

# Oral Presentations

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#### 501. A Different Look: Increased Charge Requirement of Spinal Cord Stimulators

*Ebonye Green, APRN; Ashley Benton, BSN (Little Rock, AR)*

**Introduction:** The authors describe a patient with delayed cervical spinal cord compression due to fibrous scar tissue around an epidural electrode used in spinal cord stimulation (SCS). One year after implantation of the system the stimulation became ineffective, and 1 year later the patient developed progressive paraparesis. There was no evidence of device-related complications on plain radiographs and CT scans, so the system was removed to perform MRI studies. These studies showed a dorsal myelopathy secondary to scar tissue around the electrode. At surgery thick scar tissue was resected, and the patient's neurological symptoms improved. The histological examination confirmed fibrosis, and microbiological studies excluded chronic infection. Scarring around SCS electrodes should be considered as a late complication and as a possible cause of the tolerance phenomenon.

**Methods:** Describe the different types/insertion points of SCS. Description of the different diagnosis/patient conditions that SCS are used to treat.

**Objectives:** 1. Describe the different types/insertion points of SCS. Description of the different diagnosis/patient conditions that SCS are used to treat. 2. Describe the physiologic changes that occur to make the in patients following successful implantation of SCS. 3. Discuss the special considerations necessary to effectively treat patients that develop perielectrode lesions, and subsequently have their SCS removed.

**Conclusion:** Compare and contrast previous radiographic evidence prior to implantation and after. Review patient lab work, looking specifically for elevated c-reactive protein and sediment rate, for possible clues to inflammatory response. Role of other services or traditional methods to treat patients recurrent symptoms.

#### 503. In the United States, Lack of Parent/Caregiver Compliance Interferes with the Pediatric Neurosurgery Patient Care Sequence

*Hector E. James, MD, FAANS(L); Teresa MacGregor; David Childers, Jr., MD (Jacksonville, FL)*

**Introduction:** We report limitations identified in follow-up care of pediatric neurosurgery patients because of lack of parental/caregiver compliance, unmet educational/cognitive needs, and medical insurance issues.

**Methods:** Children with neurosurgical conditions and chronic healthcare needs were seen in a comprehensive multidisciplinary clinic with a team consisting of, but not limited to: pediatric neurosurgery, developmental medicine, physical/occupational therapy, and social services. During the initial period of April 2007-June 2009, there were 114 patient visits (88 patients; 25 return visits). We followed this population through August 2012 and address outcomes in reference to educational placement and occupational therapy (OT) consultations; two categories identified as the most frequent areas of need and having potential impact on neurocognitive and educational outcomes.

**Results:** Of the 88 patients seen, 71 had referrals for a different educational venue and/or OT consultation referral. In follow-up, the parent/caregiver was questioned by the developmental medicine pediatrician and/or occupational therapist. 27 patients were identified as having inappropriate school placement and were given recommendations to change the school

setting, but 70% did not follow through. Relating patient population to health insurance coverage, 55% of the patients with government sponsored insurance (GSI) did not change to the recommended special education venues that were recommended, whereas 20% of those with private insurance (PI) did. Of 21 patients identified as needing an OT evaluation and/or ongoing therapy, 72% did not follow through. In relation to insurance, 58% with GSI did not follow through with the OT recommendations, whereas 50% with PI did.

**Conclusion:** Compliance was lower in the GSI population, which could probably be related to the different socioeconomic status. This discrepancy could be best addressed by a better link in the multidisciplinary Pediatric Neurosciences Clinic to primary care providers so as to provide family-centered healthcare.

#### 504. A Single Center Experience of Patient Outcomes and Length of Stay Following Endoscopic Assisted, Neuronavigation Guided Evacuation of Intracerebral Hemorrhage using the Apollo Aspiration System

*Robert W.J. Ryan, MD, FAANS; Ariana Pham, PA-C; Armen Choulakian, MD; Amir Khan, MD; Arash Afshinnik, MD (Fresno, CA)*

**Introduction:** Outcomes from spontaneous intracerebral hemorrhage (ICH) remain poor. Acute management requires lengthy critical care and hospital stays, and nearly 3/4 of survivors remain disabled. Minimally invasive techniques for ICH removal have shown a positive relationship between hemorrhage volume reduction and patient outcome. We describe our experience with minimally invasive, endoscopic assisted, neuronavigation guided evacuation of ICH using the Apollo system and patient outcomes.

