

## S15-Peripheral Nerve Field Stimulation (PNfS) for Chronic Intractable Neuropathic Pain, Initial Experience

손병철<sup>1</sup>, 김덕령<sup>2</sup>, 하상우<sup>1</sup>, 전신수<sup>1</sup>

<sup>1</sup>가톨릭의대 서울성모병원 신경외과학교실, <sup>2</sup>을지의대 노원을지병원 신경외과학교실

**Objective:** Peripheral nerve field stimulation (PNfS), initially suggested by Barolat, has been reported to be an effective, simple way to recruit lumbar and sacral fibers directly from the painful region, by placing electrodes in the superficial subcutaneous layer to stimulate the nerve endings and dermal receptors. Several case series have shown the effectiveness of PNfS for management of neuropathic pain and some mixed, and nociceptive pain. We report our experience of application of PNfS in three patients with chronic, neuropathic pain and discuss current limitation of its application in neuropathic pain syndrome.

**Methods:** Three patients with chronic intractable, neuropathic pain underwent trial of PNfS. The cause of pain for PNfS were; postherpetic neuralgia (PHN, n=2) and segmental trunk pain of spinal cord injury (SCI, n=1). The preoperative NRS ranged from 7-8/10 and their chronic pain did not respond to maximal medical therapy and physical therapy, radiofrequency rhizotomy.

The cylindrical lead (Octrode<sup>®</sup>, St. Jude Medical, Plano, Texas, USA) was placed in the superficial subcutaneous layer in the painful region just inside to the margin of maximal painful area. Trial stimulation was given with external stimulator. If the patient are satisfied with PNfS, an implantable pulse generator was placed.

**Results:** PNfS was effective in one patient with severe allodynic pain in cervical area (C3-5) from PHN. The allodynia decreased in the area along the course of the lead decreased. However, allodynia in the non-stimulated area by PNfS lead was not alleviated. With 3 cylindrical leads, about 30% of allodynic painful area was covered with stimulation and the patient decided to have a chronic stimulation, then the IPG was implanted. With follow-up of 12 months, the analgesic effect did not change and the patient evaluated the stimulation effect was helpful.

PNfS did not evoke any stimulation-induced paresthesia in other two patients (one PHN, one segmental pain of SCI). Their painful area which did not respond to stimulation was anesthetic to all modality of sensory stimulation (anesthesia dolorosa) and there was spontaneous deep pressure-like pain and the leads were removed after trial stimulation.



**Conclusions:** In our initial experience, PNfS provided some analgesic effect on allodynic pain of neuropathic pain. However, PNfS was not effective in spontaneous pain of anesthesia dolorosa. Although, one patient responded to PNfS, the area covered with current cylindrical lead has a limitation in full-coverage of painful area.

We thought that an application of PNfS would be more helpful in nociceptive pain or mixed pain, and in chronic neuropathic pain, the analgesic effect would be better for mild to moderate neuropathic pain, not in severe neuropathic pain such as anesthesia dolorosa.



## S16-Clinical efficacy of Pulsed Radiofrequency Neuromodulation for Meralgia Paresthetica - Minimum 6 Months Follow Up -

**Hyuk Jai Choi, Jin Seo Yang, Suk Hyung Kang, Young Jun Cho**

*Department of Neurosurgery, Chuncheon Sacred Heart Hospital, Hallym University  
School of Medicine, Chuncheon, Korea*

**Objective:** The objective of this study was to evaluate clinical outcomes of patients with meralgia paresthesia (MP), who are refractory to conventional management treated using pulsed radiofrequency (PRF) neuromodulation to the lateral femoral cutaneous nerve (LFCN).

**Methods:** From September 2010 and March 2012, 11 patients with medically intractable MP underwent diagnostic LFCN block using 1.0% lidocaine and dexamethasone twice with one week interval. Temporary pain relief of >50% was considered a positive response to the diagnostic nerve block. These patients underwent PRF neuromodulation of the LFCN for MP.

**Results:** The visual analogue scale scores at the 1, 3, 6 and 12 month follow up assessments showed significant improvements in pain compared with the pre-diagnostic block scores ( $p < 0.001$ ). Furthermore, no complications were reported.

**Conclusion:** PRF neuromodulation of the LFCN, as an alternative treatment, for the patients with MP, who are refractory to conventional management can offer relief of symptoms up to 12 month without complications.



