

P-1. Unilateral Pallidal Stimulation of Focal Hand Dystonia Misdiagnosed with Fibromyalgia: A Case Report

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The first symptoms of focal hand dystonia are usually a feeling of tightness or loss of facility with a previously easily performed action, often accompanied by fatigue and aching in the affected hand and forearm that worsen with continued hand use. This first symptoms are sometimes similar to those of fibromyalgia (FM), characterised by chronic widespread pain and a heightened and painful response to pressure. FM may be mistaken for dystonia or accompanied by dystonia. We describe a 42-year-old woman with a 3-year history of FM who presented progressive focal dystonia of the left hand to spread to the elbow in the past 1 year. She failed to conservative treatments including muscle relaxant, trigger point block, botulium toxin injection. Unilateral pallidal deep brain stimulation was performed with excellent result. Clinician must carefully examine other pathologic lesion in case of chronic intractable FM in the hand.

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P-2. Unilateral Dual-electrode Deep Brain Stimulation of Globus Pallidus Interna (GPi) and Ventralis Oralis (VO) for the Treatment of CP Patient with Posttraumatic Hemidystonia

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Objective: Cerebral Palsy (CP) is difficult to treat because it is caused by a variety of motor disorders, involve multiple regions of the brain, magnetic resonance imaging (MRI) findings may be normal. And treatment outcome for posttraumatic secondary dystonia have been reported to be relatively poor compared with treatment outcomes for other secondary dystonia. We applied a dual-electrode DBS of GPi and VO for the treatment of CP patient with posttraumatic hemidystonia to maximize therapeutic effect.

Methods: A 32-year-old right-handed patient who was diagnosed CP at childhood, had developed a right-sided upper extremity dominant hemidystonia after motor vehicle accident at 11 years of age. The patient underwent unilateral GPi and VO DBS to maximize therapeutic effect at June 2014. Clinical outcome assessment were based on Burke-Fahn-Marsden Dystonia Rating Scale (BFMDR) movement and disability scores and were determined preoperatively and at 2 months, 4 months, 5 months after implantation in four conditions: baseline; On GPi DBS/Off VO DBS (for 2 months); Off GPi DBS/On VO DBS (for 2 month); On GPi DBS/On VO DBS (for 1 months). Health-related quality of life was assessed with a 36-item short-form general health survey questionnaire preoperatively and at last follow up.

Results: The BFMDR movement and disability scores had significantly improved by 71.4% (from 14 to 4) and 30.0% (from 10 to 7) at postoperative 2 months (On GPi DBS/Off VO DBS) compared with baseline. At 4 months (Off GPi DBS/On VO DBS), the improvement had increased slightly to 78.5% (from 14 to 3) and 40.0% (from 10 to 6). At the most recent follow up 6 months (On GPi DBS/On VO DBS) postoperatively, there was sustained improvement of dystonia compared with previous results. The health-related quality of life assessment revealed satisfactory results at follow up, such that body pain, general health, vitality, social functioning, as well as emotional and mental health improved significantly.

Conclusions: We demonstrated that dual-electrode DBS of GPi and VO for CP patient with posttraumatic upper extremity dominant hemidystonia is useful not only to treat dystonic movement but also to improve quality of life.



P-3. Glucose Metabolic Correlation between Clinical Symptom and Neuroimaging Findings after GPi DBS for Lance-Adams Syndrome

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Objective: Lance-Adams syndrome (LAS) is rarely diagnosed state that occurs after complication of successful cardiopulmonary resuscitation. Its symptoms are often accompanied by cerebellar ataxia and appeared days or weeks after the event. In this study, we report about a 36 years old woman with LAS who has chronic myoclonus caused by hypoxic brain injury.

Methods: We performed bilateral globus pallidus interna (GPi) DBS for symptom control. ¹⁸F-fluorodeoxyglucose positron emission tomography (FDG-PET) images were acquired pre- and post DBS surgery. To investigate cortical metabolic changes, we utilized the SISCOM technique for FDG-PET images which were coregistered with preoperative MRI. In order to minimize the differences of total brain activity, intensity normalization was performed before the subtraction process between pre- and postoperative FDG-PET.

