Neuropsychological Evaluation of the Cognitive Correlates of Epilepsy

Gayle Deutsch, PhD, ABPP
Stanford University Medical Center
Department of Neurology and Neurological Sciences
Different Approaches to the Brain and its Disorders

- Neurology
- Neuropsychology
- Neurosurgery
- Psychology
- Psychiatry
Definition

• Study of brain-behavior relationships
• Evaluation of the effects of cerebral dysfunction on mental performance and behavior.
  – Standardized instruments
  – Interpretation using a normative data base
Neuropsychology Test Battery

- Cognitive Domains Assessed
  - Intelligence
  - Achievement
  - Learning and Memory
  - Language
  - Attention
  - Executive Function
  - Motor Function
Phineas Gage

<table>
<thead>
<tr>
<th>Born</th>
<th>July 9?, 1823</th>
</tr>
</thead>
<tbody>
<tr>
<td>Died</td>
<td>May 21?, 1860</td>
</tr>
<tr>
<td>Occupation</td>
<td>Railroad construction</td>
</tr>
</tbody>
</table>
Frontal Lobes

- Anterior premotor cortex (BA 8)
- Premotor cortex (BA 6)
- Primary motor cortex (BA 4)
- Dorsolateral prefrontal cortex (BA 9/46)
- Lateral frontopolar cortex (BA 10)
- Ventral anterior premotor cortex (BA 44/6)
- Ventrolateral prefrontal cortex (BA 47/45/44)

Anterior: Rostral; Posterior: Caudal

TRENDS in Cognitive Sciences
Executive Functions

- Working Memory
- Conceptual Reasoning
- Planning
- Set-Shifting
- Multi-tasking
- Inhibition
- Fluency
Children with Frontal Lobe Seizures

Can neuropsychologists measure cognitive functioning in these children?
Children with Frontal Lobe Seizures

• Deficits in planning and impulse control (Culhane-Shelburne et al. 2002 JINS).

• Deficits in planning and motor coordination (Hernandez et al. 2002 Neuropsychologia).

• Deficits in speed of shifting mental set and perceptual motor speed (Sinclair et al. 2004 Pediatr Neurol).
Seizure Variables to Consider

• Age of Seizure Onset
  – Early age of onset

• Duration of seizures
  – Longer seizure duration

• Seizure Frequency
  – Greater number of seizures
Frontal Lobe Epilepsy and Academic Ability

Do frontal lobe seizures affect reading???
Epilepsy and Learning Disabilities

• Prevalence of learning disabilities ranges from 2% to 10% in children.

• Prevalence of learning disabilities in children with epilepsy is 25%.
Reading and the Brain
Phonological Awareness

Sensitivity to the sound structure of words

• Rhyming
  Take  Cake

• Phoneme Segmentation
  Bold  Old

• Blending Phonemes
  Tuh  Oy  TOY
## Reading Measures

<table>
<thead>
<tr>
<th>Nonwords</th>
<th>Irregular Words</th>
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<tbody>
<tr>
<td>– ib</td>
<td>– yacht</td>
</tr>
<tr>
<td>– gat</td>
<td>– subtle</td>
</tr>
<tr>
<td>– sluck</td>
<td>– debris</td>
</tr>
<tr>
<td>– maut</td>
<td>– island</td>
</tr>
</tbody>
</table>
Reading Performance in Children with Frontal Lobe Epilepsy

- Children with frontal lobe seizures (n = 10), temporal lobe seizures (n = 10), and absence seizures (n = 10) were compared on tasks of phonological awareness and reading.
- Mean age 10.1 years

Vanasse, et al. 2005 Epilepsy & Behavior
Reading in Children with Epilepsy

Vanasse, et al. 2005 Epilepsy & Behavior
### Phonological Awareness in Children with Epilepsy

<table>
<thead>
<tr>
<th>Metaphonological tasks</th>
<th>Epileptic group</th>
<th>Control groups</th>
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<tbody>
<tr>
<td></td>
<td>Nonword repetition</td>
<td>Rhyme production</td>
</tr>
<tr>
<td></td>
<td>TLE (left/right)</td>
<td>79.5 (82.2/68.8)</td>
</tr>
<tr>
<td></td>
<td>FLE (left/right)</td>
<td>75.8 (75.3/77.5)</td>
</tr>
<tr>
<td></td>
<td>ABS</td>
<td>83.8</td>
</tr>
<tr>
<td></td>
<td>Rhyme production</td>
<td>89 (91.3/80)</td>
</tr>
<tr>
<td></td>
<td>TLE (left/right)</td>
<td>75.7 (73.4/85)</td>
</tr>
<tr>
<td></td>
<td>FLE (left/right)</td>
<td>90.3</td>
</tr>
<tr>
<td></td>
<td>ABS</td>
<td>92.35</td>
</tr>
<tr>
<td></td>
<td>Phonemic blending</td>
<td>90.8 (91.6/87.5)</td>
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<tr>
<td></td>
<td>TLE (left/right)</td>
<td>74.4&lt;sup&gt;a&lt;/sup&gt; (72.2/83.4)</td>
</tr>
<tr>
<td></td>
<td>FLE (left/right)</td>
<td>92.9</td>
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<tr>
<td></td>
<td>ABS</td>
<td>97.36</td>
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<tr>
<td></td>
<td>Phonemic segmentation</td>
<td>86.3 (91.5/65.7)</td>
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<tr>
<td></td>
<td>TLE (left/right)</td>
<td>79.2 (77.1/87.6)</td>
</tr>
<tr>
<td></td>
<td>FLE (left/right)</td>
<td>81.1&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>ABS</td>
<td>91.28</td>
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<tr>
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<td>Phonemic inversion</td>
<td>85.8 (91.6/62.5)</td>
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<tr>
<td></td>
<td>TLE (left/right)</td>
<td>69.2&lt;sup&gt;a&lt;/sup&gt; (63.6/91.7)</td>
</tr>
<tr>
<td></td>
<td>FLE (left/right)</td>
<td>83.1</td>
</tr>
<tr>
<td></td>
<td>ABS</td>
<td>91.66</td>
</tr>
<tr>
<td></td>
<td>ABS</td>
<td>91.66</td>
</tr>
</tbody>
</table>

<sup>a</sup> $P < 0.05.$

Vanasse, et al. 2005 Epilepsy & Behavior
Importance of Early Identification and Intervention

• “Wait … They Will Catch Up”
• Explicit Training in Phonological Awareness Skills
• Intervention – Frequent, Regular, and Sufficient Duration
• Resources
  – Overcoming Dyslexia by Sally Shaywitz
  – Schwab Learning www.schwablearning.org
  – Learning Disabilities Association of America www.ldanatl.org
Conclusions

• Neuropsychology plays an important role in furthering our knowledge of brain function.
• The neuropsychological evaluation is useful in measuring behavior in individuals with epilepsy.
• Children with epilepsy are at risk for academic problems.
Questions