# Resective epilepsy surgery

Resective epilepsy surgery based on an invasive EEG-monitors performed with subdural grids (SDG) or depth electrodes (stereoelectroencephalography, SEEG) is considered to be the best option towards achieving seizure-free state in drug resistant epilepsy.

Despite good outcomes from high-quality clinical trials, referrals of patients with seizures refractory to medical treatment remain infrequent [1].

Complete removal of the epileptogenic zone significantly increases the chances for postoperative seizure-freedom. In complex surgical candidates, delineation of the epileptogenic zone requires a long-term invasive video/EEG from intracranial electrodes. It is especially challenging to achieve a complete resection in deep brain structures such as opercular insular cortex [2].

## Randomized controlled trials

Three RCTs (two adult RCTs and one pediatric RCT) consistently supported the efficacy of resective surgery as treatment for epilepsy with semiology localized to the mesial temporal lobe. In these studies, 58-100% of the patients who underwent resective surgery achieved seizure freedom, in comparison to 0-13% of medically treated patients. In another RCT, the likelihood of seizure freedom after resective surgery was independent of the surgical approach (transSylvian [64%] versus subtemporal [62%]). Two other RCTs demonstrated that hippocampal resection is essential to optimize seizure control. But, no significant gain in seizure control was achieved beyond removing 2.5 cm of the hippocampus. Across RCTs, minor complications (deficit lasting < 3 months) and major complications (deficit > 3 months) ranged 2-5% and 5-11% respectively. However, non-incapacitating superior subquadrantic visual-field defects (not typically considered a minor or major complication) were noted in up to 55% of the surgical cohort. The available RCTs provide compelling support for resective surgery as a treatment for mesial temporal lobe epilepsy and offer insights toward optimal surgical strategy [3]

## Retrospective Studies

Parker et al. performed a retrospective analysis of 376 pediatric patients who underwent resective epilepsy surgery between 2007 and 2016 in Stanford using the Truven MarketScan database. Filled Anticonvulsant prescriptions during the pre-and postoperative periods were compared. Univariate and multivariate analyses identified factors associated with achieving stable discontinuation of or reduction in the number of anticonvulsants. Health care utilization and costs were systematically compared.

One hundred seventy-one patients (45.5%) achieved a >90-day ASD-free period after surgery, and 84 (22.3%) additional patients achieved a stable reduction in the number of ASDs. Achieving ASD freedom was more common in patients undergoing total hemispherectomy (n = 21, p = .002), and less common in patients with tuberous sclerosis (p = .003). A higher number of preoperative ASDs was associated with a greater likelihood of achieving ASD reduction postoperatively (hazard ratio [HR]: 1.85, 95% confidence interval [CI]: 1.50-2.28), but was not associated with a significant difference in the likelihood of achieving ASD freedom (0.83, 95% CI: 0.49-1.39). Achieving an ASD-free

period was associated with fewer hospital readmissions within the first year after surgery.

Patterns of anticonvulsant use and discontinuation after pediatric epilepsy surgery provide an unbiased surgical outcome endpoint extractable from administrative databases, where changes in seizure frequency are not captured. This quantitative measure can augment traditional surgical outcome scales, incorporating a significant clinical parameter associated with improved quality of life [4]..

---

Belohlavkova et al. retrospectively reviewed data of pediatric patients operated in Motol Epilepsy Center between October 2010 and June 2020 who underwent resections guided by intraoperative visual detection of depth electrodes following SEEG. The outcome in terms of seizure- and AED-freedom was assessed individually in each patient.

Nineteen patients (age at surgery 2.9-18.6 years, median 13 years) were included in the study. The epileptogenic zone involved opercular insular cortex in eighteen patients. The intraoperative detection of the electrodes was successful in seventeen patients and the surgery was regarded complete in sixteen. Thirteen patients were seizure-free at final follow-up including six drug-free cases. The successful intraoperative detection of the electrodes was associated with favorable outcome in terms of achieving complete resection and seizure-freedom in most cases. On the contrary, the patients in whom the procedure failed had poor postsurgical outcome.

The reported technique helps to achieve the complete resection in challenging patients with the epileptogenic zone in deep brain structures [5]

---

81 patients with tuberous sclerosis complex (TSC) who had undergone resective epilepsy surgery at Sanbo Brain Hospital, between April 2004 and June 2019. They estimated the cumulative probability of remaining seizure-free and plotted survival curves. Variables were compared using Mann-Whitney U, Pearson's correlation, continuity correction, and Fisher's exact chi-square tests. Prognostic predictors were analyzed using log-rank (Mantel-Cox) tests and Cox regression models.

At the last follow-up, 48 (59.3%) patients were classified as International League Against Epilepsy Class 1 (including 14 patients who had seizures <3 times postoperatively on the same or different day and were seizure-free at all other times). The estimated cumulative probability of remaining seizure-free postoperatively was 69.0% (95% confidence interval [CI] 58.8-79.2%), 61.9% (95% CI 51.1-72.7%), and 55.0% (95% CI 42.8-67.2%) at 2, 5, and 10 years, respectively. The mean time of remaining seizure-free was 7.24 ± 0.634 years (95% CI 6.00-8.49); en bloc resection was an essential positive predictor of postoperative seizure freedom, as was age at seizure onset, regional interictal video-electroencephalography pattern, and temporal lobe surgery. The longer the seizure-free time, the less likely a relapse. Patients who postoperatively experienced seizures remained likely to recover.

They demonstrated the efficacy of tuberous sclerosis complex treatment and intractable epilepsy with surgery. Detailed perioperative tests are a reliable predictor of postoperative seizure freedom [6]

1)

Jobst BC, Cascino GD. Resective epilepsy surgery for drug-resistant focal epilepsy: a review. JAMA. 2015 Jan 20;313(3):285-93. doi: 10.1001/jama.2014.17426. PMID: 25602999.

2), 5)

Belohlavkova A, Jahodova A, Kudr M, Benova B, Ebel M, Liby P, Taborsky J, Jezdik P, Janca R, Kyncl M, Tichy M, Krsek P. May intraoperative detection of stereotactically inserted intracerebral electrodes increase precision of resective epilepsy surgery? Eur J Paediatr Neurol. 2021 Sep 25;35:49-55. doi: 10.1016/j.ejpn.2021.09.012. Epub ahead of print. PMID: 34610561.

3)

Cramer SW, McGovern RA, Wang SG, Chen CC, Park MC. Resective epilepsy surgery: assessment of randomized controlled trials. Neurosurg Rev. 2021 Aug;44(4):2059-2067. doi: 10.1007/s10143-020-01432-x. Epub 2020 Nov 9. PMID: 33169227.

4)

Parker JJ, Zhang Y, Fatemi P, Halpern CH, Porter BE, Grant GA. Antiseizure medication use and medical resource utilization after resective epilepsy surgery in children in the United States: A contemporary nationwide cross-sectional cohort analysis. Epilepsia. 2022 Feb 25. doi: 10.1111/epi.17180. Epub ahead of print. PMID: 35213744.

6)

Huang Q, Zhou J, Wang X, Li T, Wang M, Wang J, Teng P, Qi X, Zhu M, Luan G, Zhai F. Predictors and Long-term Outcome of Resective Epilepsy Surgery in Patients with Tuberous Sclerosis Complex: A Single-centre Retrospective Cohort Study. Seizure. 2021 Mar 25;88:45-52. doi: 10.1016/j.seizure.2021.03.022. Epub ahead of print. PMID: 33812307.