## S17-Adhesion between IPG and Extension: Complication of IPG Replacement in SCS Patient

**Won Hee Lee, Seong Tae Kim, Kun Soo Lee, Se Young Pyo,  
Young Gyun Jeong, Yong Tae Jung, Moo Seong Kim**

*Department of Neurosurgery, Inje University School of Medicine, Busan Paik Hospital, Pusan, Korea*

**Objective:** Neuromodulation like deep brain stimulation (DBS) and spinal cord stimulation(SCS) has been known to be effective and safe for treatment of various disorders such as pain, movement disorder and epilepsy, etc. However, as increasing neuromodulation procedures, complications of implantable pulse generator (IPG) replacement surgery is increasing. We experienced complication that is adhesion between IPG and extension during IPG replacement surgery in SCS patient, so we report here on our experience.

**Methods:** A 66 year-old woman with spinal SCS due to failed back surgery syndrome (FBSS) underwent IPG replacement surgery. During operation under local anesthesia, We could not separate IPG and extension. As a result of observing, connector site of IPG and extension was adhered with blood clots and tissues.

**Results:** We had drilled connector site with high speed drill and separated IPG and extension. After then, we removed blood fibrosis and granulation tissues on connector site in extension and replaced new IPG.

**Conclusions:** To avoid this complication, We have to remove blood clots or tissues in connector site between IPG and extension during operation.



## S18-Optogenetic Inactivation of the Subthalamic Nucleus Improves Forelimb Akinesia in a Rat Model of Parkinson's Disease

Hyung Ho Yoon<sup>1</sup>, Jin Hoon Park<sup>2</sup>, Yong Hwan Kim<sup>3</sup>, Joongkee Min<sup>1</sup>,  
Eunmi Hwang<sup>4</sup>, C. Justin Lee<sup>4</sup>, Jun-Kyo Francis Suh<sup>5</sup>,  
Onyou Hwang<sup>6</sup>, Sang Ryong Jeon<sup>1</sup>

<sup>1</sup>Department of Neurological Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul,

<sup>2</sup>Department of Neurological Surgery, Gangneung Asan Hospital, University of Ulsan College of Medicine, Gangneung,

<sup>3</sup>Dept. of Computer Science and Engineering, Bioengineering Graduate Program, Univ. of Notre Dame, Notre Dame, IN, USA

<sup>4</sup>Center for Neural Science and WCI Center for Functional Connectomics, Korea Institute of Science and Technology, Seoul,

<sup>5</sup>Center for Bionics of Korea Institute of Science and Technology, Seoul,

<sup>6</sup>Department of Biochemistry and Molecular Biology, University of Ulsan College of Medicine, Seoul, Korea

**Background:** The inhibition of neuronal activity by electrical deep brain stimulation (DBS) is one of the mechanisms explaining therapeutic effects on Parkinson's disease (PD) patients but cannot specifically activate or inactivate different types of neurons. Recently, a new technology based on optogenetics has been developed to modulate the activity of specific neurons. However, the therapeutic effects of optical inactivation in the subthalamic nucleus (STN) have not been fully investigated.

**Objective:** We performed various behavioral tests to evaluate changes in motor functions in a PD rat model after optogene expression. Unlike previous studies, we assessed the therapeutic effects of direct optogenetic inactivation in the STN.

**Methods:** 6-hydroxydopamine (6-OHDA) induced hemiparkinsonian rats received injections of hSynapsin1-NpHR-YFP AAV or an equivalent volume of PBS. Three weeks after injection of AAV or PBS, the optic fiber was implanted into the ipsilateral STN. Stepping test, cylinder test, and apomorphine-induced rotation test were performed in three sequential steps: during light-off state, light stimulation, and light-off state.

**Results:** Stepping tests revealed that optical inhibition of the STN significantly improved 6-OHDA-induced forelimb akinesia. Interestingly, PD motor signs, as assessed by cylinder and apomorphine tests, were not affected by optical inhibition. Immunofluorescence revealed that halorhodopsin was highly expressed and co-localized with vesicular glutamate transporter 2 in the STN.



**Conclusions:** Optogenetic inhibition in the STN may be effective in improving contralateral forelimb akinesia, but not in changing forelimb preference or reducing dopaminergic receptor supersensitivity. These findings are useful as a basis for future studies on optogenetics in PD.



## S19-Interictal Electrocorticographic Activity Spatial Analysis with Two Kinds of Wavelets with Different Temporal Supports and Seizure Outcome

**Seong-Cheol Park, Sang Kun Lee, Chun Kee Chung**

*Department of Neurosurgery, Seoul National University College of Medicine, Seoul, Korea*

**Objective:** We compared between long and short temporal support wavelets for interictal electrocorticographic activity analyses including spatial information in relation to seizure outcomes in medically intractable epilepsy patients.

