

## S13-Spinal Cord Stimulation for Vegetative State

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**Objective:** DBS, SCS, median nerve stimulation affect the central nervous system function and may stimulate reconnection of communication. Spinal cord stimulation improves blood flow and neuron metabolism.

**Material & Method:** We operated five vegetative state patients with upper cervical spinal cord stimulation. Causes of vegetative state were 3 trauma, 1 suicidal attack, 1 postoperative brain tumor.

**Results:** One of them recovered his consciousness after 3 weeks. 16-year-old man can eye opening and closing in response to verbal stimuli. Now, he is in a rehabilitation state. Another 21-year-old male suicidal attack patient's rigidity was improved after postoperative 2 days, now postoperative 6 days state.

**Conclusion:** Young vegetative state patient after trauma, hypoxia, etc sometimes shows good clinical improvement after spinal cord stimulation. It increased r-CBF, enhanced the metabolism of catecholamine, and brought clinical improvement.

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## S14-Intrathecal Baclofen (Lioresal) Infusion in Persistent Vegetative State after Traumatic Brain Injury; Two Cases with Video Presentation

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**Objective:** There were sporadic case reports about recovery from persistent vegetative state after infusion of baclofen intrathecally. We present our experience of two patients who were improved their consciousness only after intrathecal infusion of baclofen trial dose.

**Methods and Materials:** Baclofen (Lioresal) was infused intrathecally to the two patients who were persistent vegetative state for more than 6 months after traumatic brain injury. Only trial dosage, 50, 75, and 100 microgram were used, and we measured JFK Coma Recovery Scale-Revised (CRS-R), SSEP, EMG, functional MR, perfusion CT with video record before and after infusion.

### Results:

**Case 1:** This 33-year-old female patient was transferred from other hospital after traumatic brain injury. Her mentality was deep stuporous, with occasional nonpurposeful movement and visual fixation, which was compatible with vegetative state. Her vegetative state was lasted 6 months after trauma, so we recommended intrathecal baclofen infusion trial for controlling spasticity. Her spasticity was responded to Lioresal and her recovery of consciousness was prominent, CRS-R improved from 4 to 11 immediate after trial period. And this phenomenon was lasted till in our hospital without no more improvement.

**Case 2:** This 68-year-old female patient, with deep stuporous mentality, underwent craniotomy because of intracranial hemorrhage with traumatic pericallosal ruptured aneurysm. Her consciousness was not changed after 6 months of hospitalization with conservative management, so we decided to manage her spasticity with intrathecal injection. Her spasticity was responded to Lioresal and her recovery of consciousness was noticed. CRS-R improved from 7 to 10. This phenomenon was very prompt after trial period, but the forward improvement was not noticed.

**Conclusion:** There are only few reports, and the protocol of baclofen infusion is not verified. Also the mechanism of baclofen on recovery from vegetative state is not explained. Systemic trials are needed to establish the effectiveness of intrathecal baclofen in recovery of consciousness.

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## S15-Continuous Intrathecal Infusion of Baclofen in Patients with Spasticity Caused by Myelopathy

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**Objective:** To evaluate the treatment outcomes continuous intrathecal baclofen in spasticity caused by myelopathy.

**Methods:** Two patients with spasticity caused by myelopathy were treated with intrathecal baclofen therapy after significant reduction in spasticity following an intrathecal test bolus of baclofen. Parameter evaluated included Ashworth scale, Penn spasm frequency scale, numeric pain rate scale, Tinetti gait scale and walking time.

**Results:** The follow-up shows a reduction in rigidity in the lower limb of 1 and 0.8 points on the Ashworth scale in each case. Penn spasm frequency scale was reduced from a mean preoperative score of 1.5 to a mean postoperative score of 0. During the follow up period, no significant difference of tinetti gait scale was noted but gait speed showed improvement. No complication associated with operation or device occurred.

**Conclusions:** ITB is a nondestructive, safe, and reversible method for treatment intractable spasticity due to myelopathy. It is necessary to have much more controlled studies to achieve more accurate and precise outcomes of ITB therapy.

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## S16-Therapeutic Effects of Wnt3a-secreting Fibroblasts Transplantation in Parkinson's Disease Model of Rats

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**Objective:** It is required for restorative approach to Parkinson's disease (PD) to develop effective therapy. It is well known that 6-hydroxydopamine (6-OHDA) lesion model is appropriate for therapeutic studies. The authors analyzed effects of striatal graft of Wnt3a-secreting fibroblasts on 6-OHDA induced PD model in rats by behavior test and histological evaluations.

