

## EO-1. Gamma Band Analysis and It's Implication During Stroop Task: MEG Study

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**Objective:** Magnetoencephalography (MEG) is a functional neuroimaging technique for mapping brain activity by recording magnetic fields which are produced by naturally occurred electrical currents in human brain. MEG is very effective way for spatial and temporal analysis of nerve activity in the brain. The aim of this study is to know which area can be activated while performing some cognitive task and to analyze the neural reactions in the task-associated areas by stroop task.

**Methods:** A total of eight normal people enrolled in this study. They all performed stroop tasks in 2 different situations, congruent and incongruent. If there is a match between a name of color and its lettering in a printed paper (e.g., the word “red” printed in red ink), appropriate naming the color means congruent task. Meanwhile, if there is a mismatch, naming the color is considered with incongruent task. Recording the MEG data during the stroop task and make the ERP and apply Fourier transform to analysis time-frequency spectrum.

**Results:** In the behavior response, congruent and incongruent reaction time showed a difference. Congruent reaction time is faster than incongruent. Furthermore, significant difference was detected on dorsolateral prefrontal cortex, especially in gamma range between the 2 stroop tasks. In 40-50 Hz, a 100-250 ms before tapping right button, the incongruent tapping ERSP (event-related spectral perturbation) power is more active compared with incongruent with statistical significance ( $p=0.00$ ).

**Conclusion:** In this study, we find out that gamma band is more active in a difficult situation, when subject encountered in two different situations to solve problems. Further researches are necessary to understand the meaning of gamma band oscillations as well as the human cognitive function.



## EO-2. Autonomic Instability in Chronic Vegetative Status

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**Objective:** Paroxysmal Autonomic Instability is a syndrome of marked agitation, diaphoresis, hyperthermia, hypertension, tachycardia, and tachypnea accompanied by hypertonia and extensor posturing. Usually episodic, it first appears in acute stage but may persist for weeks to months after trauma. It may be difficult to distinguish from life-threatening conditions such as sepsis, impending herniation, or seizure. Recently we would like to experience the autonomic instability in chronic stage.

**Methods:** From January, 2007 to March, 2011, we evaluated the clinical data of 117 mortalities, retrospectively. All of our patients that involved this study was neurosurgical intensive care unit patients and all of them was dead. We evaluated to autonomic symptoms (seven criteria: agitation, diaphoresis, hyperthermia, hypertension, tachycardia, tachypnea, abnormal posture), and duration of symptoms revealed. we reviewed that exclusive criteria (infection, side effects of drugs, seizure and other metabolic diseases). Lastly, we experienced one mixed type in acute stage and another in chronic stage among survivors since 2013.

**Results:** Among all mortalities, male and female ratio was 92:25. Mean age of patients was 52.1 (2-94) years. The mean initial GCS score was 6.36, GOS score was 1. The number of patients applied to our autonomic symptoms seven criteria was divided 8 groups (seven criteria: 4, six criteria: 4, five criteria: 5, four criteria: 4, three criteria: 10, two criteria: 42, one criteria: 32, no criteria: 16). Among survivors, one is the typical mixed type in acute stage and another is developed 7 years later in the chronic stage.

**Conclusion:** Most of autonomic instability is common complication of various cerebral injuries in acute stage and is associated with significant morbidity and mortality. However, Awareness of the features of this under-recognized condition should be emphasized in chronic stage, even though the vegetative condition has been persistent since 6 years before, 2009.

MEMO



## EO-3. Modification of Electrophysiological Activity Pattern after Anterior Thalamic Deep Brain Stimulation for Intractable Epilepsy

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**Objective:** Thalamic stimulation can provoke electroencephalography (EEG) synchronization or desynchronization, which can help reduce the occurrence of seizures in intractable epilepsy, though the underlying mechanism is not fully understood. Therefore, we investigated changes in EEG electrical activity to better understand the seizure-reducing effects of deep brain stimulation (DBS) in intractable epilepsy patients.

**Methods:** We analyzed electrical activation patterns in the epileptogenic brain using classical low-resolution electromagnetic tomography analysis recursively applied (CLARA). We compared electrical activity recorded during thalamic stimulation with those recorded during preoperative and postoperative off-stimulation in patients who underwent anterior thalamic nucleus (ATN)-DBS for intractable epilepsy.

**Results:** Interictal EEG was fully synchronized to  $\beta$ -frequency in the postoperative on-stimulation period. CLARA showed that electrical activity during preoperative and postoperative off-stimulation states was localized in cortical and subcortical areas, including the insular, middle frontal, mesial temporal, and precentral areas. No electrical activity was localized in deep nucleus structures. However, using CLARA, we localized electrical activity in the postoperative on-stimulation period in the anterior cingulate area, basal ganglia, and midbrain.