**Methods:** Patients presenting with ICH and treated with the Apollo system since October 2014 were included in this retrospective review. All had a neurovascular study negative for underlying vascular lesion, and were treated using a burr hole approach. Patient demographics, ICH volume, clot reduction, degree of midline shift, ICU and hospital length of stay, discharge disposition and last known functional outcome were assessed.

**Results:** 39 patients were treated, average age 53.0±15.1 years, and 28% were female. Starting clot volume was 52.9±30.2cc, reduced to 7.7±9.1cc post-operatively, for an average reduction of 86.8±14.6%. Midline shift measured at the level of the septum pellucidum improved from 6.3±4.1mm to 4.0±3.3mm. Average length of ICU stay was 9.1±5.6 days, with 12.7±10.5 hospital days. Covariate analysis showed that shorter ICU stay was correlated with greater percent reduction in ICH volume (p=0.027), and trended with improvement in midline shift. Mortality was 30.8%, with 30.8% returned home after hospital or acute rehabilitation; the remainder going to skilled nursing facilities or still inpatients.

**Conclusion:** ICH volume can be rapidly reduced using the Apollo system, and greater clot reduction correlated with shorter ICU length of stay. Improvement in midline shift also trended towards shorter length of stay. Patient outcomes were favorable when compared with historical controls, although randomized controlled studies will be required to determine long term clinical benefit.

### 506. Prospective Study of the Use of Intraoperative Neuromonitoring in Determining Post-Operative Energy Requirements and Physiologic Midline in Spinal Cord Stimulation

Claire Collison; Julia Prusik, BS; Steven Paniccioli, BS; Michael Briotte; Rachael Grey; Paul Feustel, PhD; Julie Pilitsis, MD, PhD (Albany, NY)

**Introduction:** Intraoperative neuromonitoring (IONM) through electromyography (EMG) studies has been shown to be a safe, effective way to determine the laterality of the spinal cord and guide electrode placement during spinal cord stimulation (SCS). However, the use of IONM to predict post-operative energy requirements and midline has not been examined and offers a new avenue to streamline programming and device selection. Further, the impact of cerebrospinal fluid (CSF) thickness on intraoperative and post-operative amplitudes has not been assessed.

**Methods:** A total of 24 patients undergoing SCS for chronic pain had intraoperative EMG studies performed to determine physiologic midline. The intraoperative midline was compared to the midline determined on post-operative day 1 based on paresthesia patterns during programming. For patients who had thoracic leads placed, the amplitudes needed to induce abdominal and extremity lateralization during SCS placement were compared with the intensities needed to induce therapy at post-operative day 1. Additionally, we examined whether CSF thickness, body mass index, diabetes, drug use, and smoking correlated with intraoperative and post-operative amplitudes.

**Results:** Intraoperative EMG was able to predict post-operative paresthesia-based midline in 70.83% of patients. There was a statistically significant relationship between the intraoperative intensity needed to induce extremity lateralization with the post-operative intensity to induce therapy ( $p=0.009$ ) as well as the intraoperative intensity needed to stimulate abdominals with the post-operative intensity ( $p=0.033$ ). There was also a relationship seen between CSF thickness and the post-operative energy requirements in patients ( $p=0.039$ ).

**Conclusion:** EMG accurately predicts post-operative energy requirements and midline in SCS patients. While 29.17% of patients did not have a match between their intraoperative and post-operative midlines, EMG testing was still valuable in guiding electrode placement and providing information to predict post-operative intensities. Additionally, CSF thickness correlated with amplitude settings on the first post-operative day.

### 507. History of Bone Morphogenetic Protein (BMP) and its Application in Spine Surgery

Lee Onn Chieng, BS; Karthik Madhavan; Michael Wang, MD (Miami, FL)

**Introduction:** Recombinant human Bone Morphogenetic Protein (rhBMP) has been increasingly used in spinal fusion over the past decade. In this abstract, we sought to provide historical vignette that led to the discovery of BMP and its subsequent robust development in the field of spine surgery. In 1889, Senn noted that decalcified bone can induce healing of bone defects secondary to osteomyelitis. His initial intent was to use iodoform as antiseptic and utilized the decalcified bone as a carrier of the iodoform. His method not only reduce infection but also led to osseous regeneration. In 1934, Lacroix reported crude alcohol extract from cartilaginous epiphysis of the long bones of rabbit (which he later called it as osteogenin) induced new bone injection when injected into muscle. These earlier works have led to the discovery of the bone matrix ability to induce new bone formation by Urist in 1965. However it was not until Reddi and Sampath confirmed that BMP from the bone matrix led to ectopic bone formation. They described the fibroblast-chondroblast-osteoblast transformation with BMP in 1972. In 1992, human BMP was successfully purified clinically. It was FDA approved for repair in long bone defect and ALIF since 2002. Today, BMP often combined with allograft for spinal fusion, which has become the standard of care. With reducing trend of autograft, BMP and newer bone grafts able to reduce infection rate and improve bony fusion.

