CORPUS CALLOSOTOMY FOR PEDIATRIC EPILEPSY SURGERY

Dr. Nguyen Ngoc Pi Doanh
Pediatric Neurosurgery Department
• Epilepsy in children
• Treatment of Intractable Epilepsy in Children
• Corpus Callosum
• Corpus Callosotomy
• Researches
• Indication
PEDIATRIC EPILEPSY

- Seizures: # 10% of children → 1/3 epilepsy
- General seizures: 45.4% (51% idiopathic, 36% cryptogenic)
  
  (ILAE Classification 2010)

- Epilepsy Syndromes:
  - Seizure Syndromes with onset in the first year of life
  - Lenox-Gastaut Syndrome.
  - Landau-Kleffner Syndrome.
  - ...
10-40% pediatric patients: *intractable seizure*. 
→ impair cognitive and psychosocial development.

**Medical Intractable Epilepsy:**
- Inadequate seizure control $\geq 2$ EADs 18-24 months.
- Adequate seizure control with unacceptable drug-related side effect.
PEDIATRIC EPILEPSY
Diagnostic Work-up

- EEG and Video EEG
- Neuroimaging:
  - CT/ MRI
  - PET/ SPECT
- Functional MRI
- Wada test
- Neurocognitive testing

EPILEPSY SURGERY TEAM
  - Epileptologists
  - Neurosurgeons
  - Radiologists
  - EEG technicians
  - Neuropsychologists
  - Pediatricians
  - Therapists
  - ....
Corpus Callosum

- 200 M fibers
Neuropsychological Profile of Agenesis of the Corpus Callosum: A Systematic Review

Vanessa Siffredi, Vicki Anderson, Richard J. Leventer & Megan M. Spencer-Smith

The Role of Corpus Callosum Development in Functional Connectivity and Cognitive Processing


The Role of the Corpus Callosum in Interhemispheric Transfer of Information: Excitation or Inhibition?

Jilliana S. Bloom, George W. Hynd
OF TWO MINDS  Experiments with split-brain patients have helped to illuminate the lateralized nature of brain function.

Split-brain patients have undergone surgery to cut the corpus callosum, the main bundle of neuronal fibres connecting the two sides of the brain.

A word is flashed briefly to the right field of view, and the patient is asked what he saw.

Now a word is flashed to the left field of view, and the patient is asked what he saw.

Because the left hemisphere is dominant for verbal processing, the patient’s answer matches the word.

The right hemisphere cannot share information with the left, so the patient is unable to say what he saw, but he can draw it.
Roger Wolcott Sperry
1913-1994
Neuropsychology
1981 Nobel Prize in Physiology and Medicine
Split-Brain Syndrome
Corpus Callosotomy

- Palliative surgery
- 1940s, Dr. William P. van Wagenen, 10pts.
- 1960s, Bogen & Vogel: Clinical and neuropsychological outcome of the surgery
- 1970, Luessenhop: The corpus callosotomy could replace the hemispherectomy
Corpus Callosotomy Technique
Complete remission of seizures after corpus callosotomy

Masaki Iwasaki, M.D.,¹ Mitsugu Uematsu, M.D.,² Yuko Sato, M.D.,² Tojo Nakayama, M.D.,² Kazuhiro Haginoya, M.D.,³ Shin-ichiro Osawa, M.D.,¹ Hisashi Itabashi, M.D.,⁴ Kazutaka Jin, M.D.,⁴ Nobukazu Nakasato, M.D.,⁴ and Teiji Tominaga, M.D.¹

• 13 pts, infantile or childhood onset epilepsy, 1.5yrs- 24yrs (M:7yrs)
  11 West syndrome, 2 Lennox- Gastaut syndrome

• 1-stage total corpus callosotomy.

• F.U: 8- 35 months ( M: 19 months)

• Seizure free: 4 - ↓>50%: 3 – unchanged: 6 ( 9 : ↓ seizure intensity )

• No drop attacks: 8, ↓>90%: 5
Corpus callosotomy in refractory idiopathic generalized epilepsy

Sigmund Jenssen *, Michael R. Sperling, Joseph I. Tracy, Maromi Nei, Liporace Joyce, Glosser David, Michael O’Connor

Table 2  Demographic data

<table>
<thead>
<tr>
<th>ID</th>
<th>Age</th>
<th>Sex</th>
<th>Epilepsy onset</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>46</td>
<td>m</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>22</td>
<td>m</td>
<td>18</td>
</tr>
<tr>
<td>3</td>
<td>39</td>
<td>m</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>31</td>
<td>m</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>44</td>
<td>f</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>37</td>
<td>m</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>40</td>
<td>m</td>
<td>14</td>
</tr>
<tr>
<td>8</td>
<td>48</td>
<td>m</td>
<td>12</td>
</tr>
<tr>
<td>9</td>
<td>34</td>
<td>f</td>
<td>15</td>
</tr>
</tbody>
</table>
Long-term follow-up of seizure outcomes after corpus callosotomy

Shigeki Sunaga *, Hiroyuki Shimizu, Hidenori Sugano

Department of Neurosurgery, Tokyo Metropolitan Neurological Hospital, 2-6-1 Musashidai, Fuchu, Tokyo 183-0042, Japan

