P1-Abnormal Resting State Functional Brain Network in Epilepsy Patients with Focal Cortical Dysplasia

Woorim Jeong[1,2], Seung-Hyun Jin[1,3], Museong Kim[1], June Sic Kim[1], Chun Kee Chung[1,3,4]

[1]MEG Center, Department of Neurosurgery, Seoul National University Hospital, Seoul,
[2]Interdisciplinary Program in Neuroscience, Seoul National University College of Natural Science, Seoul,
[3]Neuroscience Research Institute, Seoul National University Medical Research Center, Seoul,
[4]Department of Brain and Cognitive Sciences, Seoul National University College of Natural Sciences, Seoul, Korea

Objective: Despite of recent interest of network approaches derived from graph theory on epilepsy, resting state network analysis of focal cortical dysplasia (FCD) brain compared with control brain has not been adequately investigated. Here we investigated the difference in the resting state functional network between epilepsy patients with focal cortical dysplasia (FCD) and healthy subjects by using whole-brain magnetoencephalography.

Methods: We retrospectively analyzed MEG signals from 35 epilepsy patients with FCD and 23 healthy controls. A global mutual information (MIglob) as a measure of strength of functional connectivity, and the global efficiency (Eglob) as a measure of efficiency of functional network were calculated for theta (4-7 Hz), alpha (8-12 Hz), beta (13-30 Hz), and gamma (31-45 Hz) bands to compare global network differences between FCD patients and controls groups.

Results: FCD brains at the resting state had stronger functional connectivity (MIglob) in the beta (p= 0.000) and gamma bands (p=0.007), and also showed higher efficiency of functional network (Eglob) in the beta (p=0.001) and gamma bands (p=0.003) than controls. For the type of FCD, functional connectivity of FCD type I (MIglob, p=0.004; Eglob, p=0.012) and type II (p=0.016; Eglob, p=0.006) in the beta band were higher than that of normal controls. In the gamma band, the values of FCD type II were higher than those of normal controls (MIglob, p=0.001; Eglob, p=0.000) and FCD type I (MIglob, p=0.038; Eglob, p=0.031).

Conclusion: We revealed that FCD brains had increased functional connectivity in the beta and gamma bands at the resting state compared with those in healthy controls. Resting state network differences could be used even when there is no prominent interictal spike activity, and would enhance our understanding of epileptogenesis of FCD.

P2-Adult Congenital Muscular Torticollis Treated by Surgical Release: Experience in 24 Patients with Follow-ups of More Than 6 Months

이건상, 이명기, 이성우, 김우재, 김호상, 김정호, 김윤석

메리놀병원 신경외과

Objective: Congenital muscular torticollis (CMT), when untretaed, sometimes results in cosmetic deformity including head tilting and limitation in the neck movement. The result of surgical release of the tightened muscle are good in the infants, even with older children. However, little importance is avaliable on the surgical treatment of adult CMT. We assessed the surgical results of bipolar release in 24 patients with CMT in adult.

Methods: Twenty-four patients underwent a bipolar release of the sternocleidomastoid muscle and were retrospectively analyzed with follow-ups of more than 6 months. They have no history of operation on the torticollis. The mean follow-up period was 13.4 months (range, 6-48). The mean age at time of surgery was 30.1 years (range, 20-58). A soft cervical collar was applied for 2 or 3 weeks after surgery. Intermittent stretching exercise by themselves started 3 days after surgery. Patients were evaluated with modified Lee's scoring system and global satisfactory rating scale using patient self-reporting. Head tilt was measured by the cervicomandibular angle using the cervical spine anteriorposterior X-ray.

Results: According to the modified Lee's scoring system, excellent results were noted in 13 (54.2%) patients, good in 7 (29.2%) and fair in 4 (16.7%). The mean cervicomandibular angle was 15.7° (range, 8-37) preoperatively, which improrved to a mean of 5.5° (range, 0-25) after surgery. Subjective improvement reported averaged 92.1% (range, 88-95%) at last follow-up. There were no surgical-related complications except for transitory sensory loss on the lower ear lobe in three cases

Conclusions: This result shows that bipolar release as a safe and highly effective treatment option for the treatment of CMT in adult. Although the cervical spine changes remained, the patients are very gratified with the functional and cosmetic results without neurologic complication in the neck.

