Comparison in outcomes between corpus callosotomy and vagus nerve stimulation for medically refractory epilepsy in children

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COI

• The author has completed the declaration of conflict of interest for the last 3 years to the Japan Neurosurgical Society and has no COI directly relevant to the content of this presentation.
Rationale and Objectives

• Vagus nerve stimulation (VNS) therapy has become gradually popular as a palliative treatment option for intractable epilepsy in Japan. Corpus callosotomy (CC) is palliative as an intracranial epilepsy surgery. However, we occasionally hesitate over which procedure to choose. The object of this study was to assess the efficacy of VNS and CC in seizure reduction for child patients aged 10 years old and younger.
Methods

• Twenty-three child patients who underwent VNS implantation from 2011 through 2015 were retrospectively reviewed. Outcomes of VNS were evaluated using the McHugh (MH) Outcome Classification. In the same way, 11 child patients who underwent CC in the same period of time were reviewed.

* McHugh Class:
  - Class I: ≥80% seizure reduction
  - Class II: 50-79% seizure reduction
  - Class III: <50% seizure reduction
  - Class IV: magnet benefit alone
  - Class V: no improvement
Background of patients who were treated by VNS

- Age: 1-10 y-o (mean: 6.0 y-o)
- Follow-up period: 4-54 months (mean: 20.0 mo)
- Frequency of seizures: daily 20 cases, weekly 1 case, monthly 2 cases
- Diagnoses & Syndromes: symptomatic generalized epilepsy 15 cases, symptomatic localization-related epilepsy 8 cases
- Prior surgical procedures: CC 6 cases, focus resection 2 cases
- One case was excluded due to infection of the device, and another case was also excluded because seizure reduction was obviously obtained owing to an anti-epileptic drug.
### Background of patients who underwent corpus callosotomy

<table>
<thead>
<tr>
<th>Case</th>
<th>Age</th>
<th>Diagnoses &amp; Syndromes</th>
<th>Etiologies</th>
<th>Seizure types</th>
<th>Fq of Sz</th>
<th>Extent of CC</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>6</td>
<td>SGE (LGS)</td>
<td>cerebral palsy</td>
<td>Tonic sz, spasm</td>
<td>daily</td>
<td>4/5</td>
</tr>
<tr>
<td>#2</td>
<td>5</td>
<td>SGE (West syndrome)</td>
<td>unknown</td>
<td>Tonic sz, spasm</td>
<td>daily</td>
<td>4/5</td>
</tr>
<tr>
<td>#3</td>
<td>8</td>
<td>SGE (Myoclonic astatic epilepsy)</td>
<td>unknown</td>
<td>Tonic sz, spasm</td>
<td>weekly</td>
<td>4/5</td>
</tr>
<tr>
<td>#4</td>
<td>8</td>
<td>SGE (LGS)</td>
<td>unknown</td>
<td>Tonic sz, spasm, SPS, GTC</td>
<td>daily</td>
<td>total</td>
</tr>
<tr>
<td>#5</td>
<td>8</td>
<td>SGE (LGS)</td>
<td>unknown</td>
<td>Tonic sz, spasm, SPS, GTC</td>
<td>daily</td>
<td>total</td>
</tr>
<tr>
<td>#6</td>
<td>1</td>
<td>SGE (West syndrome)</td>
<td>hemimegalencephaly bilateral polymicrogyria</td>
<td>Tonic sz</td>
<td>daily</td>
<td>total</td>
</tr>
<tr>
<td>#7</td>
<td>4</td>
<td>SGE</td>
<td>acute encephalopathy with biphasic seizures and late diffusion</td>
<td>spasm</td>
<td>daily</td>
<td>total</td>
</tr>
<tr>
<td>#8</td>
<td>4</td>
<td>SGE</td>
<td>unknown</td>
<td>Tonic sz, spasm, atypical absence</td>
<td>daily</td>
<td>total</td>
</tr>
<tr>
<td>#9</td>
<td>7</td>
<td>SGE</td>
<td>unknown</td>
<td>Tonic sz</td>
<td>daily</td>
<td>total</td>
</tr>
<tr>
<td>#10</td>
<td>7</td>
<td>SGE</td>
<td>Down syndrome</td>
<td>Tonic sz, spasm</td>
<td>daily</td>
<td>total</td>
</tr>
<tr>
<td>#11</td>
<td>5m</td>
<td>SLRE (multifocal)</td>
<td>unknown</td>
<td>Tonic sz, spasm</td>
<td>daily</td>
<td>total</td>
</tr>
</tbody>
</table>

Fq: frequency, CC: corpus callosotomy  
SGE: symptomatic generalized epilepsy, LGS: Lennox-Gastaut syndrome, sz: seizure  
SLRE: symptomatic localization-related epilepsy
Outcomes by VNS therapy

SGE: symptomatic generalized epilepsy
SLRE: symptomatic localization-related epilepsy
Outcomes by callosotomy

- **Total cases (N=11)**
  - ≥80% seizure reduction (Class I): 0%
  - 50-79% seizure reduction (Class II): 0%
  - No improvement (Class V): 100%

- **Complete CC (N=8)**
  - ≥80% seizure reduction (Class I): 0%
  - 50-79% seizure reduction (Class II): 0%
  - No improvement (Class V): 100%

- **CC for epileptic falls (N=5)**
  - ≥80% seizure reduction (Class I): 100%
  - 50-79% seizure reduction (Class II): 0%
  - No improvement (Class V): 0%

* All cases obtained seizure freedom.

** Five out of 11 cases (45%) showed improvement in behavior.
Treatment for LGS

Combination of CC & VNS

- All seizures (N=5)
- Tonic seizures (N=4)
- Spasms (N=3)

VNS only

- All seizures (N=9)
- Tonic seizures (N=7)
- Spasms (N=7)

Legend:
- Class I
- Class II
- Class III
- Class IV
- Class V
• VNS efficacy appears to be maintained and even possibly improved over time. There are low surgical risks and low overall side effects associated with stimulation. If a non-curative procedure is being considered, perform VNS first.

• Callosotomy, on the other hand, can be performed with low morbidity, and the prospect of perhaps greater relief from more injurious sudden falls may make it equally reasonable for patients willing to undergo a larger procedure.
Choice of callosotomy or VNS in our epilepsy center

- Symptomatic generalized epilepsy without epileptic falls
- Localization-related epilepsy with multifocal or diffuse EEG findings
- Patients older than 15 y-o

VNS 1\textsuperscript{st}
Callosotomy 2\textsuperscript{nd}

- Epileptic falls (drop attacks)
- West syndrome or Lennox-Gastaut syndrome
- Child patients aged 15 and younger

Callosotomy 1\textsuperscript{st}
VNS 2\textsuperscript{nd}
Conclusion

- VNS and CC were considerable treatment options as palliation for child patients who are not suitable for other curative surgical procedures. Although CC is an invasive procedure, CC has potentials in obliterating epileptic falls and improvement of mental development. On the other hand, VNS is less invasive and can be effective in 50-60% of patients, although VNS needs time for programming and its output to be increased.