<table>
<thead>
<tr>
<th>Affiliation</th>
<th>Neurology</th>
<th>Name</th>
<th>Morito Inouchi</th>
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<tbody>
<tr>
<td>Name of the meeting</td>
<td>63rd Annual Meeting of the American Epilepsy Society</td>
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<td>Period and venue</td>
<td>From December 4 to 8 at Boston, MA, USA</td>
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| Type of your presentation | 1) Invited lecture  
2) Poster presentation  
3) Workshop / Symposium  
4) Others (Please explain specifically below (  ) ) |
| Title of your presentation | A generator mechanism of epileptic spasms and generalized spikes in a patient with a focal cortical lesion |

1. Summary of your presentation (Include what you learned from discussions with audience)

**Background:** Epileptic spasms (ES) usually occur in infancy and are infrequently associated with a focal cortical lesion. Involvement of subcortical structures such as the brainstem, the putamen and thalamus was suggested as a generator but it is not clear in the case of ES with a focal lesion.

**Objective:**

To verify the hypothesis that a focal cortical lesion can activate the subcortical structures producing ES, we investigated a patient with late onset ES having a focal lesion by means of simultaneous recording of EEG and functional MRI (EEG-fMRI).

**Methods:** The patient was a 5 year-old right-handed girl with normal psychomotor development. She had suffered from daily ES for half a year in spite of multiple antiepileptic drugs. Video-EEG monitoring captured frequent ES and independent left hemiconvulsion. Interictally, generalized spikes were recorded and the seizure pattern consisted of repetitive generalized spikes. MRI revealed a small lesion in the ventral part of the right precentral gyrus, pathologically diagnosed as ganglioglioma. Electrocorticogram (ECoG) during surgery showed focal polyspikes at and around the tumor. She has been free of seizures and spikes on scalp EEG since tumor resection.

EEG-fMRI was recorded for 30 minutes before surgery based on the stepping stone sampling method (Anami, et al., 2003) under sedation using 3 tesla MR scanner (Trio, Siemens, Erlangen, Germany) and EEG amplifier (Synamp I, Neuroscan Lab, Sterling, VA, USA). (IRB approval number E217). Interictal generalized spikes were identified on post-processed EEG and served as onsets for a general linear model using an event-related design analysis including convolution with a hemodynamic response function and its temporal derivative. An F contrast was used to estimate significant spike-related BOLD signal changes (FWE < 0.05). Fitted response was calculated on
Results: EEG-fMRI revealed positive BOLD in the bilateral thalami, putamen, mesial temporal lobes, cingulate and insular cortices. In the lateral convexity, positive BOLD was mainly seen in the areas around the tumor. Negative BOLD was found in the bilateral parietal association cortices. The location of positive BOLD around the tumor corresponded to focal polyspikes seen in ECoG.

Discussion: Taking into account seizure freedom and absence of spike after tumor resection, restricted BOLD signal change and focal paroxysmal activity around the tumor suggested that primary epileptogenic focus was at and around the tumor. A robust activation in the bilateral mesial cortical and subcortical structures would reflect cortico-subcortical interaction, which was consistent with the hypothesized network of ES. In this particular patient, ES and generalized spikes seem to be generated by a focal cortical lesion and developed by subcortical structures. Although a patient with similar clinical manifestation is very rare, further case accumulation is warranted to establish this hypothesis.
2. Other topics of your interest

| As demonstrated in our study focusing on epileptic network involved in generation of epileptic spasms, EEG-fMRI provides a unique opportunity to identify brain areas related to epileptiform discharges including subcortical structures. McGill University group, one of the pioneers in this research field, presented many interesting studies using EEG-fMRI technique. Grova, et al. studied functional connectivity between subcortical structures and cerebral cortices during spike-free EEG period in patients with idiopathic generalized epilepsy (IGE) in whom it has been generally believed that the brain activity in spike-free period is normal. They first identified local maxima of BOLD signal changes at the bilateral thalami, caudate nuclei, precuneus, fronto-mesial cortices and mesial cerebellum using EEG-fMRI. Then, connectivity among these cortical and subcortical areas were calculated based upon fMRI signal changes during spike-free period, and compared with that in control subjects. Connectivity in bilateral thalami was significantly decreased compared with control subjects for thalamic, caudate and fronto-mesial seeds, consistent with some reports suggesting thalamic abnormality in IGE patients. Rathakrishman, et al investigated negative BOLD signal changes in patients with focal epilepsy. A localized negative BOLD signal changes concordant to the spike distribution were uncommon but, if present, consistent among patients. Recent studies described that (positive) BOLD signal changes could occur even before onsets of focal spikes. Thus, the authors studied if the undershoot of a preceding positive response might explain this type of negative BOLD, by analyzing hemodynamic response functions peaking every 2 seconds from -9 to +9 seconds around the spike. Eight patients who met inclusion criteria (with clear focal spikes corresponding focal negative BOLD and without widespread negative BOLD) were selected for the study. In the results, only two out of eight patients showed preceding positive BOLD signal changes probably caused by earlier focal discharges invisible on scalp EEG. The mechanisms of negative BOLD around epileptogenic area remains to be solved and may be heterogeneous. |
3. Impression of the meeting you got (e.g., major trends in the field, status and contribution of your study and/or studies in Japan to the field, etc.)

63rd Annual Meeting of the American Epilepsy Society was held at Hynes Convention Center in Boston from December 4 to 8. The contents of the meeting is comprehensive, including more than 1000 presentations from basic to clinical researches. Many lectures were also provided to attendees.

Among them, high frequency oscillation (HFO) seemed to be one of the hot topics. Now technical developments allow us to acquire ‘wide band’ EEG from DC to several hundred hertz. Especially, high frequency activity has been of great interests for researchers in clinical epilepsy and system neuroscience, often referred as HFO.

For example, some presentations suggested the close relationship between ictal onset zone and the interictal and ictal HFO. Another studies demonstrated that HFO was also found in response to a cognitive task.

Thanks to development of non-invasive neuroimaging techniques, such as high-resolution anatomical MRI, diffusion tractography, EEG-fMRI, FDG-PET, several studies attempted to delineate epileptic network by combining several different modalities.

The meeting was very educational and presented studies on the cutting edge in various research fields. I greatly appreciate kind financial support from global COE.