Selective Mesial Temporal Resection: When is it beneficial?

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Selective Mesial Temporal Resection:
When is it beneficial?

- In a study of 74 patients with temporal lobe epilepsy (TLE) who underwent selective amygdalohippocampectomy (SAH) or anterior temporal lobectomy (ATL), patients with unilateral mesial temporal atrophy had significantly better seizure outcome compared with the bilateral or no atrophy group. The two different surgical techniques were equally effective in seizure control. Studies of postoperative memory performance failed to demonstrate the superiority of one technique.


- It remains that if the site of origin of the seizures resides in the damaged structures then these should be resected as radically and selectively as possible. The larger cortical removal in standard resection should not become, or remain, simply a method of exposing the limbic structures.

Why not do a selective resection?

✓ The only real way to address the issue of ATL versus SAH is a prospective randomized controlled trial.
✓ Appropriate selection of candidates for SAH is essential.
   There is evidence of hippocampal sclerosis as the primary or secondary epileptogenic focus.
   The epileptogenic tissues are within the resection.
✓ Postoperative seizure control outcome --
✓ Postoperative neuropsychological outcome --

✓ Postoperative visual field defect
   Thirty TLE with HS patients underwent transsylvian SAH. Postoperative visual deficits in 11 patients (36.6%). The reason is the interruption of the anterior bundle of the optic radiation fibers during opening the temporal horn through the inferior limiting sulcus of the insula.

Surgical approaches for selective mesial temporal resection

1. Transsylvian approach – Yasargil in 1970’s
2. Anterior approach via minisupraorbital craniotomy – Figueiredo EG, 2010
3. Transcortical (T1, T2) approach – Niemeyer in 1950’s, Olivier A in 1990’s

Role of neuronavigation, intraoperative MRI and Gamma knife radiosurgery (?)
Transsylvian approach for selective amygdalohippocampectomy:
After opening the sylvian fissure, cortical incision is made 15-20 mm lateral to the M1 segment of middle cerebral artery.
After entering the temporal horn, the amygdala is removed first. The fimbria is identified to expose the hippocampal arteries. The collateral eminence is entered to dissect the parahippocampus. The hippocampus and parahippocampus are removed in an en bloc fashion.
The amygdala and anterior 2/3 of hippocampus and parahippocampus (2.5-3.0 cm in length) are removed. The posterior margin of removal can be as far as the posterior rim of cerebral peduncle where the P2 segment bifurcates.
The advantages of SAH via transsylvian approach

✓ Transsylvian selective SAH is a technical demanding procedure that requires micro-neurosurgical experiences.
✓ Transsylvian SAH offers a good rate of postoperative sustained seizure control.
✓ It decreases the risk of postoperative cognitive decline and visual field deficits when comparing with ATL and transcortical SAH.
✓ It decreases the risk of retraction injury to the temporal lobe when comparing with the subtemporal SAH.
✓ It allows direct and short access to the medial temporal structures.
From 1987 to 2007, there were 354 adult MTLE patients underwent ATL at Taipei Veterans General Hospital. Among them, 257 patients had non-lesional MTLE. Overall, 202 patients had preoperative MRI, IQ tests and early postoperative EEGs. There were 132 patients (65%) and 96 patients (58%) remained Engel’s Class I outcome at 2-years and 5-years after ATL respectively.
### Demographic characteristics and seizure outcome of patients underwent ATL and SAH

<table>
<thead>
<tr>
<th></th>
<th>ATL (n = 16)</th>
<th>SAH (n = 15)</th>
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<tbody>
<tr>
<td>Gender (M/F)</td>
<td>4/12</td>
<td>7/8</td>
</tr>
<tr>
<td>Age of onset (mean± s.e.)</td>
<td>13.31±2.55</td>
<td>13.15±2.37</td>
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<tr>
<td>Age of surgery (mean± s.e.)</td>
<td>33.31±1.90</td>
<td>35.2±2.65</td>
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<td>Side of surgery (L/R)</td>
<td>6/10</td>
<td>5/10</td>
</tr>
<tr>
<td>Presurgical FSIQ (mean± s.e.)</td>
<td>91.44±2.78</td>
<td>85.33±3.50</td>
</tr>
<tr>
<td>Presurgical VIQ (mean± s.e.)</td>
<td>90.19±3.57</td>
<td>83.73±3.49</td>
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<tr>
<td>Presurgical PIQ (mean± s.e.)</td>
<td>94.44±2.40</td>
<td>88.87±3.80</td>
</tr>
<tr>
<td>Seizure-free at 1 year</td>
<td>15</td>
<td>14</td>
</tr>
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</table>