### 508. Brain repair and neural network remodeling by hematopoietic growth factors in subacute phase of traumatic brain injury in animal model

Gentian Toshkezi, MD; Lawrence Chin, MD, FACS; Michele Kyle; Sharon Longo; Li-Ru Zhao, MD, PhD (Syracuse, NY)

**Introduction:** The objective of this study is to determine the therapeutic role of SCF+G-CSF in subacute phase of TBI.

**Methods:** After induction of TBI, mice were randomly divided into: a vehicle control group and an SCF+G-CSF treatment group and shams. Treatment was given 2 weeks after TBI, SCF (200 $\mu$ g/kg) and G-CSF (50 $\mu$ g/kg) sq daily for 7 days. Neurobehavioral tests for evaluation of cognitive function (water maze and novel object recognition tests), anxiety (elevated plus maze test), and motor function (Rota-Rod test) were performed during the period of 2 to 9 weeks after treatment. MAP2 antibody to study dendritic density and Fluoro-jade C test the level of neurodegeneration were performed.

**Results:** In the water maze test, SCF+G-CSF-treated TBI mice showed a significant reduced latency to find the hidden platform as compared to the TBI vehicle controls ( $p<0.05$ ), while there was no difference between the sham controls and treated TBI mice. Elevated plus maze test displayed a significant reduction of the post-traumatic anxiety and risk taking behavior in the SCF+G-CSF-treated TBI mice when compared to the TBI vehicle controls while no difference was observed between the SCF+G-CSF-treated TBI mice and sham control. Rota-Rod test and NOR did not reveal differences between the treated and non treated animals. MAP 2 testing shows statistical significant increase of dendritic density contralateral  $P<0.05$  and a trend of increasing dendritic density ipsilateral to the lesion. Fluoro-jade C shows statistical significant decrease of neurodegeneration contralateral to the lesion  $p<0.05$  to the lesion.

**Conclusion:** SCF+G-CSF treatment in the subacute phase of TBI shows recovery in spatial learning and memory and the post-traumatic anxiety in mice. The immunohistochemistry indicates that treatment with SCF and G-CSF enhance neural network remodeling through creation of the new synapses and decreased neurodegeneration.

### 509. Palliative Care and Communication Training in Neurosurgery Residency

Stephen P. Miranda; Kristen Schaefer, MD; George Vates, MD, PhD; William Gormley; Mary Buss, MD, MPH (Rochester, NY)

**Introduction:** Neurosurgeons care for critically ill patients near the end of life, yet little is known about how well their training prepares them for this role. We surveyed neurosurgery residents nationwide to describe (1) the quantity and quality of teaching activities related to communication and palliative care, and (2) resident attitudes and perceived preparedness to care for seriously ill patients.

**Methods:** A previously validated survey instrument was adapted to reflect required communication and palliative care competencies in the ACGME Milestones for Neurological Surgery. The survey was reviewed for content validity by independent faculty neurosurgeons, piloted with graduating neurosurgical residents, and distributed online in August 2016 to all North American neurosurgery residents using the AANS/CNS Joint Section on Neurotrauma & Critical Care email listserv. Multiple choice and Likert scale responses were analyzed using descriptive statistics.

**Results:** 62 responses were recorded between August-October 2016. Most respondents reported no explicit teaching on: explaining risks and benefits of intubation and ventilation (69%), formulating prognoses in neuro-critical care (60%), or leading family meetings (69%). Compared to performing craniotomies, respondents had less frequent practice leading discussions about withdrawing life-sustaining treatment (61% vs. 90%,  $p=0.00016$ , weekly or more frequently), and were less often observed (18% vs. 87%,  $p<0.0001$ ) and given feedback on their performance (11% vs. 58%,  $p<0.0001$ ). Nearly all respondents (95%) felt prepared to discuss