</td>
<td>-0.2 (-1.8 to 1.4)</td>
<td>.82</td>
<td>5.7 (5.6)</td>
<td>-0.6 (-2.1 to 0.8)</td>
<td>.37</td>
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<tr>
<td>d2 Test of attention (speed)(^e)</td>
<td>276 (62.8)</td>
<td>Abnormal (39)</td>
<td>321 (79.0)</td>
<td>46.4 (13.0 to 79.8)</td>
<td>.008</td>
<td>342 (81.7)</td>
<td>60.1 (30.5 to 89.6)</td>
<td>&lt;.001</td>
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<tr>
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<td>429 (81.2)</td>
<td>Normal (52)</td>
<td>411 (82.0)</td>
<td>-19.3 (-44.4 to 4.7)</td>
<td>.11</td>
<td>409 (76.5)</td>
<td>-19.6 (-42.8 to 3.6)</td>
<td>.09</td>
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<td>TMT-A(^i)</td>
<td>77.3 (43.0)</td>
<td>Abnormal (19)</td>
<td>60.2 (14.1)</td>
<td>-17.9 (-39.7 to 3.8)</td>
<td>.09</td>
<td>52.2 (11.3)</td>
<td>-25.1 (-46.3 to -3.9)</td>
<td>.02</td>
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<td>43.8 (10.9)</td>
<td>Normal (74)</td>
<td>43.1 (12.8)</td>
<td>0.01 (-3.2 to 3.2)</td>
<td>.99</td>
<td>44.3 (12.6)</td>
<td>1.2 (-1.9 to 4.4)</td>
<td>.43</td>
</tr>
<tr>
<td>TMT-B(^i)</td>
<td>181 (56.0)</td>
<td>Abnormal (23)</td>
<td>152 (64.7)</td>
<td>-29.5 (-55.9 to -3.9)</td>
<td>.03</td>
<td>142 (65.9)</td>
<td>-32.5 (-61.5 to 3.6)</td>
<td>.03</td>
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<td>105 (33.9)</td>
<td>Normal (68)</td>
<td>106 (41.2)</td>
<td>2.7 (-5.9 to 11.3)</td>
<td>.52</td>
<td>111 (46.7)</td>
<td>4.9 (-4.6 to 14.5)</td>
<td>.30</td>
</tr>
</tbody>
</table>
Figure 3. Mean Scores of the 6 Subdomains of the Nijmegen Cochlear Implant Questionnaire (NCIQ) Before and After Cochlear Implantation
Future Directions

• Prospective clinical trials:
  • University of Utah; Antwerp Belgium
• Cognitive testing develop for hearing impaired individuals
• Increasing awareness of CI among older adults
• Hearing loss is associated with cognitive decline in older adults
• Hearing loss may be a remedial risk factor for dementia
• Current efforts are underway to understand the association
Thank you