ACNS Annual Meeting & Courses
February 5-10, 2013
Miami Marriott Biscayne Bay
Miami, Fla.

Poster Abstracts

**F1**

**A Study of Autonomic Dysfunction and Sympathetic Skin Response in Motor Neuron Disease**

*Wang Xinning, MD; Cui Liying, MD; Liu Mingsheng, MD; Guan Yuzhou, MD*

**Objectives:** The aim of our study was to investigate the symptoms of autonomic dysfunction and SSR abnormality in MND patients.
**Methods:** Collect the clinical features of autonomic dysfunction among the patients as dullness or pruritus of the skin, parahidrosis, xerostomia, salivation, abnormal skin temperature, orthostatic hypotension, posture-related cardiac arrhythmia, mydriasis, ptosis or abnormal pupillary light reflex, diarrhea, constipation, voiding dysfunction and sexual dysfunction. SSR was performed in all the patients. The result of SSR was judged according to the normal range of our laboratory. Abnormality rate in MND patients was calculated. The relationship between clinical symptoms and SSR parameters were analyzed by statistical methods.
**Results:** In a total of 142 MND patients, the incidences of symptoms of autonomic dysfunction were as follows: dullness (53.5%), pruritus of the skin (15.5%), parahidrosis (10.6%), xerostomia (9.1%), salivation (2.1%), abnormal skin temperature (14.8%), orthostatic hypotension (2.1%), posture-related cardiac arrhythmia (0.7%), diarrhea (4.2%), constipation (16.2%), voiding dysfunction (9.9%) and sexual dysfunction (1.4%). Abnormal SSR was found in 51(35.9%) of the 142 cases, 12(8.5%) in palmar and 47(33.1%) in plantar. The features of abnormal SSR included delayed latency of palmar ($P<0.05$) and decreased amplitudes of both palmar and plantar compared with normal ranges ($P<0.01$ respectively). The group of patients with lumbosacral onset had higher abnormal rate of SSR than those of other onset sites. There was no significant correlation between clinical symptoms and abnommal SSR parameters.
**Conclusion:** Patients of MND can demonstrate autonomic dysfunction of skin, gland secretion, cardiovascular system and sphincters. Some patients show abnormal SSR with prolonged latency and decreased amplitude. The abnormalities of SSR are not related to clinical features of autonomic dysfunction. Patients with onset of lower limbs have a higher rate of abnormal SSR.

**F2**

**Protracted Post-ictal Trismus : A Case Report**

*Abdorasool Janati, MD; Naif Saad ALGhasab, MD; Muhammad Umair, MD; Abdulrahman Mohammad Almalik, MD; Ghassab ALGhassab,MD*

**Introduction:** Trismus is a motor disturbance of the trigeminal nerve , especially spasm of the masticatory muscles, resulting in difficulty in opening the mouth. It has a number of potential causes which range from the simple and non-progressive to those that are potentially life-threatening. In this paper we report for the first time the occurrence of trismus in the post ictal state.
**Method:** This was a case study which was conducted at King Khalid Hospital.
**Results:** After a series of generalized convulsive seizures the patient developed a sustained trismus in the postictal phase, lasting for three days.
**Conclusion:** A number of physiological and metabolic factors have been implicated in the termination of seizure activity and transition to post-ictal state by creating inhibitory signals. In our patient the trismus may have signified a partial failure of the afore-mentioned inhibitory mechanisms at the mesencephalic-pontine level , causing a disruption of projections of the mesencephalic trigeminal nucleus to the pontine nucleus, resulting in a state of hypertonicity in the latter.

