S1-Automatic Path Planning by Fast Scanning for Robotic Control of Deep Brain Stimulation Using Multi-modal Images

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Deep brain stimulation has been used widely to modulate several functional disorders, such as Parkinson's disease, dystonia, essential tremor, or etc. This procedure has several postoperative complications. Among them, intracranial hemorrhage is the most disastrous event. To prevent the hemorrhage, a surgeon should trace trajectory and vessel enhancement on T1 weighted gadolium enhanced images or CT angiography during preoperative planning surgeon's eye view. This work takes a great deal of time and is troublesome.

Authors proposed a novel method of automatic path planning software to find safe trajectory.

S2-Variability of the Target Coordinates in Thalamic Deep Brain Stimulation for Epilepsy, Review

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Background: Deep brain stimulation (DBS) of the thalamus is an emerging treatment for patients with medically refractory epilepsy not suitable for resective surgery.

Objective: Although an accurate placement of the electrode within thalamic subnucleus is an essential element, the target coordinates in the literatures differ from centers to centers and the descriptions of the target coordinates are often vague. We reviewed the variability of target coordinates of the anterior nucleus of the thalamus (AN) and centromedian nucleus (CM) in the literatures.

Methods: A total of 16 papers met the criteria and were included. The X, Y, Z coordinates and procedural remarks about target planning were summarized.

Results: The X, Y, and Z coordinates for AN varied approximately 3 mm in distance. The X and Y coordinates of CM were in range of 3 mm in variation. However, the Y coordinates of CM varied widely from 11 anterior to PC to the anterior level of PC.

Conclusions: Among the reported target coordinates for AN/CM thalamic DBS, the Y coordinates of CM were most variable. Direct visual target selection from MRI was possible for AN, but not for CM.

S3-Clinical Trial of Fetal Mesencephalic Dopamine Neuronal Precusor Cells in Patients with Parkinson's Disease

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Objective: Parkinson's disease (PD) is a progressive neurodegenerative disease and fetal mesencephalic dopamine neuronal precursor cells (FMD NPCs) have been considered to be the most suitable candidates for cell therapy. Problems of fetal brain tissue transplant are expected to be solved by providing abundant cells for many patients through FMD NPC. Our object is to explore the safety and efficacy after transplantation of FMD NPCs in patients with idiopathic PD.

Methods: Fifteen patients will be enrolled in this clinical trial and inclusion criteria are as follows: (1) Patients with idiopathic PD, (2) Hoehn and Yare stage III or IV, (3) Positive response to Levodopa, (4) less than 70 years. We developed a new techniques to provide a large amount of FMD NPCs for transplantation through in vitro expansion. FMD NPCs will be transplanted into the both side of putamen. UPDRS score and PET scan will be evaluated to compare preoperative and postoperative state.

Results: The eight patients underwent FMD NPCs transplantation for PD. There are no complications during the follow-up period. At the 6 months follow-up visit, subscore for axial impairment (item 27-30) were significantly improved in first case. From second to 8th patient's follow-up periods is insufficiently short. Therefore, the F/U period needs to be extended.

Conclusion: We expect that NPC transplantation would be effective and helpful in Parkinson's patients. We will develop a clinical trial that would use FMD NPCs for the treatment of PD.

S4-Neuropsychological Effects of Magnetic Resonance Guided Focused Ultrasound Thalamotomy

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Objective: Thalamic procedure, regardless thalamotomy and thalamic deep brain stimulation is well accepted for their efficacy for controlling tremor. However, there were some debates of the effect for cognitive functions by these procedures. One of the reasons of limiting interpretation of this effect is that thalamic procedures previously performed should penetrate frontal area and it could be influence the cognitive functions. Recently developed technology, magnetic guided focused ultrasound surgery (MRgFUS), can makes lesions at deep brain nucleus without frontal lobe penetration, and, with this tools, it makes possible to evaluate changes of non-motor cognitive functions after thalamic lesions, exactly.

Methods: Total 6 patients who underwent MRgFUS thalamotomy for essential tremor were enrolled in this study. All patients received MRgFUS thalamotomy at left side ventrails intermedius nucleus of thalamus, and magnetic resonance imaging was taken for confirming lesion at thalamus. Seoul neuropsychological screening battery (SNSB) containing tests for attention, language and related functions, visuospatial function, verbal memory test, visual memory test, frontal executive function test was used for evaluating cognitive changes at pre-operation and 6 months after operation.

Results: All patients experiences significant improvement of their tremor symptom. All domains of SNSB test including moods were not changed after thalamotomy statistically. However, there were tendency to decrease in generational naming, visuaspatial memory, and verbal immediate memory, and increase in cisual recognition and inhibitory control without statistical meaning.

Conclusion: Although small sample size makes difficult to conclude the effect on cognition by isolated thalamic lesioning, it seems to be true that thalamotomy, by it self, doesn't make definite decline of cognitive function. Considering the efficacy of thalamotomy on tremor control, the patients can be underwent MRgFUS thalamotomy without worrying of cognitive decline.

S5-Subcomponent of Cervical Dystonia which Showed Difference Clinical Course from Pallidal Deep Brain Stimulation

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Objective: Cervical dystonia (CD) is the most common type of dystonia that brings lots of social embarrassment and disabilities of daily living. It is known that medically refractory CD would be treated successfully with GPi DBS. However surgical outcomes in each different dystonic components have not been discussed well.