**Materials and Methods:** 24 male adult Wistar rats unilaterally received injection of 6-OHDA into medial fore-brain bundle. Apomorphine induced rotation test was performed to select complete PD animals. Three weeks after 6-OHDA lesion, each group received cell transplantation into ipsilateral striatum: Control group (n=6; needle insertion only), Vehicle group (n=7; 15  $\mu$ L  $1.0 \times 10^6$  L929 fibroblasts), and Wnt group (n=6; 15  $\mu$ L  $1.0 \times 10^6$  Wnt3a-secreting fibroblasts). Apomorphine tests were repeated to evaluate the therapeutic effects of cell transplantation during 7 weeks after cell injection. Immunostaining of the tyrosine hydroxylase (TH) and Wnt3a was performed to observe the histological changes by Wnt signaling.

**Results:** In apomorphine induced rotation test, Control group (n=6) showed significant increase in contralateral rotation at the 7 weeks after sham operation (RPM=16.9 $\pm$ 6.1) compared to 1 week after 6-OHDA injection (RPM= 13.0 $\pm$ 5.0) (p=0.017), while Wnt group (n=6) showed significant decrease in contralateral rotation between the same durations (RPM=16.9 $\pm$ 5.4 and 13.8 $\pm$ 6.1) (p=0.049). In Vehicle group, there was no statistically significant change (RPM =12.8 $\pm$ 8.4 and 12.8 $\pm$ 3.8). In Control group, TH immunostaining indicated 91 $\pm$ 3.4% of dopaminergic neuronal loss in the ipsilateral substantia nigra, whereas in Wnt group, TH immunostaining indicated 79 $\pm$ 17.9% of dopaminergic neuronal loss in the ipsilateral substantia nigra (p=0.074).

**Conclusion:** The current study suggests that Wnt3a signaling by cell transplantation has therapeutic effects on 6-OHDA induced PD model of rats. Further study is needed to evaluate the mechanism of Wnt3a signaling.

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## S17-백서의 척수 신경 손상 모델에서 Wnt3a 분비 섬유 아세포와 Hydrogel 혼합물의 재생 효과

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**Objective:** 비가역적인 손상인 척수 신경 손상을 치료하기 위해 많은 연구들이 이루어지고 있지만, 아직까진 명확한 치료 방법을 밝혀내지 못한 실정이다. 이에 본 연구는 생체적합하고, 생 분해가 용이한 hydrogel (alginate)과 Wnt3a-secreting fibroblast를 혼합하여 sub-acute 시기의 hostile micro-environment에서 좀더 생존력을 높이고 contuse injury에서 발생하는 cavity 안에서 bridge 역할을 해줄 수 있는 hydrogel mixture에 관한 연구를 하였다. 선행 연구와 마찬가지로 비 침습적 방법으로 그 효과를 객관적으로 증명해 줄 수 있는 Manganese-enhanced MRI를 이용하여 손상된 척수의 변화를 관찰 하고, Basso-Beattie-Bresnahan (BBB) locomotor scale test를 하여 운동기능 회복의 정도를 알아보았다.

**Method:** Zoletil과 rompun 이용한 전신마취 하에서 백서의 제 7번 흉추의 후궁을 제거하고, NYU Impactor (10 g, 25 mm height)를 이용하여 외상성 완전 척수손상 모델을 만든 후 Wnt cell (Wnt3a-secreting fibroblast,  $1 \times 10^6$  cells/15  $\mu$ l)을 주입한 군(n=5), Wnt cell + HG (Wnt3a-secreting fibroblast+hydrogel,  $1 \times 10^6$  cells/15  $\mu$ l)을 주입한 군(n=5), 손상만을 준 군(n=5)으로 나누어 모든 백서 모델을 대상으로 손상 후 1, 2, 3일 후, 1, 2, 3, 4, 5, 6주일 후에 BBB locomotor scale test를 통해 운동기능의 변화를 관찰 하였다. 손상 1주일 후, 6주일 후에 Manganese-enhanced MRI를 시행하여 척수 신경의 변화를 확인하고 manganese로 인해 발생하는 signal intensity를 수치화하여 비교분석 하였다.

**Result:** 손상 6주 후, BBB locomotor scale test 결과 손상만을 준 실험 군에 비해 Wnt cell을 injection한 그룹이 3.2점, Wnt cell + HG injection 그룹이 4.4점 높았다. Wnt cell과 Wnt cell + HG간에는 1.2점 차이를 보였다. 또한 MRI 촬영 후, signal density를 비교한 결과 손상만을 준 그룹에 비해 Wnt cell + HG injection 그룹이 약 30% 정도 높았으며, Wnt cell injection 그룹 보다 Wnt cell injection 그룹이 약 24% 높은 양상을 보여 Wnt cell + HG injection 그룹에서 axonal regeneration이 가장 활발히 발생하였음을 보여 주었다.

**Conclusion:** 백서의 척수 손상에서 Wnt3a-secreting fibroblast 단독 주입 보다 Wnt3a-secreting fibroblast와 hydrogel을 혼합하여 주입하는 것이 축삭 재생에 더욱 효과적임을 알 수 있었다. 향후 추가적 실험을 통하여 hydrogel의 작용기전 및 다양한 종류의 hydrogel의 개발이 필요할 것으로 사료된다.