**F3**

**Electrographic Seizures in Critically Ill Children**

*Nicholas S. Abend, MD; Daniel Arndt, MD; Jessica L Carpenter, MD; Kevin E Chapman, MD; William B Gallentine, DO; Christopher C Giza, MD; Joshua L Goldstein, MD; Cecil D Hahn, MD, MPH; Jason T Lerner, MD; Tobias Loddenkemper, MD; Joyce H Matsumoto, MD; Kristin McBain, MS; Kendall B Nash, MD; Eric Payne, MD; Sarah M Sanchez, BA; Ivan Sanchez Fernandez, MD; Justine Shults, PhD; Korwyn Williams, MD, PhD; Amy Yang, BS; Dennis J Dlugos, MD*

We aimed to describe the characteristics of electrographic seizures in critically ill children. Eleven hospitals each retrospectively enrolled 50 consecutive critically ill children (1 month to 21 years) who underwent EEG monitoring. We collected information on the following variables: age, gender, historical neurologic disorders including prior epilepsy and intellectual disability, acute neurologic disorder, clinical seizures prior to EEG monitoring, mental status at EEG onset, initial EEG background, and inter-ictal epileptiform discharges. 550 patients (one EEG study per patient) were included. EEG monitoring duration was < 24 hours in 50%, 24-48 hours in 23%, and >48 hours in 23%. Electrographic seizures occurred in 162 (29.5%). Electrographic status epilepticus occurred in 61 of 162

(37.7%) [continuous seizure lasting >30 minutes: 28 (45.9%), recurrent seizures >50% per hour: 31 (50.8%)]. Fifty-nine subjects (36.4%) had only subclinical seizures while a clinical correlate occurred with all seizures in 43 (26.5%) and some seizures in 55 (34.0%). Multivariable analysis showed that risk factors for electrographic seizures were: young age, clinical seizures prior to EEG monitoring, abnormal initial EEG background, inter-ictal epileptiform discharges, and prior diagnosis of epilepsy. Our results provide the largest epidemiologic characterization of electrographic seizures in critically ill children.

**F4**

**Improving ICU Research Recruitment: Lessons from the DETECT Study**

*Kristin McBain; MSc, Helena Frndov; Eric Payne, MD; Margaret Wilkinson; Roy Sharma; Judith Van Huyse, RN; Carter Snead, MD; Christopher Parshuram, MD, PhD; Jamie Hutchison, MD; Cecil D Hahn, MD MPH*

Recruitment of research subjects in the high-stress ICU environment is challenging. Although historical data can be used to estimate how many patients may be eligible for a study, many unforeseen factors can reduce recruitment. The prospective observational DETECT study is employing continuous EEG (cEEG) monitoring to screen for seizures among comatose critically-ill children. In its first year, the study encountered several recruitment challenges. By analyzing the CONSORT diagram we identified several barriers to recruitment and developed strategies to overcome them. Creation of an online screening dashboard allowed us to continually screen for eligible subjects in real time. Initially, 47% of eligible patients were not enrolled because parents/guardians were unavailable for consenting. Since cEEG represents minimal risk, a deferred consent approach was approved by our Research Ethics Board, permitting cEEG initiation even when parents/guardians were initially unavailable, resulting in successful enrollment of 10/11 additional subjects. Weekend screening permitted an additional 11/13 eligible subjects to be enrolled over 12 months. A creative, multipronged approach can successfully increase research recruitment in the challenging ICU environment.

**F5**

**Features of PLEDs Stratifies Risk in the Ictal-Interictal Continuum**

*Stephen T. Hantus, MD; Christopher Newey, DO*

**Introduction:** PLEDs are often found in association with acute structural lesions and may have risk-stratifying features. We looked at electrographic features of PLEDs on cEEG to identify predictors of electrographic seizures.
**Methods:** Retrospective review of 100 consecutive patients with PLEDs. PLEDs described based on electrographic features: triphasic morphology, sharply contoured, overlying fast frequencies, and/or rhythmicity (loss of inter-discharge interval lasting > 1 second). EEG seizures were defined as evolving in frequency, distribution, or morphology at >2 Hz for >10 seconds.
**Results:** Overall, electrographic seizures occurred in 54% of patients with PLEDs. PLEDs with sharply contoured morphology (n=45/71) were more likely to develop seizures (OR 3.85 (CI 1.52-9.68); p=0.0041). PLEDs with overlying fast (n=29/37) were also significantly likely to develop seizures (OR 5.51 (CI 2.17-13.98); p=0.0002). Rhythmicity (n=44/56) was most significant for predicting seizures (OR 12.47 (4.82-32.27), p<0.0001). The presence of triphasic morphology (n=9/29) had the lowest risk for seizures (OR 0.26 (CI 0.10-0.65); p=0.0041).
**Conclusions:** Determining seizure risk for patients with acute structural lesions may benefit from using the electrographic features of PLEDs. Sharply contoured morphology, overlying fast or rhythmicity showed progressively higher risk of seizures on cEEG, while triphasic morphology appeared to be protective against seizures.