P3-The Successful Implantation of Bilateral Pallidal Stimulation for Generalized Dystonia in a Patient with a Previous Cochlear Implant

이명기, 이성우, 이건상, 김우재, 김호상, 김정호, 김윤석

메리놀병원 신경외과

Objective: In one recent report, cochlear implant produced image distorsion affecting imaging distorsion in MRI. Therefore, MRI-based targeting for deep brain stimulation (DBS) is impossible in patients with cochlear implant. We describe the successful implantation of bilateral pallidal DBS using CT for generalized dystonia in a patient with a preexisting cochlear implant.

Methods: A 15-year-old girl presented with progressive dystonia for 1 year. She was bed-ridden state and suffered from intractable severe generalized dystonia with pain such as status dystonia on admission. A right cochlear implant was placed in age of 5 years due to bilateral hearing loss. Thin slice CT was checked and evaluated anaterior commissure-posterior commissure line before operation. After CT-based targeting, she underwent bilateral implantation of DBS electrodes leads (DBS Model 3387, Medtronic) into the internal globus pallidus under general anesthesia by using microelectrode recording. After 3 days of a trial test, the extension and pulse generator was implanted.

Results: Progressive improvement of her dystonia was noted until now 6 months after the operation. No significant complications were encountered.

Conclusion: This case report demonstrates successful implantation of bilateral pallidal deep DBS using CT for generalized dystonia in a patient with a preexisting cochlear implant. DBS can also be used safely without adverse interactions to the cochlear implant.

P4-Effect of Hippocampal Sclerosis on Functional Cortical Hubs in the Resting State

Seung-Hyun Jin, Woorim Jeong, Chun Kee Chung

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

Objective: To test the hypothesis that mesial temporal lobe (mTLE) epilepsy patients with hippocampal sclerosis (HS) have different electrophysiological functional cortical hubs (highly central parts of the network) from that of healthy controls.

Methods: The resting-state functional networks in the theta, alpha, beta, and gamma frequency bands were evaluated in 44 mTLE patients with HS (22 left mTLE; age range 17-56, M:F=8:14; 22 right mTLE: age range 20-51, M:F =9:13) and 46 age- and gender-matched healthy controls. All patients achieved seizure-free after surgery. We investigated the network with betweenness centrality (BC) measures at the source level with magnetoencephalography (MEG) signals. A Kruskal-Wallis test and post-hoc Mann-Whitney test were performed to assess the group differences in BC.

Results: We showed the altered electrophysiological functional cortical hubs in mTLE patients with HS compared to healthy controls. Noticeably, the left hippocampus showed the significant differences among groups in the theta and alpha frequency bands. From a post-hoc analysis after correction for multiple comparisons, we found that the left mTLE patients showed the significant increase of the BC in the left hippocampus in the alpha band.

Conclusions: Considering that the node with high BC value can be regarded as a network hub of the network, our results suggest that the left hippocampus acts as a functional cortical hub in the left mTLE patients' brain. We presume that the removal of this network hub (a strong candidate of epileptogenic focus) led to the seizure-free outcome in the left mTLE patients with HS. Because there were no hippocampus related hubs in the right mTLE patients, clinical correlations should be considered. However, the resting-state analysis looking at the functional cortical hubs may help characterize mTLE, which ultimately may assist with diagnosis.

P5-Functional MRI Finding by Proprioceptive Input in Patients with Thalamic Hemorrhage

Hyoun Ho Lee[1], Seong Ho Kim[1], Sang Ho Ahn[2], Sung Ho Jang[2]

[1]Department of Neurosurgery, College of Medicine, Yeungnam University, Korea
[2]Department of Physical Medicine and Rehabilitation, College of Medicine, Yeungnam University, Korea

Little is known about the recovery mechanism of somatosensory function in thalamic hemorrhage. We investigated the recovery mechanism of somatosensory function, using functional MRI (fMRI) findings by proprioceptive input in chronic patients with thalamic hemorrhage. Eleven consecutive chronic patients with thalamic hemorrhage who showed severe proprioceptive dysfunction were recruited. The subscale for kinesthetic sensation of the Nottingham Sensory Assessment (NSA) was used for determination of proprioceptive function. fMRI was performed during passive movements of the metacarpophalangeal joint.

From fMRI, the laterality index (LI) was calculated for assessment of the relative activity in the ipsilateral versus the contralateral primary sensori-motor cortex (SM1). The average LI for affected and unaffected hand stimulation was 0.89 and 0.90, respectively, and there was no significant difference between LIs ($p>0.05$). In addition, LI of the affected hand stimulation was positively related to NSA scores ($r=0.790$, $p<0.05$). Our results for LI suggest that the cortical activation pattern of SM1 was similar in the affected and unaffected hemispheres. Therefore, it appears that the proprioceptive function of the affected hand likely recovered by the normally existing medial lemniscus and its thalamocortical pathway in our patients.