**Method:** 22 patients with medically intractable epilepsy operated after electrocorticographic monitoring between Oct. 2010 and Feb. 2012 were included for the study. Interictal segment of 60 s duration with abundant epileptiform activities were selective for the analysis. Wavelet transform was performed in 20 frequency bands from 625 to 1 Hz by two kinds of complex Morlet wavelets with long support bandwidth parameter, 18 and short support bandwidth parameter one. Activities with amplitude and durations within thresholds were detected in the wavelet transformed domain. Number of activities were counted. Resection of zones with activities over the threshold number were compared between seizure outcome groups by Mann-Whitney U-tests. Thresholds were randomly generated and selected to differentiate seizure outcome groups significantly by the genetic algorithm. Optimization target was to obtain p-values as low as possible. Results with the significance or tendency in the last 200 threshold sets were retested in a different interictal dataset from the same group of patients.

**Results:** Delta band was significant and reproducible in short-support wavelets ( $p < 0.01$ ). Theta to 20 Hz bands were significant in both wavelets ( $p < 0.01$ ). At 80 Hz band tendency of the negative relationship between resection extents and seizure outcome were found by the long-support wavelet ( $p < 0.1$ ). In the other gamma and ripple bands no reproducible relationship were found. Both wavelets could reproducibly differentiate seizure outcome groups at tendency level at fast ripple bands ( $p < 0.1$ ). Locations of cortices with seizure outcome related activities were within seizure onset zones.

**Conclusion:** Optimal wavelet temporal supports to detect seizure outcome related activities are different according to bands. Positively or negatively seizure-outcome related activities were found within seizure onset zones.



## S20-Relationship Between the Accuracy of the Diagnosis with the MRI Findings on MRI Stereotactic Biopsy

**Young Goo Kim, Young Cheol Na, Won Seok Chang,  
Hyun Ho Jung, Chung, Jin Woo Chang**

*Division of Stereotactic and Functional Neurosurgery, Department of Neurosurgery, Brain Research Institute,  
Yonsei University College of Medicine, Seoul, Korea*

**Objective:** The aim of this retrospective study was to evaluate the correlation with MRI findings and diagnostic accuracy of MRI guided stereotactic biopsy.

**Methods:** 270 MRI guided stereotactic biopsy, was performed in 257 patients between July, 2005 and December, 2013 in our institute. Age ranged from 15 to 88 years (mean 45); the male to female ratio was 150:107. MRI finding was classified as follows, enhancement, multiplicity, location of lesion and perfusion.

**Results:** Histological diagnosis was made in 242 patients (diagnostic yield 94.2%) enhanced lesions were more likely to be diagnosed in MRI guided stereotactic biopsy, than non-enhanced lesions ( $p=0.02$ ). Among 59 patients who MRI finding was non-enhanced lesions, multiple lesions were more to be diagnosed than single lesions ( $p=0.01$ )

**Conclusions:** Accuracy of the diagnosis on MRI guided stereotactic biopsy is related to the enhancement and multiplicity of lesion





## S21-Stereotactic Biopsy and Cytology

김무성, 이원희, 김성태, 이근수, 표세영, 정영균, 정용태

인제대학교 의과대학 부산백병원 신경외과학교실

**Objective:** A stereotactic biopsy frequently is indicated when radiotherapy is being considered if definitive diagnosis has not been established. Sometimes, accuracy of biopsy was not so good, so we use 5×5 mm advance method. We underwent stereotactic biopsy and washed water of stereotactic biopsy device sent to cytology. We double checked of the result of biopsy and cytology.

**Methods:** We operated 36 brain tumor patients during last 3 years.

**Results:** Biopsy result was 8 glioblastoma (cytology result: 2 malignant cells, 6 negative), 8 malignant lymphoma (cytology result: 2 malignant cells, 3 benign cells, 3 negative), 6 metastasis (cytology result: 6 malignant cells), 2 anaplastic astrocytoma (cytology result: 1 suspicious cells, 1 benign cell), 3 low grade glioma (cytology result: 1 benign cell, 2 negative), 4 gliosis (cytology result: 2 benign cell, 2 negative), 1 oligodendroglioma (1 malignant cell), etc.

In a patient, biopsy was lost and cytology result was metastatic carcinoma.

**Conclusion:** In malignant tumors, cytology for washed water of stereotactic biopsy device is helpful for tumor diagnosis. Cow give many good material (beef, gomguk, etc), cytology of malignant brain tumor gives us may information.



MEMO