**F6**

**Current EEG Monitoring Practice in Critically Ill Children**

*Sarah M Sanchez, BA; Daniel Arndt, MD; Jessica L Carpenter, MD; Kevin E Chapman, MD; Dennis J Dlugos, MD; William B Gallentine, DO; Christopher C Giza, MD; Joshua L Goldstein, MD; Cecil D Hahn, MD, MPH; Jason T Lerner, MD; Tobias Loddenkemper, MD; Joyce H Matsumoto, MD; Kristin McBain, MS; Kendall B Nash, MD; Eric Payne, MD; Ivan Sanchez Fernandez, MD; Justine Shults, PhD; Korwyn Williams, MD, PhD; Amy Yang, BS; Nicholas S. Abend, MD*

We aimed to describe the clinical utilization of EEG monitoring in critically ill children. We retrospectively enrolled 550 consecutive critically ill children (1 month to 21 years) who underwent EEG monitoring (50 from each of 11 hospitals). EEG monitoring indications were: encephalopathy with possible seizures in 368 (67%), event characterization in 209 (38%), management of refractory status epilepticus in 62 (11%), and management of intracranial pressure in 16 (3%). Acute diagnoses were: traumatic brain injury in 61 (11%), cardiac arrest in 69 (13%), ECMO in 25 (5%), and therapeutic hypothermia management in 19 (3%). Monitoring lasted <12 hours in 16%, 12-24 hours in 34%, 24-48 hours in 23%, 48-72 hours in 8%, and >72 hours in 17%. The mean monitoring duration was longer in children who were comatose (41 hours) than those who were obtunded (32 hours) or had normal mental status (25 hours) (p<0.001) and in children with rather than without inter-ictal epileptiform discharges (40 versus 28 hours, p<0.001). Monitoring onset occurred outside standard hours (17:00-08:00) in 47%. Our study provides the first systematic assessment of the clinical use of EEG monitoring in critically ill children.

**F7**

**Time Savings and Sensitivity of CSA in ICU EEG**

*Lidia M V R Moura, MD; Marcus Ng, MD, FRCPC; Sandipan Pati, MD; Mouhsin M Shafi, MD, PhD; Andrew J Cole, MD, FRCPC; M. Brandon Westover, MD, PhD*

**Objective:** To evaluate the time savings and sensitivity achievable by using compressed spectral arrays (CSA) for screening ICU EEG recordings.
**Background:** Increasing patient volumes demand increased efficiency in reviewing ICU cEEG studies. CSA is often used, but its performance in clinical practice is unknown. We hypothesized that using CSA for screening studies would save time while providing good sensitivity compared with review of the raw data.
**Methods:** Three neurophysiologists (group 1) reviewed the first 30 minutes of each cEEG, then used CSA to guide subsequent review. Reviewers were allowed to view 120 seconds of raw EEG surrounding suspicious CSA segments. Two independent neurophysiologists (group 2) performed standard interpretation of all cEEGs. We recorded review times and, for group 2, detection and miss rates (vs group 2) for pathological patterns.
**Results:** Both groups reviewed 594 hours of cEEG. Average review times were: Group 1: 8 minutes, vs Group 2: 24 minutes ($t = 8.0302$, $df = 30$, $p<0.0001$). Sensitivity of CSA-guided review was: seizures 87,05% (195/224), PEDs 84,6% (11/13), RDA 62,5(5/8), focal slowing 76,1% (16/21), generalized slowing 96,2% (26/27); epileptiform discharges: 80% (16/20).
**Conclusions:** CSA-guided review reduces cEEG review time by 2/3 with modest reduction in sensitivity compared with exhaustive review.