*Since 2007, 16 patients with MTLE underwent ATL and another 15 underwent SAH at Taipei Veterans General Hospital.

**No significant differences were noted between two groups.

***ATL = anterior temporal lobectomy, SAH = selective amygdalohippocampectomy
<table>
<thead>
<tr>
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<th>ATL (n = 15)</th>
<th>SAH (n = 7)</th>
<th>significance</th>
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<tbody>
<tr>
<td><strong>FSIQ</strong></td>
<td></td>
<td></td>
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<tr>
<td>preoperative</td>
<td>91.87±11.38</td>
<td>84.86±10.22</td>
<td>n.s.</td>
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<tr>
<td>postoperative</td>
<td>96.53±12.79</td>
<td>91.71±11.95</td>
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<tr>
<td><em>p</em>-value</td>
<td>0.008</td>
<td>0.028</td>
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<tr>
<td><strong>VIQ</strong></td>
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<tr>
<td>preoperative</td>
<td>90.33±14.75</td>
<td>84.71±9.1</td>
<td>n.s.</td>
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<tr>
<td>postoperative</td>
<td>91.47 ± 14.68</td>
<td>87.14±12.03</td>
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<tr>
<td><em>p</em>-value</td>
<td>0.439</td>
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<tr>
<td><strong>PIQ</strong></td>
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<tr>
<td>preoperative</td>
<td>95.07 ± 9.57</td>
<td>86.86± 11.68</td>
<td>n.s.</td>
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<tr>
<td>postoperative</td>
<td>100.60±11.54</td>
<td>93.14 ± 6.87</td>
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<tr>
<td><em>p</em>-value</td>
<td>0.014</td>
<td>0.236</td>
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Wilcoxon Signed Ranks Test for pre- and postoperative scores
An 18 y/o right-handed male began his seizure at the age of 10 after an episode of CNS infection. The ictus consisted of frightening followed by ororalimentary automatism and impaired response. MRI revealed sclerotic change over right hippocampus. FDG-PET demonstrated hypometabolism over right medial temporal lobe.

Ictal EEG onset from right temporal region and slow wave phase reversal at T4
This patient underwent right-sided transsylvian SAH after intraoperative ECoG recording. Habitual seizures persisted after the surgery. Reoperation for removal of the lateral temporal cortex should be considered after reevaluation of the possible epileptogenic focus.

Intraoperative ECOG showed repetitive spikes on hippocampal surface but no spikes were found on lateral temporal surface.
Seizure control outcome

- 73% of patients with classical hippocampal sclerosis had an Engel’s Class I outcome after SAH. In MTLE patients with more extensive disease affecting the temporal neocortex or the seizure generating structures exceeded the area of resection, only 12% had an Engel’s Class I outcome. In patients with lesional MTLE, 70% of patients with vascular malformations or benign tumors had an Engel’s Class I outcome. MTLE patients with dual pathology had a seizure outcome similar to that in patients with HS.


- Overall 40% of the 114 patients who had temporal lobe epilepsy surgery were seizure free at 1-year. A good outcome (Engel’s class I and II) was significant more frequent in ATL than in SAH. (66% and 44%, P = 0.003) (The parahippocampus was not removed during SAH)

Neuropsychological outcome (1)

- Seventy-two patients underwent surgery (36 CAH and 36 SAH) for MTLE with HS. The IQ increased postoperatively in both surgical groups. The CAH group revealed a postoperative decline in nonverbal memory after right sided resection and verbal memory decline after left-sided resection. In SAH group, there was a slight postoperative decline only in verbal memory after left-sided resection. However, no significant difference was found between these two approaches regarding memory. There was also no significant difference in terms of seizure outcome at 1-year follow-up.


