Impact factors affecting long term surgical outcome in adult neocortical epilepsy

探討影響成人頑固性癲癇手術之長期預後因子

Analysis of preoperative and postoperative predictive factors

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Abstract

Objective: To present the factors influencing of long term post surgical outcome in adult neocortical epilepsy. It is essential in order to choose ideal candidates for surgery and also can be used to predict individual prognosis.

Method: A descriptive study of neocortical epilepsy who underwent surgery at CGMH Linkou from single author (CCN) since 2001. Patient charts were reviewed to collect information on pre surgical evaluation, surgical procedures, histopathology and follow up. Long term follow up was done by looking at the medical records and interview in outpatient clinic.. Data was analyzed using univariate analysis.

Result: Thirty nine patients included in this study. Mean age was 32 ± 9.3 years (range 18-55). Male : female was 28 (71.8%) : 11 (28.2%) and mean time of follow up was 3.8 ± 3.2 year (range 0.5-9.8). Twenty nine (74.4%) patients have good outcome (Engel class I) at last time follow up. 83.3% of 30 patients with structural MRI lesion have good surgical outcome, in contrast that only 44.4% with normal MRI was good outcome. Fourteen (14) patients underwent lesionectomy and other fourteen with lesionectomy and topectomy with good outcome were 78.6% and 92.8%. Early postoperative seizures occurred in 19 patients (48.7%) and only 47.4% of these patients have good surgical outcome. Seizures event in 1 month after surgery and seizure with more than 50% decreased in frequency post operatively seems two and three fold have opportunity to long term good surgical outcome.

Conclusions: This study shows that the important impact factors associated with a good long term outcome subsequent to epilepsy surgery in adult neocortical epilepsy include existence of structural MRI lesion, type of procedures and early seizures event after surgery. These factors have to be considered in every selection and follow up of adult neocortical epilepsy candidates who received surgical treatment.

Methods

Patients selection

Inclusion criteria are:

1) Intractable epilepsy with epileptic discharge source from neocortex.
2) Diagnosis of neocortical epilepsy based on neocortical focal lesion found through MRI and suitable according to epileptic discharge identified in EEG monitor or normal MRI but the invasive EEG examination showed epileptic discharge of neocortex.
3) Had resective surgery with the aim of eliminating seizure or reducing their frequency or severity.
4) Follow up minimal of 6 months, with the age range from 18 years to 55 years.

Data collection and follow up outcome

Outcome information based on post surgical seizure and was classified with Engel classification. Outcome was calculated every post surgical anniversary every year and in the end of the follow up session. Good outcome is Engel class I. Poor outcome is patients with Engel class II to IV.

Pre surgical evaluation and surgical technique

Standard evaluation for epilepsy including semiology, clinical examination, standard 1,5T MRI, ictal or interictal SPECT (if necessary) and scalp EEG (routine, 24 hours or long term) was conducted. Acute or chronic invasive EEG monitoring will be used based on:

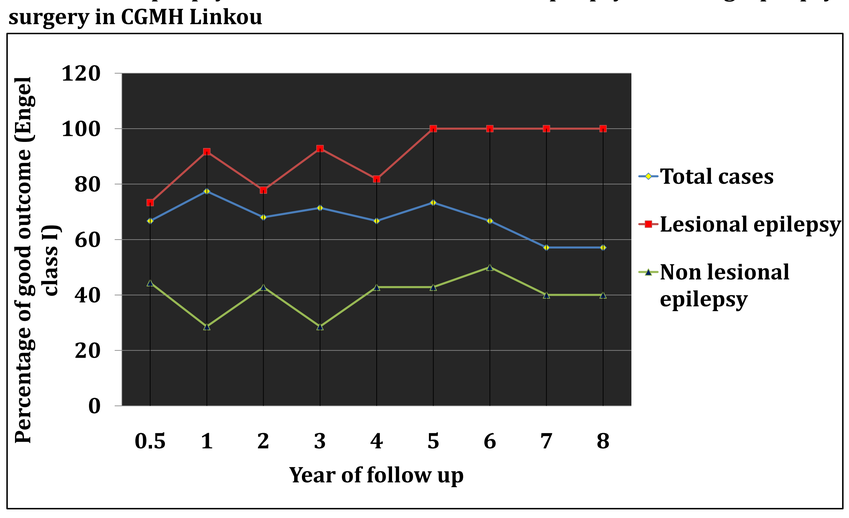
a) non conclusive results from non invasive presurgical evaluation.
b) non lesional MRI
c) lesion in MRI with localitazion of the lesion closed to the eloquent area..