P6-Improvement of Dopamine Dysregulation Syndrome in Parkinson's Disease after Transient Global Brain Ischemia

Kyoung-Min Jang, Yong-Sook Park

Department of Neurosurgery, Chung-Ang University College of Medicine, Seoul, Korea

Objective: Parkinson's disease (PD) is increasingly recognized as a neurodegenerative disease characterized by motor dysfunction. Longstanding dopamine replacement therapy in PD can develop behavioral and psychological problems associated with dopamine dysregulation syndrome (DDS) including pathological gambling, compulsive shopping or hypersexuality. In this report, we introduce an interesting case of resolution of hypersexuality after transient global cerebral ischemia.

Case presentation: A 58-years-old man visited our clinic for advanced PD. He was admitted for deep brain stimulation (DBS). He presented severe dyskinesia and hypersexuality, a kind of dopamine dysregulation syndrome and showed stooped posture. He was diagnosed as PD 10 years ago and had been taking L-dopa 1000mg per day. His posture was not suitable to take an MRI and required deep sedation. During taking the MRI, he suddenly showed respiratory holding and cyanosis. Performing prompt resuscitation for about 4 minutes, he has been returned spontaneous circulation. After this event his symptom of hypersexuality resolved completely despite taking a higher dosage of L-dopa than before (1,000 mg - >1,200 mg). However on dyskinesia and other symptoms were not changed and did not show memory impairment. Three weeks later, DBS on the bilateral subthalamic nucleus was performed. He is free from dyskinesia and DDS symptoms now, three months since DBS surgery.

Conclusion: Transient global cerebral ischemia resulting from cardiac arrest could cause selective neuronal damage. The hippocampal pyramidal cells of CA1, pyramidal neocortical neurons (layers 3, 5, and 6), Purkinje cells, and striatal neurons have the highest vulnerability on brief hypoxic ischemia. In this case it is hard to estimate why his DDS has resolved after cardiac arrest even higher dose of L dopa, DDS is known to related mesolimbic dopamine pathway. We hope that this case could give us a chance to understand the pathomechanism of the DDS, dopamine pathway and selective neuronal interruption.

P7-Dorsal Root Entry Zone (DREZ) Lesioning for Severe, Neuropathic Radicular Pain (Anesthesia Dorolosa) of Failed Back Surgery Syndrome (FBSS)

임상혁 · 하상우 · 손병철 · 전신수

가톨릭대학교 의과대학 서울성모병원 신경외과학교실

Objective: Among the chronic neuropathic pain of failed back surgery syndrome (FBSS), severe allodynic neuropathic pain of radiculopathy is notoriously difficult to relieve. Severe allodynic pain of anesthesia dorolosa usually does not respond to conventional medical treatment, blocks, even with spinal cord stimulation (SCS).

DREZ lesioning has mostly been reported for the treatment of neuropathic pain of brachial and lumbosacral plexus avulsion pain and some cancer pain of Pancoast tumor. We report the effectiveness of DREZ lesioning for severe, allodynic neuropathic radicular pain of FBSS.

Methods: Two patients with severe, chronic neuropathic radiculopathic pain from FBSS were treated with DREZ lesioning. Patient #1 (M/58) presented with left L5 pain of 5 years duration. He underwent three times of lumbar operation. His NRS was 7-8/10 and his pain did not responded to maximal medical and conservative treatment. SCS was tried and partially effective. For disabling L5 neruopathic pain, DREZ was performed. Patient #2 (M/32) presented left L5/S1 allodynic pain of 3 years duration. His pain developed after 3rd operation for disc herniation. He showed a feature of anesthesia dorolosa and hyperpathia. An intrathecal morphine infusion via implantable pump and SCS were already perfomed. He underwent a DREZ lesioning of left L5 and S1 for pain relief. At time of DREZ lesioning, NRS was 9-10/10. DREZ lesioning was done through hemilaminectomy or total laminectomy of T111-L1 and a radiofrequency lesion was done in an usual manner.

Results: an intermittent painful spasm with severe allodynia immediately disappeared. An ataxia of affected lower extremities were noted for 2-3 months. A deep hypesthesia was noted but allodnynia was alleviated. Their NRS declined to 4-5/10 in 6 months follow-up. However, moderate burning dysesthesia developed in the denervated painful area.