Methods: Data were retrospectively obtained by reviewing medical records of patients whose operation were performed from March 2000 to February 2014. Preoperative medical data of patients were carefully reviewed that included phenomenology of CD (mobile or fixed), component of CD (torticollis, retrocollis, laterocollis and anterocollis) and Toronto Western Spasmodic Torticollis Rating Scale (TWSTRS). Improvement rates of TWSTRS were calculated by difference between preoperative score and postoperative follow up score divided by preoperative score. The improvement rates of two surgical modalities were compared using chi-square test for parametric data (data number more than 12) and Mann-Whitney U test for nonparametric data (data number less than 12).

Results: Thirty patients with CD underwent GPi DBS were found in the searched data. Among them, patients who had been followed more than 6 months were 20. Average improvement rates of these 20 cases were 67.8% (severity 77.6%, disability 49.4% and pain 69%). Mobile type showed statistically better result than fixed type in 1week, 1 month and 3 months (70.1% vs. 47.3%, p=0.014) after operation while this statistic difference was disappeared after 6 months (69.3% vs. 60.2%, p=0.309) after operation. Though CD patients who does not have laterocollis component showed slightly better outcome at 6 months after operation than who have laterocollis (66.4% vs. 61.2%), statistic value was not significant (p=0.624). Moreover patients without retrocollis component showed better outcome than whom with retrocollis without statistical significant (69.2% vs. 53.0%, p=0.127).

Discussion: Patients with CD show various clinical features and course, and each of clinical features is worthy to examine surgical outcomes separately. Our results showed statistically different response courses between mobile and fixed type of CD. Even though it was failed to show statistical diffe rences among laterocollis and retrocollis component in this study, we think that differences between CD components could be unfolded in future.

S6-Retrocollis with a Component of Laterocollis Successfully Treated with Selective Peripheral Denervation: A Case Report

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Objective: Clinical experience with selective peripheral debervation (SPD) for complex type of retrocollis and latrocollis is very limited. A previous study also reported patient with marked retrocollis did not benefit from SPD. The authors describe a patient with retrocollis with a component laterocollis successfully treated with SPD.

Methods: A 32-year-old man suffered from modeate backward deviation of neck with a component of moderate right head tilt. He failed to treatment with oral medication, botulism toxin, and physical therapy. He underwent bilateral posterior cervical muscle denervation (extradural C1-C6 denervation on the ipsilateral side of the tilting head with contralateral extradural C1-C4 denervaion) plus ipsilateral levator scapulae denervation (ventral ramisecomy of C3 and C4).

Results: His abnormal neck movement immediately disappeared almost after surgery. He showed an excellent outcome in 4 months follow-up period with tolerable sensory change on the occipital area. There was transient swallowing disturbance, that recorved completely in 3 months after surgery.

Conclusion: The SPD may be an effective treatment for refractory complex type of cervical dystonia with retrocollis and laterocollis.

S7-O-arm Imaging Technology for Verification of the Lead Location in Functional Neurosurgery
(Deep Brain Stimulation and Spinal Cord Stimulation)

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Objective: Correct lead location in the desired target has been proven to be a strong influential factor for good outcome in functional neurosurgery. Commonly a surgeon's first reliable assessment of such location is made on postoperative imaging. While intraoperative CT and intraoperataive MR imaging have been previously described, the authors present technique of O-arm imaging for verification of lead location in deep brain stimulation (DBS) and spinal cord stimulation (SCS).

Methods: 1.5-T MR imaging stereotactic imaging was performed on the day of surgery and initial target coordinates were made using StealthStation software (Framelink 5.1, Medtronic, Inc.). After 4 channel MER was then performed with kinesthetic responses and macrostimulation, the DBS lead (model 3389, Medtronic, Inc.) was placed. Intraoperative O-arm imaging was performed and the scanned imaging datas were transferred to Stealth Station, the lead location was verified with overlay of Schaltenbrand and Wahren atlas on the merged images of the O-arm and MR imaging. For spinal cord stimulation, the operation for laminotomy and lead placement was performed in the O-arm table. After insertion of paddle electrode in the posterior epidural space, O-arm imaging was done and 3D reconstruction of O-arm imaging was displayed. With the information of O-arm imaging showing lead displacement, adjustment of the lead was done and repeated O-arm imaging was done until final verification of O-arm imaging showing a midline placement of the paddle lead.

Results: O-arm imaging was done in five consecutive DBSs and three paddle lead SCSs. The O-arm imaging technology provided a real-time information about the lead location in the operating field. With limited numbers of cases, there was no grossly misplaced electrodes. The preoperative MR, intraoperative O-arm imaging, and postoperative CT imagings were transferred to Stealthstation and lead location was again verified with co-registeration of Schaltendrand and Wahren atlas.

Conclusion: Although the application of O-arm imaging technology requires extra-time and possible risk of radiation exposure, we think we can limit the number of O-arm passes performed, therby we can reduce effective radiation exposure. The initial experiences of using O-arm imaging could provide a valuable, real-time information of lead location in the intraoperative OR field.