Based on the presurgical evaluation, by assistance of neurophysiology and navigation system, type of surgical procedures was chosen, which is: lesionectomy, topectomy, callosotomy, multiple subpial transection (MST) or its combination.

Statistical analysis

Continuous data such as age at surgery, age at epilepsy onset, duration of epilepsy, presurgical seizure frequency per months was analyzed with t-test. Chi square test or Fisher exact test was used for categorical data which is: gender, the presence of secondary GTC, epileptic discharge, lesion in MRI, interictal SPECT, surgery site, histopathology and early post operative seizure. Univariate analysis was done for all this variables and compared with the long term outcome Engel class I or Engel class II–IV. P-value <0.05 was significant. Data was analyzed by SPSS (SPSS Inc, Chicago, Illinois, USA).

Figure 1. Percentage of long term good outcome (Engel class I) in all case of neocortical epilepsy, lesional and non lesional epilepsy following epilepsy surgery in CGMH Linkou



Result

Clinical characteristic

Clinical characteristics and outcome following epilepsy surgery in 39 patients and univariate analysis were shown in table 1. 23 (58.9%) patients were frontal lobe epilepsy, 3 (7.7%) of parietal lobe epilepsy, 1 (2.6%) of occipital lobe epilepsy and 12 (30.7%) patients were neocortical temporal lobe epilepsy.

Table 1	Outcome Engel class		
	I	II-IV	
n	29 (74.4%)	10 (25.6%)	P-value
Male (female)	21 (8)	7 (3)	0.59
Mean of age at onset, years	25.4 ± 13.9	19.4 ± 9.9	0.22
Mean of age at surgery, years	32.3 ± 9.9	30.6 ± 6.9	0.6
Mean of duration of seizure, years	6.9 ± 7.9	11.3 ± 9.3	0.17
Mean preoperative seizure frequency, (month)	7.1 ± 8.8	11.9 ± 11.8	0.18
Presence of preoperative secondary GTC	13 (76.5%)	4 (23.5%)	0.54
Presence of multi foci epileptic discharges	9 (69.2%)	4 (30.8%)	0.72
Presence of structural MRI lesion	25 (83.3%)	5 (16.7%)	0.03
Focal abnormal (SPECT) (n = 14)	10 (71.4%)	4 (28.6%)	0.72
Side of surgery (right)	14 (73.7%)	5 (26.3%)	0.6
Type of procedures	29 (74.4%)	10 (25.6%)	0.02
Presence of lesion in histopathology	24 (82.7%)	5 (17.3%)	0.06
Early seizure event after surgery (<1 year)	9 (47.4%)	10 (52.6%)	0.000
Mean follow up, years	3.9 ± 2.9	4.8 ± 3.3	0.76

Presurgical and surgical evaluation

All of the patients were examined by EEG and MRI studies. Nine patients (23.1%) have non structural MRI lesion. Ten (71.4%) of 14 patients with neoplastic lesion, 10 (90.9%) of 11 patients with vascular malformation and all patients with cerebromalacia have good long term surgical outcome (table 2). Lesionectomy procedures were conducted in 30 patients (76.9%) whereby 14 (46.7%) with lesionectomy alone and other 14 (46.7%) with combination of lesionectomy and topectomy (p=0.02) (table 3).

Table 2	Outcome Engel class		
	I	II-IV	Total cases
MRI examination (p value 0.03)	29	10	39
Lesion	25	5	30
Neoplasma	10	4	14
Vascular malformation	10	1	11
Cerebromalacia	5	0	5
Non lesion	4	5	9

Table 3	Outcome Engel class		
	I	II-IV	Total cases
Type of procedures (p value 0.02)	29	10	39
Lesionectomy	11	3	14
Lesionectomy and topectomy	13	1	14
Lesionectomy and MST	1	0	1
Lesionectomy, topectomy and MST	0	1	1
Topectomy and MST	2	3	5
MST	1	2	3
Callosotomy	1	0	1

Histopathology

The specimen from epileptogenic zone revealed neoplastic lesion in 13 (37.1%) patients which is oligodendroglioma in 6 (WHO grade 2 in 4, grade 3 in 2), astrocytoma in 4 (WHO grade 2 in 2, grade 3 in 2), ganglioglioma (WHO grade 1) in 2 and DNET (WHO grade 1) in 1 patient. Vascular malformation in 12 (34.2%) such as cavernoma in 7, AVM in 4 and hemangioma in 1 patient. Gliosis and heteropia neuron were in 9 and 1 patient (table 4). The histopathological finding (lesion or normal) was used as the dichotomous variable, but no difference was found, presumably because of the rather low number of cases with normal pathology.