Results: When bilateral GPi DBS was maintained with low-frequency stimulation (25 Hz), the patient showed significant improvements in myoclonus symptom. In the SISCOM analysis, cortical metabolic activity of postoperative FDG-PET was strongly increased in bilateral GPi. And also another hyper-uptake regions were found in bilateral precentral, putamen, thalamus, amygdala, limbic lobe, brainstem and cerebellum. In contrast, significant decrease of cortical metabolic activity was observed in dorsolateral prefrontal cortex, left anterior premotor cortex, medial superior frontal gyrus and right inferior parietal lobe.

Conclusions: In a patient with Lance-Adams syndrome, we demonstrated that myoclonus symptoms were improved after bilateral GPi DBS and cortical metabolic activity increased in associated regions with motor function. Our results support that these regional metabolic increases are positively correlated to connectivity changes with GPi by brain plasticity.



P-4. Gamma Knife Thalamotomy for Tremor

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Objective: Deep brain stimulation (DBS) and radiofrequency (RF) thalamotomy are effective neurosurgical procedures in the treatment of medically refractory tremors. Both procedures are clinically proven to be highly effective and relatively safe. But there is a subset of patients who are not eligible for invasive neurosurgery due to comorbid medical conditions. For these patients, Gamma knife thalamotomy (GKT) has been suggested to be a less invasive alternative treatment.

Methods: From June 2012 to August 2013, we have performed GKT for 7 medically refractory tremor patients. Mean age was 72.8 years (range from 70-75 years). All patients received unilateral GKT on the left side ventralis intermedius nucleus (VIM) with 4 mm collimator and 130 Gy of maximal dose. We used Fahn-Tolosa-Marin tremor rating scale (TRS) to objectively assess outcome. The mean follow-up period was 5.9 months (range from 1-12 months).

Results: There were no significant neurologic complications related to the treatment. All five patients who had taken initial and follow-up TRS showed improvement in scale. 3 patients who were followed up more than 6 months showed subjective improvement of tremor symptoms but 3 patients who were followed up less than 6 months remained subjectively equivalent. One patient was not followed up yet after GKS. Follow-up MRI was performed in 5 patients. Among 5 patients, 3 patients demonstrated well circumscribed spherical lesion in the target area as initially planned but 2 patients who performed follow-up MRI before 4 months showed no remarkable change.

Conclusion: GKT with 130 Gy of maximal dose is a safe procedure for patients who cannot tolerate invasive surgical procedures. Although GKT is a convenient tool in the treatment of medically refractory tremor patients the short term outcome is not superior to DBS or RF lesioning. Approximately 6 to 12 months of time interval could be required for the radiation effect to occur and such time lag should be informed to patient before receiving the procedure. In our study, no neurologic complications occurred, however one should keep in mind of the possibility that radiation effect around the target site is always not predictable and imaging changes are not always correlated with functional improvement.



P-5. A Method for Application of Leksell Stereotactic Frame Using the Hard Palate in Stereotactic and Functional Neurosurgery

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Objective: The importance of careful frame application to the success of stereotactic functional procedure is often underestimated. If the anterior commissure (AC) - posterior commissure (PC) is parallel to the base of a stereotactic frame, determination of a target point for functional surgery may become difficult. We introduce a method for application of Leksell stereotactic frame running parallel to the AC-PC line.

Methods: We measured an angle between AC-PC line and the superior cortical surface of the hard plate on midline sagittal T2-weight MR image (1.5 Tesla GE; TR/TE, 4,500/120; echo train length, 18; section thickness, 2 mm). Brain CT was then checked as the predetermined ganglionic angle relative to the hard plate as identified on the lateral CT scout film (slice thickness, 1 mm and 2 mm). After obtaining a CT plane containing both AC and PC, cutaneous external landmarks using laser guide light of the CT were displayed. Leksell coordinate frame, which is parallel to the cutaneous landmark, was applied to the patient's head. Twenty three patients who underwent functional stereotactic surgery for movement disorders were analyzed.