Seizure 18 (2009) 124–128

Clinical data of 78 patients

<table>
<thead>
<tr>
<th></th>
<th>n (%)</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>50 (64)</td>
<td>0–31</td>
</tr>
<tr>
<td>Female</td>
<td>28 (36)</td>
<td></td>
</tr>
<tr>
<td><strong>Age at seizure onset (year)</strong></td>
<td></td>
<td>0–31</td>
</tr>
<tr>
<td><strong>Seizure duration (year)</strong></td>
<td></td>
<td>0–38</td>
</tr>
<tr>
<td><strong>Age at surgery (year)</strong></td>
<td></td>
<td>0–39</td>
</tr>
<tr>
<td><strong>Pediatric patients</strong></td>
<td>51</td>
<td>≤16</td>
</tr>
<tr>
<td><strong>Adult patients</strong></td>
<td>27</td>
<td>17–39</td>
</tr>
<tr>
<td><strong>Preoperative seizure type</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drop attack</td>
<td>73 (41)</td>
<td></td>
</tr>
<tr>
<td>GTCS</td>
<td>45 (25)</td>
<td></td>
</tr>
<tr>
<td>Absences</td>
<td>32 (18)</td>
<td></td>
</tr>
<tr>
<td>Complex partial</td>
<td>14 (8)</td>
<td></td>
</tr>
<tr>
<td>Simple partial</td>
<td>15 (8)</td>
<td></td>
</tr>
</tbody>
</table>

Total No. of corpus callosotomy (> 3 years follow-up)

- 82 patients excluded due to combination with other surgical procedures
- Questionnaires sent to 89 patients
- 7 no response, 4 dead

Subjects for analysis

- Total section 60
  - Partial section 13
    - Total section 34
      - Partial section 12

(> 6 years followed)
Long-term follow-up of seizure outcomes after corpus callosotomy

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Department of Neurosurgery, Tokyo Metropolitan Neurological Hospital, 2-6-1 Musashidai, Fuchu, Tokyo 183-0042, Japan

Fig. 2. Rate of satisfactory outcomes for each seizure types.

<table>
<thead>
<tr>
<th>Seizure Type</th>
<th>Satisfactory Outcome %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drop attacks</td>
<td>88</td>
</tr>
<tr>
<td>GCS/GTCS</td>
<td>44</td>
</tr>
<tr>
<td>Atypical absence</td>
<td>47</td>
</tr>
<tr>
<td>CPS</td>
<td>21</td>
</tr>
<tr>
<td>SPS</td>
<td>53</td>
</tr>
</tbody>
</table>

- ** Drop attack-free: 90%  
- ** Drop attacks recurred: 
  - Total section (n=60): 10%
  - Partial section (n=13): 54% (46% recurred)
Canada, 1981-2001
- 95 patients, F.U > 5 years
  (M: 17.2 years)
# Long-term seizure outcome after corpus callosotomy: 
a retrospective analysis of 95 patients

**Clinical article**

*Taner Tanriverdi, M.D., André Olivier, M.D., Ph.D., Nicole Poulin, R.N., M.Ed., Frederick Andermann, M.D., and François Dubeau, M.D.*

## TABLE 3: Overall outcome according to each patient’s most disabling seizure type*

<table>
<thead>
<tr>
<th>Seizure Type</th>
<th>Class A</th>
<th>Class B</th>
<th>FO (%)</th>
<th>Class C</th>
<th>Class D</th>
<th>Class E</th>
<th>UFO (%)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>drop attacks</td>
<td>24</td>
<td>22</td>
<td>74.1</td>
<td>15</td>
<td>1</td>
<td>0</td>
<td>25.8</td>
<td>62</td>
</tr>
<tr>
<td>GTCS</td>
<td>10</td>
<td>7</td>
<td>73.9</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>26.08</td>
<td>23</td>
</tr>
<tr>
<td>GTS</td>
<td>2</td>
<td>1</td>
<td>75</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>25</td>
<td>4</td>
</tr>
<tr>
<td>tonic adv sz</td>
<td>0</td>
<td>1</td>
<td>33.3</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>66.6</td>
<td>3</td>
</tr>
<tr>
<td>myoclonic abs</td>
<td>0</td>
<td>3</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td><strong>total</strong></td>
<td><strong>36</strong></td>
<td><strong>34</strong></td>
<td><strong>73.6</strong></td>
<td><strong>19</strong></td>
<td><strong>2</strong></td>
<td><strong>4</strong></td>
<td><strong>26.3</strong></td>
<td><strong>95</strong></td>
</tr>
</tbody>
</table>
Complications

- Postoperative Complications
- Disconnection Syndrome
- New type seizures: **postural seizure**
- Language Impairment
Indications

- Generalized seizures:
  - Drop attacks
  - Tonic
  - Clonic
  - Tonic- Clonic
  - Absence Seizures
Conclusions

- **Functional Neurosurgery - Palliative surgery**
- Corpus callosotomy is a disconnection procedure that is highly effective for drop attacks and atonic seizures.
- One-stage, complete corpus callosotomy may be indicated for patients with severe neurologic deficits or neurocognitive/speech impairment.
- Anterior two-thirds callosotomy may be appropriate for patients who can read or are expected to be able to read in the future.
Referrences

- Principle and Practice of Pediatric Neurosurgery 3rd.
- Schmidek & Sweet Operative Neurosurgical Technique
- William P. van Wagenen and the first corpus callosotomies for epilepsy
Thanks for your attention