COMMENT: DEBATE ON THAT EPILEPSY SURGERY SHOULD BE OFFERED EARLY EVEN TO PATIENTS WITH NON-LESIONAL MRI SCANS

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There is inherent difficulty in identifying the epileptogenic zone in nonlesional epilepsy, which leads to the incomplete resection. However, with careful interpretation of other studies including functional neuroimaging results, surgical treatment can benefit selected patients with nonlesional on MRI. There are two important issues regarding epilepsy surgery for these patients. One issue is when we can define the true intractability. Another issue is success rate of epilepsy surgery performed on these patients. Increasing medical costs with advancing age and high mortality associated with refractory seizures should also be considered. Concordance with two or more presurgical evaluations among interictal EEG, ictal EEG, FDG-PET, and ictal SPECT was significantly related to a seizure-free outcome in these patients. Intracranial EEG is one of the most important procedures in planning surgery and achieving a good surgical outcome. Careful placement of intracranial electrodes based on the results of presurgical evaluations should be needed. Resection that includes more electrodes with ictal rhythm or interictal abnormalities predicts a good surgical outcome. In conclusion, early application of epilepsy surgery for nonlesional patients can be considered case by case. The strong hypothesis based on the results of non-invasive evaluation is a key to successful epilepsy surgery.

Introduction

Neocortical epilepsy has comprised only a minor portion of epilepsy surgical series until now (1). It has not homogenous clinical manifestations. Widely different seizure semiologies could be found depending on the location of the epileptogenic foci. Clear understanding of epileptogenic network has not been possible. Scalp EEG often misleads or falsely localizes the ictal onset zone due to inaccessible location or widespread ictal onset. A focal structural lesion on MRI is a usually reliable indicator of the seizure onset (2-4). Concordant results of electrophysiological studies and MRI findings have high predictive value for good surgical outcome (5,6). However, MRI is ineffective in many partial epilepsy patients, even patients with cortical dysplasia. Multimodal evaluations are mandatory for the successful epilepsy surgery in these patients. Intracranial recording is also indispensable role for these patients. Surgical outcome has usually been known to be less well satisfactory (1,7,8). In the context of all these issues, determining the prognostic factors for good surgical outcome and suggesting the guideline of successful epilepsy surgery is very important for the this special group of patients.

Prognostic factors in neocortical epilepsy surgery

Although extratemporal resections are known to be generally less successful than are temporal lobe resections, the recent series suggested that many neocortical epilepsy patients are likely to benefit from surgical treatment, and 57.5% became seizure free more than two years after surgery (9). Positive prognostic factors for the surgical resolution of neocortical epilepsy were the presence of a tumor, an abnormal MRI, EEG/MRI concordance, and extenseiv surgical resection. The resection of an epileptognic lesion with an ictal onset zone is recognized as the most important factor for a good surgical outcome. The majority of surgical series suggested that the identification of a specific lesion usually leads to a favorable outcome (2-4). Our recent study based on a multivariate analysis of a large series of patients also showed that a focal lesion on MRI, focal hypometabolism on PET, and localized ictal onset on EEG were independent significant positive prognostic factors (9).

Surgical outcome and prognostic factors of nonlesionlal neocortical epilepsy

There is inherent difficulty in identifying the epileptogenic zone in nonlesional neocortical epilepsy, which leads to the incomplete resection. Until recently, only a minority of patients have been known to be seizure free after the resection. Seizure free outcome ranged from 31 to 70% for nonlesional temporal lobe epilepsy, and from 17% to 57% for extratemporal nonlesional epilepsy (10-15). Two recent large studies including ours demonstrated that seizure free outcomes were 47 and 55% for nonlesional TLE, and 41 and 43% for nonlesional extratemporal lobe epilepsy patients (14,15). Our study also showed that localization by FDG-PET and interictal EEG was correlated with a seizure-free outcome. Concordance with two or more presurgical evaluations among interictal EEG, ictal EEG, FDG-PET, and ictal SPECT was significantly related to a seizure-free outcome (15). With careful interpretation of other studies including functional neuroimaging and concordant results, surgical treatment can benefit patients with nonlesional neocortical epilepsy.

False localization of functional neuroimaging

Ictal SPECT and FDG-PET can be critical for localizing the seizure focus, especially in nonlesional patients. We analyzed 33 consecutive patients with nonlesional neocortical epilepsy who had a scalp ictal onset zone localized in the temporal lobe and good surgical outcome after focal neocortical resection (16). Epileptogenic zone outside the temporal lobe was not infrequently encountered in the patients who were diagnosed as non-lesional lateral temporal lobe epilepsy on long-term scalp video-EEG monitoring. FDG-PET and subtraction SPECT was valuable in the diagnosis of non-lesional neocortical epilepsy (17-22). However, in the patients with intracranial ictal onset zones outside the temporal lobe, their value was limited. FDG-PET and subtraction SPECT had localizing value in no more than half of patients, which even showed false localizations occasionally. Careful placement of intracranial electrodes on temporal lobe and adjacent areas should be needed for these patients.

Repositioning of intracranial electrodes

Accurate localization of ictal onset zone by intracranial electrodes is one of the most sensitive and important method in the success of epilepsy surgery (23-26). In the presurgical evaluation of non-lesional neocortical epilepsy, intracranial monitoring is indispensable but has the limitation in sufficient sampling. To get the appropriate information from intracranial monitoring, many intracranial electrodes are needed. Nevertheless, because these electrodes cover only limited portion of brain, the true ictal onset zone can sometimes be missed (27-29) and the repositioning or additional electrode can be needed.

Our group recruited 18 cases underwent a second invasive study consisting of repositioning or additional implantation of intracranial electrodes performed a week after the initial invasive study (30). The repositioning of intracranial electrodes identified a new ictal onset zone in 13 patients. In another four cases the second evaluation made the change of decision on the resection margin. Seven of 11 patients who were ultimately found to have focal ictal onset zone by the second evaluation became seizure free after the operation. The spatial restriction of ictal rhythm is the important predictor for good surgical outcome. These results support consideration of one-week interval repositioning of intracranial electrodes in selected patients.

Decision of extent based on the results of invasive study

The objectives of intracranial EEG are to define interictal abnormalities and the ictal onset zone, and to map the cortical function. Based on these results, physicians can determine the extent of the surgical resection. The surgical outcome depends strongly on the identification and complete resection of a well-defined epileptogenic zone. Therefore, the extent of the resection may contribute to the surgical outcome (31). Intracranial EEGs were analyzed in 177 consecutive patients who had undergone resective epileptic surgery (32). Based on the results of invasive evaluations, slow propagation and focal or regional ictal onset were associated with a seizure-free outcome. A seizure-free outcome was significantly associated with a resection that included the area showing

ictal spreading rhythm during the first three seconds or included all the electrodes showing pathological delta waves or frequent interictal spikes more than 0.2 Hz. In other words, resection that includes more electrodes with ictal rhythm or interictal abnormalities predicts a good surgical outcome.

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