Results: For one of the 23 hard palate measurements a reliable consensus could not be reached due to distorted anatomy, artifact due to dental prosthesis. AC-PC line was angled 9.2 ± 4.0 degrees from the hard palate and AC-PC length was measured 23.5 ± 1.3 mm in 22 cases (11 Parkinson's disease, 8 Dystonia, 3 Essential tremor). After application of the Leksell frame, AC-PC length was measured 24.2 ± 0.6 mm in 22 cases. The AC and PC were visible at the same axial image in 18 cases (82%). The remaining 4 cases (18%) were visible on the adjacent slices. Statistically significant difference was not observed between the length of AC-PC line before and after the frame application ($p=0.615$, significant p -value <0.005).

Conclusions: The MR and CT images by using the hard palate offer a useful method in application of Leksell stereotactic frame running parallel to the AC-PC line in stereotactic and functional neurosurgery.



P-6. Development of a Focused Ultrasound Device for Small Animals: Preliminary Results and Troubleshooting

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Introduction: For the treatment of neurodegenerative disorders and neuro-oncological disorder, various drug and chemotherapy agents have been developed and tried in clinical field. However, the efficacy of these drugs or chemotherapeutic agents showed limited efficacy because of blocking by the blood brain barrier (BBB). Recently, a local and selective drug delivery method using focused ultrasound (FUS) which was traditionally used for tissue destruction was introduced for localized and transient opening of BBB. We tried to develop FUS devices for small animals. With the developed device, we studied the effect of FUS on BBB opening and the sonication parameters for targeted drug delivery.

Methods: In this study, we introduce the developed FUS device and an optimal ultrasound condition for BBB-disruption for small animals. To verify the feasibility of the developed FUS device, we have observed that changes of BBB in the striatum of SD-rat during transcranial sonication with micro-bubbles using the developed device (n=20). Moreover, to find the optimal sonication parameters for the BBB-disruption, we examined various sonication conditions at the pulse frequency of 1.1 MHz such as acoustic pressures range (2-6 MPa), pulse repeated frequency (2-100 Hz) and duty cycle (0.1-10%).

Results: We showed some results with Evans blue (about 900 kd) which show solutions of very large molecular weight could be diffused through the disrupted BBB. And we also demonstrate the optimal BBB-disruption condition of the ultra-sonication for drug delivery.

Conclusion: In this pre-clinical study, we demonstrated that FUS can make transient opening of BBB at focal area. It is expected that this technique can be applied for targeted drug delivery into the localized brain area. However, further investigation about the limitation of molecular weight for transposition across the BBB, controlling of focus size and location, and optimal parameters for drug delivery according to the molecular weight should be needed before applying clinical field.



P-7. Effect of Whole-body Exposure to the 848.5-MHz Radiofrequency Electromagnetic Field on Adult Neurogenesis in the Young, Healthy Rat Brain

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Introduction: Whether exposure to the 848.5-MHz Radiofrequency (RF) signal affects adult neurogenesis is unclear.

Methods: An animal experiment was performed with a reverberation chamber designed as a whole-body RF exposure system using code division multiple access (CDMA). Male Sprague-Dawley rats were assigned to three groups (n=6 per group): cage-control, sham-exposed, and RF-exposed groups. Rats in the RF-exposed group were exposed to the RF signal at a 2 W/kg whole-body specific absorption rate (SAR) for 1 or 8 h daily, 5 days per week, for 2 weeks. Rats received a single intraperitoneal injection of Bromodeoxyuridine (BrdU) to label proliferative cells daily for the last five consecutive days of RF signal exposure. An unbiased stereological method was used to estimate the number of BrdU+cells in the subventricular zone (SVZ) and dentate gyrus (DG).

Results: We found no significant changes in the number of BrdU+cells in the SVZ or DG in the RF-exposed rats, compared with rats in the cage-control and sham-exposed groups ($p>0.05$).

Conclusion: Our results suggest that exposure to the RF signal does not affect neurogenesis in the adult rat brain, at least under our experimental conditions.

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