**F8**

**The Inter-Burst Interval Can be Modulated by Photic Stimulation**

*Dragos A Nita, MD, PhD; Cecil D Hahn, MD MPH; Mihai Moldovan, MD, PhD*

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**Background:** The EEG pattern of burst-suppression (BS) reflects severe encephalopathy due to a variety of brain pathologies. Our aim was to explore whether the BS pattern is reactive to photic stimulation (PS) and whether BS responsiveness to PS is more likely to reflect the severity of encephalopathy than the baseline BS pattern.
**Methods:** Five consecutive critically ill children undergoing continuous EEG monitoring with BS at the onset of monitoring were included in this study, irrespective of the underlying etiology. One minute long trains of 1 Hz photic stimuli were applied and the influence of PS on inter-burst intervals (IBI) and burst duration (BD) was quantified and compared to IBI and BD during baseline epochs.
**Results:** PS consistently elicited bursts with less than 1 second latency and similar BD. At stimulation onset there was an increased bursting rate followed by a decreased bursting rate at stimulation offset. A mathematical model of cumulative increases in the threshold of subsequent burst generation followed by an exponential recovery can reproduce the IBI behaviour during PS.
**Conclusions:** IBI is modulated by PS. Further studies are needed to assess if BS reactivity is a biomarker that can assist with prognostication in critically ill children.

**F9**

**Baseline EEG Pattern and Incidence of Seizures on Continuous ICU EEG Monitoring**

*Christa Swisher, MD; Aatif M. Husain, MD*

**Objective:** To identify the probability of detecting non-convulsive seizures (NCS) based on the initial pattern seen in the first 20-30 minutes of continuous electroencephalographic (cEEG) monitoring.
**Methods:** CEEG monitoring reports from 243 adult patients were reviewed, assessing the baseline cEEG monitoring pattern in the first 20-30 minutes and the presence of seizures during the entire monitoring period. The baseline EEG patterns were classified into nine categories: seizures, periodic lateralized epileptiform discharges (PLEDs), generalized periodic epileptiform discharges (GPEDs), focal epileptiform discharges, burst suppression, focal slowing, diffuse slowing, triphasic waves and normal.
**Results:** Overall, 51 patients (21%) had NCS at any time during cEEG monitoring. Notably, 112 patients had diffuse slowing as the initial EEG pattern and none of these patients were noted to have seizures. Similarly, no patients with triphasic waves (n=3) developed seizures. Seizure rates were as follows: PLEDs (56%, n=9), burst suppression (50%, n=10), GPEDs (50%, n=2), normal (33%, n=3), focal epileptiform discharges (31%, n=35) and focal slowing (11%, n=46). Patients in the high-risk group (PLEDs, GPEDs, burst suppression and focal epileptiform discharges, n=56) were more likely to have seizures compared with the low risk group (diffuse slowing, focal slowing, triphasic waves and normal, n=164), odds ratio 16.9 ($p < 0.0001$).
**Conclusion:** Patients with diffuse slowing, focal slowing and triphasic waves seen on the baseline EEG recording are very unlikely to develop seizures on subsequent cEEG monitoring. This data can be used to decide how long to continue cEEG monitoring in patients based on their initial EEG findings.

**F10**

**Brief Ictal Rhythmic Discharges (BIRDs) in the Critically Ill**

*Ji Yeoun Yoo, MD; Nicolas Gaspard, MD PhD; Nishi Rampal, MD; Ognen A. C. Petroff, MD; Lawrence J. Hirsch, MD*