Table 4			Outcome Engel class		
Histopathology examination (p value 0.06)			I	II-IV	Total cases
	Epileptogenic zone I	Epileptogenic zone II	27	8	35
Lesion	Neoplasma	Gliosis	11	2	13
	Vascular malformation	Gliosis	10	2	12
	Gliosis	Gliosis	4	1	5
Normal	Heteropia neuron	Gliosis	0	1	1
	Gliosis	Gliosis	2	2	4

Take Home Message:

In neocortical epilepsy, the best chance to gain a good outcome if an epileptogenic zone which well localized either by MRI and electricity is completely disappeared.

In term of long term surgical outcome, while the adult neocortical epilepsy patients fulfilled all of our favourable predictive factors, the chance of Engel class I outcome was 74.4%. This study demonstrates that the seizure outcome for neocortical epilepsy patient in our institution is favourable and overall compare well to those from other countries.

Table 5 Classification	Seizure time event and percentage	n	Engel class I	Engel class II-IV	% to long term good outcome
I	<1month	9	6	3	66.67%
A	≥ 50%	5	5	0	100%
B	< 50%	4	1	3	25%
II	≥1month	10	3	7	30.00%
A	≥ 50%	7	3	4	42.86%
B	< 50%	3	0	3	0%

Table 6 Classification	Percentage (%)	Engel class I	Engel class II-IV	% to long term good outcome
A	≥50	8	5	61.54%
B	<50	1	5	16.67%
		9	10	

Early postoperative seizures event

Nineteen (48.7%) of the 39 patients had at least one seizure during 1 year of postoperative follow-up. Nine (47.4%) of the 19 patients experienced their initial seizure event during the first postoperative month. 10 (52.6%) others had initial seizures over the first postoperative month (table 5). Thirteen (68.4%) of the 19 patients which have seizure event postoperatively have subsiding percentage of seizure frequency over 50% rather than before surgery and their long term surgical outcome as good as four times higher than 6 (31.6%) patient with have less than 50% of subsiding percentage in postoperative seizure frequency (table 6).

Predictive factors

By univariate analysis, data such as: age at surgery, age at onset, duration, presence of secondary GTC, frequency of seizure, epileptic discharge, surgical site, SPECT and histopathology showed no significant results as a predictive factor. The significant results as predictor of long term surgical outcome were obtained such as: existing structural lesion in MRI, type of surgery, and early postoperative seizure event.

Discussion:

Previous studies have suggested that good surgical outcome for neocortical epilepsy vary between 23% and 80%, whereas lesional is better compared to non lesional. The result of our study suggest that many neocortical epilepsy patients are likely to benefit from surgical treatment and 74,4% of our adult patients achieved good outcome in long term follow up. Indeed, with longer follow up duration, fewer patients are classed as Engel class I (figure 1).

Presurgical and surgical predictive factors

The most important factor to achieve good outcome is complete surgical resection. A less successful detection of structural abnormality on preoperative MRI studies may be associated with a higher percentage of incomplete resection. In term of surgical technique, for long term follow up, the complete resection of abnormal structural on MRI studies with additional resection of epileptogenic discharge zone from the presurgical EEG evaluation will achieve higher seizure free outcome. The present study demonstrated that lesionectomy and topectomy procedure in adult neocortical epilepsy achieve best surgical outcome due to scrupulous and comprehensive presurgical evaluation in such a way that epileptogenic zone both structural or electricity could be completely removed.

Post surgical predictive factor

We found that first postoperative year seizures event determine the predictive factor for poor long term surgical outcome ($p<0.05$), whereas patients who have time to first seizures in over 1 month postoperative get poorer outcome than during in 1 month postoperative period presumably because the margins of surgical resection, whenever that happens, may take over the role of generator or several potential zone of epileptic generation may be initiated. After disappearing the dominant epileptic focus by surgery, by the time, there will emerge other focus as become the centre of the next seizure.

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