Temporal lobectomy for bilateral temporal lobe epilepsy

- Semiological differences between children and adults with temporal lobe epilepsy: a video-EEG based multivariate analysis
- Language and Memory Network Alterations in Temporal Lobe Epilepsy: A Functional and Structural Connectivity Study
- Frequency-specific network changes in mesial temporal lobe epilepsy: Analysis of chronic and transient dysfunctions in the temporo-amygdala-orbitofrontal network using magnetoencephalography
- Temporal lobectomy in bilateral temporal lobe epilepsy: A relook at factors in selection, invasive evaluation and seizure outcome
- Long-term neuroplasticity in language networks after anterior temporal lobe resection
- Predictors of Surgical Failure in Pediatric Lesional Temporal Lobe Epilepsy Surgery
- Predictors of long-term memory and network connectivity 10 years after anterior temporal lobe resection
- Connectome reorganization associated with temporal lobe pathology and its surgical resection

A **temporal lobectomy for bilateral temporal lobe epilepsy (BTLE)** presents a complex clinical decision, as the usual approach for **temporal lobe epilepsy (TLE)** is **anterior temporal lobectomy (ATL)**, which is typically performed **unilaterally**. However, when epilepsy is **bilateral**, the risks and benefits must be carefully weighed.

Key Considerations

1. **Lateralization of Seizures**:
    1. In BTLE, seizures may arise from both temporal lobes. However, in some patients, one hemisphere may be the dominant seizure focus.
    2. Detailed **electroencephalography (EEG)** and **stereo-EEG (sEEG)** are crucial to assess whether one side is the primary generator of disabling seizures.
    3. If one hemisphere is significantly more epileptogenic, a **unilateral lobectomy** may be considered.
2. **Risk of Memory Impairment**:
    1. Bilateral resection of the **medial temporal structures (hippocampus, amygdala, entorhinal cortex, parahippocampal gyrus)** can cause **severe anterograde amnesia**.
    2. If one side is resected, the remaining hippocampus must be able to sustain memory function.
    3. **Preoperative neuropsychological testing and functional MRI (fMRI) for language and memory lateralization** are crucial.
3. **Alternative Surgical Options**:
    1. **Responsive Neurostimulation (RNS)**: Implantable neurostimulation targeting both hippocampi can reduce seizure frequency without the cognitive risks of resection.
    2. **Deep Brain Stimulation (DBS)**: Stimulation of the anterior nucleus of the thalamus (ANT-

DBS) can modulate seizure activity bilaterally.
3. **Stereotactic Laser Ablation (SLA)**: Laser interstitial thermal therapy (LITT) can target smaller areas of the temporal lobe while preserving function.
4. **Corpus Callosotomy**: In cases with atonic or generalized seizures, disconnection procedures might be considered.

4. **Bilateral Lobectomy as a Last Resort**:

1. **Sequential unilateral resections** (i.e., removing one temporal lobe first, then evaluating whether further surgery is needed) can sometimes be an option.
2. **Bilateral lobectomy** leads to a high risk of severe memory loss and **Klüver-Bucy syndrome** (hyperorality, hypersexuality, emotional blunting). - Rarely performed unless** intractable seizures significantly impair quality of life **despite all other treatments. ===== Conclusion ===== -** Most patients with BTLE are not candidates for bilateral lobectomy **due to the high cognitive risks. -** Comprehensive presurgical evaluation **(sEEG, fMRI, neuropsychological testing) is essential to determine if one hemisphere is more affected. -** Alternative surgical and neuromodulatory treatments** (RNS, DBS, SLA) should be considered before contemplating bilateral surgery.

Retrospective cohort studies

Patients undergoing surgical intervention for TLE (the vast majority being mesial temporal lobe epilepsy) during 7 years were retrospectively categorized as suspected BTLE (sBTLE) or UTLE. Temporal lobectomy was performed in the sBTLE group on the side of a maximum number of intracranial EEG seizure onsets. EEG, MRI, laterality of iEEG ictal onset (in sBTLE), seizure outcome, and drug tapering data were retrospectively analyzed.

Of 148 adult patients undergoing temporal lobe epilepsy surgery, 24 (16.2 %) fit the criteria of sBTLE, amongst whom iEEG ictal onset proved to be unilateral in 14 (uBTLE, 58.3 %) and bilateral in 10 (dBTLE, 41.7 %). Of operated patients in the dBTLE group, the first seizure onset was ipsilateral to the resection in 4 patients (57.1 %) and contralateral in 3 (42.9 %). In the UTLE group, seizure freedom (Engel 1) was achieved in 87.8 % at mean follow-up of 59.2 ± 27.9 months. Seizure freedom was achieved in 92.9 % of uBTLE patients at 52.8 ± 36.6 months. Seven of 10 dBTLE patients underwent resection on the side of a maximum number of iEEG seizure onset, and 6 (85.7 %) remained seizure-free at 40.14 ± 25 months. There was no statistically significant difference in seizure-free outcome between UTLE and sBTLE (Pearson Chi-Square test, p-value = 0.67).