- Forty-one transsylvian and 40 transcortical SAH patients were enrolled. 75% of patients became Engel’s Class I with no difference between two groups. The cognitive outcomes after both approaches were essentially the same. The only exception was phonemic fluency, which was significantly improved after transcortical approach.

Neuropsychological outcome (2)

- Left-sided SAH for HS tends to improve verbal memory function with the preservation of other types of memory function. Right-sided SAH can lead to significant improvement in memory function, with memory improvement observed 1-month and persisting 1-year after surgery.


- 84% of 26 patients attained either Engel’s Class I or II seizure outcome. No subjective visual field loss was marked in any patient. One patient had permanent postoperative memory impairment. Subtemporal SAH provides favorable surgical and neuropsychological outcomes and does not cause significant postoperative decline of verbal memory if performed on the dominant side.

Neuropsychological outcome (3)

- In 161 patients with MTLE/HS, 80 had anterior temporal lobectomy (ATL) and 81 had selective amygdalo-hippocampectomy (SAH). Both ATL and SAH groups had similar favorable seizure control outcome (72% and 71% Engel’s Class I respectively). Postoperative verbal memory scores may improve in patients who undergo SAH in the dominant temporal lobe.


- Several retrospective reviews have shown a better outcome with regard to total IQ, verbal and performance IQ in transsylvian SAH versus ATL (Morino). The risk of developing severe global memory deficits or persistent dysphasia was reported in 1-5% in ATL series but absent in transsylvian SAH (Yasargil). A slight decline in verbal memory was noted following left-sided transsylvian SAH, especially in patients who had good preoperative verbal memory function.

Neuropsychological outcome (4)

- One year after surgery, cognitive outcome of postoperatively seizure-free patients with mesial TLE and HS, who underwent either SAH (N = 62) or combine temporal pole resection with amygdalohippocampectomy (TPR+) (N = 35) were compared. Verbal memory outcome was worse after left-sided operation, especially for SAH. Figure memory outcome was worse after right-sided operation, preferentially for TPR+. Attention improved independent of side or type of surgery, and language functions showed some improvement after right-sided surgeries.

Mesial temporal lesionectomy via transsylvian approach

A 39 years old female had intractable TLE for 4 years. MRI revealed a lesion within right-sided hippocampal head. Telemetry demonstrated seizure onset from right mesial temporal lobe. Lesionectomy was performed via transsylvian approach. Patient became and remained seizure-free after the surgery. Pathology: ganglioglioma

Preoperative MRI revealed a lesion within right-sided hippocampus

Postoperative MRI showed complete removal of the lesion with minimal cortical damage.
In MTLE patients with more extensive disease affecting the temporal neocortex or the seizure generating structures exceeded the area of resection, only 12% had an Engel’s Class I outcome.


A 36 years old male had intractable TLE for 3 years. MRI revealed an infiltrating lesion over right-sided amygdala and adjacent temporal lobe. Telemetry showed seizure onset from right mesial temporal lobe. ATL with lesionectomy but sparing hippocampus was performed. Patient became and remained seizure-free after the surgery.

Pathology: ganglioglioma

Preoperative MRI revealed an infiltrating lesion over right amygdala extending to adjacent temporal lobe.

Right-sided ATL with lesionectomy but sparing hippocampus was performed.
In well selected intractable TLE patients, selective mesial temporal resections provide similar favorable seizure outcome as ATL. There were some retrospective reports suggesting the neuropsychological benefits of SAH in comparison to ATL. SAH is recommended in TLE patients with dominant sided HS and good preoperative verbal memory performance. In our institute, we perform SAH via transsylvian route. This is a technically demanding approach with the possibility of vascular injury. However, this approach provides shortest distance from cortex to temporal horn and minimal cortical damage. If there is evidence for “secondary” HS or “dual pathology”, both the lesion and gliotic hippocampus should be resected. Besides the completeness of the removal of the epileptogenic lesion, the underlying histopathology of the resected structures is the major factor for seizure outcome.

Summary