Conclusion: DREZ lesioning is effective for a selected case of severe, neuropathic radicular pain (anesthesia dorolosa) from FBSS. Because DREZ lesioning is associated with significant risk of ataxia, sensory loss, secondary neuropathic pain, its application should be reserved for an extraordinary case of lumbosacral radicular neuropathic pain of FBSS.

P8-Parameters of Electroporation to Make Wnt3a-secreting Adipose-derived Mesenchymal Stem Cell

민중기[1], 윤형호[1], 김승후[2], 전상용[1]

울산대학교 의과대학 신경외과학교실[1], 생화학분자생물학교실[2]

Objective: 척수 신경 손상을 치료하기 위해 많은 연구자들이 다양한 방법을 이용하여 연구하고 있다. 그 중 세포를 이용한 치료 가운데 중간엽 줄기세포를 이용한 연구들도 많이 이루어지고 있다. 하지만 줄기세포 단독 주입 방법으로는 서서히 한계가 드러나기 시작했으며, 중간엽 줄기세포의 분화 능 중 신경 재생에 포커스를 맞춰 연구를 진행해야 하는 필요성이 대두되기 시작했다. 이에 본 연구는 axonal regeneration에 도움을 준다고 알려진 Wnt3a protein을 만들어 낼 수 있는 adipose-derive mesenchymal stem cell을 만드는 방법과 만들어진 세포가 하루에 어느 정도의 wnt3a protein을 생산해 내는지를 확인하여 척수 신경손상 동물모델에 적용하기 전 단계의 연구이다.

Methods: 백서의 inguinal area에서 지방 조직을 추출하여 0.075% collagenase type II를 지방 조직과 동일한 volume으로 첨가하여 37°C에서 한 시간 동안 반응시킨다. 반응이 끝나면, 600×g에서 10분간 원심분리 후 상층 액을 제거하고, 160 mM ammonium chloride 를 첨가하여 3분간 반응 시킨다. 70-μm nylon mash filter를 사용하여 추출 액을 걸러주고 다시 600×g에서 10분간 원심분리 한 다음, 10% FBS가 첨가된 DMEM media에서 배양한다. 세포의 수가 1×10^7개가 되면 12 ug GFP vector를 혼합하여 다양한 조건으로 electroporation을 실시해 형광현미경 하에서 GFP 발현 양을 관찰하여 최적의 조건을 잡아낸다. 조건이 잡히면, pLNCX-Wnt3a-HA vector를 지방 유래 중간엽 줄기세포에 위와 같은 동일한 조건으로 electroporation을 실시하고, 10% FBS가 첨가된 DMEM media에서 배양한다. 배양 후, 1, 4, 7, 10째 되는 날의 media를 추출하여 ELISA를 실시한다. 이때 각 날짜 별 배지 추출물의 조건을 동일하게 해주기 위해 세포수는 5×10^5개 배양 시간은 24시간으로 통일하여 조건을 맞춰 준다. 추출한 배지를 이용하여 Wnt3a protein ELISA를 측정하여 세포의 Wnt3a protein 분비량과 분비 기간을 분석한다.

Results: 백서에서 추출한 지방유래 줄기세포는 FACS를 촬영하여 중간엽 줄기세포 임을 확인하였다. Positive marker로 CD90, CD29를 사용하여 각각 99%, 100% 임을 확인하였고, negative marker로 CD45, CD11b를 사용하여 각각 2%, 0.1%를 확인하여 중간엽 줄기세포임을 확인하였다. GFP vector를 통해 electropo-

ration 조건을 1,700 V, 20 ms, 1 pulse로 조건을 잡았으며, 동일 조건으로 pLNCX-Wnt3a-HA vector를 지방 유래 중간엽 줄기세포에 집어 넣었다. 배양 후, 1, 4, 7, 10째 되는 날의 media를 추출하여 ELISA로 5×10^5 개의 세포에서 media로 secreting된 Wnt3a protein의 양을 측정한 결과, Day 1은 2.31 pg/ml, Day 4는 2.24 pg/ml, Day 7은 2.24 pg/ml, Day 10은 2.26 pg/ml이 각각 발현되었다.

Conclusion: 기존의 세포를 이용한 치료 방법의 전문화 및 특성화를 위해 중간엽 줄기세포와 axonal regeneration에 도움이 된다고 알려진 Wnt3a protein, 이 두 가지 아이템을 결합하여 치료 효과를 극대화시키고자 본 연구를 진행하게 되었고, 앞으로의 세포 치료 연구에 있어서 또 다른 방향을 제시 할 수 있을 것으로 생각된다.

MEMO