Following standard temporal lobectomy, high seizure freedom rates were observed in both unilateral and bilateral disease. However, the study lacks pre- and post-resection neuropsychological data to conclude on the cognitive sequelae of resective surgery in established bilateral mesiotemporal epilepsy [1).

The study by Jayakumar et al. represents a valuable contribution to the field of epilepsy surgery, demonstrating that unilateral temporal lobectomy can yield high seizure freedom rates even in cases with suspected bilateral involvement. However, significant gaps remain regarding cognitive outcomes, patient selection criteria, and alternative treatment approaches. Addressing these issues in future research will be essential to refining surgical strategies and optimizing patient care in BTLE.

Zhou et al.. retrospectively reviewed the data of patients diagnosed with BTLE by scalp electroencephalogram (EEG) and underwent ATL from 2001 to 2015. In addition, 80 patients were randomly selected as a control group.

Results: One hundred seventeen patients were included in this study and were divided into four groups by intracranial recordings as follows: 78 patients with unilateral seizure onset (Group 1), 13 patients with lateralizable dominant seizure onset (Group 2), 14 patients with lateralizable neuroimaging abnormalities (Group 3), and 12 patients without lateralizable dominant seizure onset or neuroimaging abnormalities (Group 4). The 12 patients in Group 4 declined surgical resection, whereas the remaining 105 patients received ATL, and 93 of them were followed up for more than 1 year after surgery. At the 1, 2, and 3-year follow-ups, the percentage of patients who were seizure-free was 52.9%, 56.5%, and 58.9%, respectively. For the mean postoperative efficacy, there was a statistical difference in patients who were seizure free either between Group 1 + Group 2 + Group 3 and the control group (44.1% vs. 67.5%, $p = 0.002$), or between Group 1 and the control group (48.5% vs. 67.5%, $p = 0.019$), or between Group 2 + Group 3 and the control group (32.0% vs. 67.5%, $p = 0.002$). However, the difference was significant only at the first year follow-up, and there was no significant difference afterward.

Significance: Although the surgical outcome of patients with BTLE is not as good as that of patients with unilateral TLE in short-term follow-up, quite a portion of these patients could benefit from unilateral temporal lobe resection in the long term [2).

Zhou et al.. provide valuable insights into ATL outcomes for BTLE patients, highlighting that while seizure freedom rates are lower than in unilateral TLE, ATL remains a viable surgical option for a subset of patients. However, given the study’s limitations, future research should focus on prospective, multicenter studies with larger cohorts, more comprehensive preoperative evaluations, and detailed long-term neuropsychological and QoL outcomes to refine patient selection criteria and optimize treatment strategies.

Sirven et al.. determined how noninvasive presurgical data relate to prognosis after temporal lobectomy in patients with independent bilateral temporal lobe (IBTL) complex partial seizures on the intracranial electroencephalogram (EEG). Between 1986 and 1994, 28 patients had IBTL seizures on intracranial EEG. Fifteen of these 28 patients underwent temporal lobectomy, and 13 were not offered surgery. Of the 15 patients who had surgery, 10 patients became seizure-free. Magnetic resonance imaging (MRI) and the Wada test were the only variables associated with a seizure-free outcome. Seven of 10 seizure-free patients had a lateralized Wada result or the presence of unilateral hippocampal sclerosis, whereas none of the patients with persistent seizures had either of these findings. Variables not found to be predictive of a seizure-free outcome included location of scalp interictal spikes, degree of seizure-onset laterality, presence of early epilepsy risk factor, duration of epilepsy, and full-scale intelligence quotient. We conclude that MRI and the Wada test provide information of prognostic value in patients with bilateral temporal seizures independent of intracranial EEG data [3)].

Sirven et al.. provide valuable insight into the prognostic role of MRI and Wada test results in patients with IBTL seizures undergoing temporal lobectomy. Their findings suggest that these noninvasive tools offer critical guidance in surgical decision-making. However, the study is limited by its small sample size, potential selection bias, and lack of detailed outcome stratification. Future research should aim to validate these findings in larger, prospective cohorts incorporating modern imaging and electrophysiological techniques to refine surgical prognostication in this complex patient population.

1)

Jayakumar H, Gopinath S, Narayanan S, Rajeevan S, Rajeshkannan R, Parasuram H, Pillai A. Temporal lobectomy in bilateral temporal lobe epilepsy: A relook at factors in selection, invasive evaluation and seizure outcome. Neurophysiol Clin. 2025 Mar 4;55(3):103064. doi: 10.1016/j.neucli.2025.103064. Epub ahead of print. PMID: 40043337.

2)

Zhou X, Yu T, Zhang G, Ni D, Qiao L, Wang X, Xu C, Liu C, Wang Y, Li Y. The surgical outcome of patients with bilateral temporal lobe epilepsy. Epilepsy Res. 2018 Aug;144:7-13. doi: 10.1016/j.eplepsyres.2018.04.013. Epub 2018 Apr 26. PMID: 29729534.

3)

Sirven JI, Malamut BL, Liporace JD, O'Connor MJ, Sperling MR. Outcome after temporal lobectomy in bilateral temporal lobe epilepsy. Ann Neurol. 1997 Dec;42(6):873-8. doi: 10.1002/ana.410420608. PMID: 9403479.