**Background:** Brief ictal rhythmic discharges (BIRDs) have been described mainly in the neonates, and their significance is still unclear. We aimed to identify BIRDs in non-neonatal critically ill patients and explore their association with seizures and other EEG findings.
**Methods:** We screened our EEG database for patients with brief focal rhythmic discharges. BIRDs were defined as rhythmic discharges of theta or higher frequency lasting less than 10 seconds.
**Results:** Using these criteria, we retrospectively identified BIRDs in 10 out of 540 patients undergoing continuous EEG (cEEG) monitoring. Typical frequency and duration of BIRDs were 4-7 Hz and 1-3 seconds. Nine out of 10 patients had acute CNS injury (3 intracranial hemorrhage, 1 ischemic stroke, 2 subarachnoid hemorrhage, 2 metastatic tumor, 1 mitochondrial disease). Five had altered mental status. Six out of 10 had seizures (clinical and/or on cEEG). In all 5 patients with seizures on cEEG, BIRDs preceded the seizure onset. All 5 patients had co-localizing lateralized periodic discharges (LPDs) and 3 also had co-localizing rhythmic delta activity (RDA).
**Conclusion:** The present data demonstrate the presence of BIRDs in non-neonatal population and its association with seizures. A larger prospective study is needed to better understand their clinical and prognostic significance.

**F11**

**Cortical Stimulation Combined with White Matter Tractography.**

*Leonardo Bonilha, MD, PhD; Ekrem Kutluay, MD; Steven S Glazier, MD; Gabriel Martz, MD; Jonathan C. Edwards, MD*

The identification of eloquent cerebral cortex prior to epilepsy surgery traditionally relies on intracranial cortical stimulation to map function to brain areas that should be avoided during the resection of epileptogenic tissue. Even though intracranial cortical stimulation can identify the functional anatomy of the cerebral cortex, the excision of the epileptogenic tissue often encompasses subcortical regions underlying the lesion. We suggest that cortical stimulation should be combined with anatomical mapping of white matter pathways in order to avoid disconnection of eloquent cortex. Recent advances in diffusion MRI can enable white matter tractography to be performed in a clinically feasible matter. We argue that increased anatomical precision of pre-surgical mapping can be achieved by combining white matter tractography with direct cortical stimulation. We report a case of a patient with a dorsolateral frontal focal cortical dysplasia in close anatomical proximity with the somatosensory cortex. White matter tractography enabled the determination of the pathways traversed by the pre-central cortex underlying the cortical dysplasia. The resection was then tailored to avoid eloquent cortical areas defined by intracranial cortical mapping, and also to avoid the fibers arising from the eloquent cortex. Post-surgical seizure freedom was achieved with no functional somatosensory impairment.

**F12**

**Power Spectral Density of Scalp and Subdural EEG – Beta and Gamma Bands**

*Hitten P Zaveri, PhD; Ognen A Petroff, MD; Irina I Goncharova, PhD*

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**Background:** The first studies recording both scalp and cortical EEG noted a significant loss of EEG power and fidelity in the scalp recordings. Subsequent work focused on the loss of fidelity of epileptiform activity and evoked potentials.
**Methods:** Twenty patients (age 18–55) from the Yale Comprehensive Epilepsy Center undergoing intracranial EEG monitoring for surgical evaluation were recruited. EEG was recorded simultaneously from the scalp and subjacent subdural electrodes (Clin Neurophysiol 2010;121:311-317). The power spectral density (millivolts2) of artifact-free EEG segments was obtained for each electrode contact and the ratio of scalp electrode to subjacent subdural electrode signal power was calculated between 0.1 and 80 Hz in 0.5 Hz increments.
**Results:** The ratio of scalp to intracranial median power spectral density in the beta (13 - 25 Hz) frequency band was 0.063 (95%CI 0.060 - 0.064) and 0.057 (95%CI 0.055 - 0.081) for the gamma frequencies (25 - 55 Hz). The scalp to intracranial ratio increased linearly with frequency from 40 to 80 Hz.
**Conclusion:** Extra-cranial signals and recording system noise may account for the relative increase in scalp EEG power spectral density above 40 Hz and would confound measurement of the faster gamma frequencies using scalp EEG.