**Conclusion:** Anterior thalamic stimulation could spread electrical current to the underlying neuronal networks that connect with the thalamus, which functions as a cortical pace maker. Consequently, the thalamus could modify electrical activity within these neuronal networks and influence cortical EEG activity by inducing neuronal synchronization between the thalamus and cortical structures.

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## EO-4. Hippocampal Transection for Temporal Lobe Epilepsy

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Temporal lobectomy was established in the 1950s and has been widely applied to intractable temporal lobe epilepsy. It is excellent for seizure control with around 70% success rate. However, it is known that verbal memory declines after left temporal lobectomy in patients with left temporal lobe epilepsy without hippocampal atrophy on preoperative MRI. Hippocampal transection has been developed to overcome this problem. This procedure is based on the principle of multiple subpial transection (MST). The neuronal structure of the hippocampus is completely different from that of the surface cerebral cortex. However, the rationale of MST, disrupting the horizontal interneuronal connections and preserving vertical connection fibers, can also apply to the hippocampal structure. We have performed hippocampal transection in patients with left temporal lobe epilepsy without or mild hippocampal atrophy.

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## EO-5. Relationship Between Postoperative EEG Recruiting Response and Lead Location in Deep Brain Stimulation of the Anterior Nucleus of the Thalamus for Refractory Epilepsy

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**Objective:** A controversy exist in interpreting the postoperative EEG driving response (DR) an indicator of electrode placement within the thalamic nucleus in the deep brain stimulation (DBS) of the anterior nucleus of the thalamus (ANT) for refractory epilepsy.

**Methods:** We retrospectively investigated the relation between postoperative EEG DR and the location of electrodes (n=11) in 6 patients who underwent ANT DBS for refractory epilepsy.

**Results:** A cerebral synchronizing, EEG DR was observed in 10 electrodes, however, 9 of 11 electrodes were found to be located within ANT. Among the 2 electrodes missed ANT, DR was observed in one, misplaced electrode facing the anterior surface of ANT within the third ventricle. The other misplaced electrode without DR elicitation showed a DR after repositioning of the electrode.

**Conclusion:** A diagnostic significance of DR as an indirect evidence of electrode within thalamic nuclei is limited. If DR is not elicited, it should be regarded as a misplacement. Even if DR is elicited, it should not be interpreted as a sound indicator of proper electrode placement within the thalamus. Therefore, a sophisticated, postoperative imaging study is warranted in every case of ANT DBS.

MEMO



## EO-6. Bilateral Anterior Capsulotomy with MR-guided Focused Ultrasound for Refractory Obsessive-compulsive Disorder: 1 Year Results

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**Objective:** Obsessive compulsive disorder (OCD) is a common and chronic disorder that causes uncontrollable thoughts and behaviors resulting functional impairments to the patients. Neurosurgical interventions have accepted in the treatment of medically intractable cases including lesioning procedure and deep brain stimulation. Magnetic resonance-guided focused ultrasound (MRgFUS) has been newly developed as a minimally invasive technique to make thermal lesion in the brain. In this study, the authors investigated the use of MRgFUS for patients with treatment refractory OCD in perspective of efficacy and safety.

**Methods:** The authors performed bilateral thermal lesioning of anterior limb of internal capsule using MRgFUS. A total of 11 patients with medically intractable OCD were included. Clinical outcomes were evaluated with Yale-Brown Obsessive-Compulsive Scale (Y-BOCS), the Hamilton Rating Scale for Depression (HAM-D), and the Hamilton Rating Scale for Anxiety (HAM-A) at 1 week, 1 month, 3 months, 6 months, and 12 months following MRgFUS. Serial MRI scannings were performed to investigate the changes of lesion sites. Perioperative complication was also assessed during 1 year follow up period.

**Results:** Score of Y-BOCS was significantly decreased following MRgFUS capsulotomy (median Y-BOCS score, 34 vs. 22,  $p < 0.001$ ). HAM-D and HAM-A also showed improvements during the follow up period (median HAM-D score, 19 vs. 6,  $p < 0.001$ ; median HAM-A score, 20 vs. 6). There were several complications including headache, nausea and anxiety during sonication, which were mostly mild and transient. No major adverse events were reported after sonication.

**Conclusion:** The authors found that anterior capsulotomy using MRgFUS could be an efficient treatment option for intractable OCD. As well, the adverse events occurred significantly less than other neurosurgical interventions. The randomized and controlled are required to convince the favorable outcome and optimal indications for MRgFUS.