**F13**

**Evolving Cyclicity on Quantitative EEG: A New Form of NCSE**

*Asma Zakaria, MD; Nishi Rampal, MD*

Two middle aged women were transferred to the hospital with a diagnosis of status epilepticus and were placed on cEEG monitoring. Both patients had a history of seizures and were non-compliant with medications prior to admission. Initial EEG revealed a theta background which was abruptly interrupted by a cyclic pattern of generalized rhythmic delta activity. There was a clear onset and offset to these cycles but no evolution or spread which would characterize them as ictal. Twenty-four hour cEEG trends revealed a striking rhythmic pattern to these cycles which occurred in clusters, evolved in frequency and amplitude and then broke down in a pattern reminiscent of a single epileptic seizure. Both patients were treated aggressively for these events, and resolution of the cycles was associated with clinical improvement and subsequent extubation. Although each individual event did not meet ictal criteria, we propose that clusters of evolving generalized rhythmic delta activity in comatose patients with prior status epilepticus lies on the continuum of non-convulsive status epilepticus, are ictal, and should be treated as such.

**F14**

**QEEG Analysis Reveals Changes Evoked by Intranasal Midazolam in Intracranial Recordings**

*Bin Tu, MD, PhD; Derek J Chong, MD, MSc; Lawrence J. Hirsch, MD*

Intranasal application of midazolam is a convenient and effect way for immediate seizure control. EEG changes induced by intranasal midazolam application have not been previously reported. In this study, we obtained scalp EEGs (n=5) and intracranial EEGs (n=2) before, during, and after intranasal 3 mg midazolam application. EEG changes were demonstrated using quantitative EEG (QEEG) values, which include alpha, beta, delta, and theta powers and aEEG. Significant increase in beta power was seen in both cases of intracranial EEG recordings starting 5 and 6 min after application, peak at 11 and 27 min. Other QEEG values did not significantly change. No significant changes were seen in Scalp recordings. These results suggested that it is possible to evaluate effects of intranasal midazolam on brain functions using intracranial EEGs. Further studies are proposed to investigate more intracranial studies, and also to improve scalp EEG quality, in order to better show QEEG changes. We believe QEEG is a useful tool to evaluate time course of subtle changes in cerebral rhythms after nasal midazolam application.

**F15**

**Slow Frequency Components of EEG Epileptiform Transients**

*Fumisuke Matsuo, MD*

EEG polygraphic recognition of focal interictal epileptiform transients (FIET) predictive of epilepsy (spike or sharp waves: SSW) has depended on high frequency components. Wicket spikes (WS) often mimic SSW, and differentiation between SSW and atypical WS (aWS) challenges clinicians. When applied to SSW analysis, PGCO (polygraphic channel overlay) could improve detection of slow frequency components (Matsuo, 2012 AES Annual Meeting, www.aesnet.org). Mixed 121 FIET (72 SSW and 49 aWS) were blindly ranked by visual inspection in multi-channel polygraphic montages.Ranked FIET were segmented into 11 tiers of succeeding 11 FIET to construct 11-by-11 grid. PGCO was generated by manually superimposing high contrast digital display image. Display gain was controlled in common average reference derivations with frequency window and temporal resolution set at 0.16 – 70 Hz and 150 mm/s, respectively. Each PGCO replaced corresponding FIET on grid and each tier was examined as group. Lower tiers of FIET grid consisted of increasing numbers of aWS. When slow frequency components were examined in PGCO, 26 (21 %) of FIET classifications were questioned. PGCO also facilitated comparison of FIET amplitude, compromised in conventional multi-channel polygraphic display. It is suggested that PGCO can assist differentiation between SSW and WS.

**F16**

**Periodic Complexes at 2-4 Second Intervals in EEE**

*Joseph W McSherry, MD, PhD*

Among the periodic complexes with relatively specific disease correlates, periodic transients at 2-4 second intervals are usually associated with Herpes Simplex Encephalitis. We recently had EEGs of two patients ultimately diagnosed with Eastern Equine Encephalitis. In one patient periodic complexes in the left temporal area occurred at 4 second intervals. Remarkably the right temporal area showed complexes at 3 second intervals. Subsequent monitoring for nonconvulsive status epilepticus revealed several other patterns. The second patient showed complexes at 2-4 second intervals, occasionally with PLEDS at 1 second intervals. During subsequent monitoring complexes at 2-4 second intervals occur for periods, mixing with other periodicity at other times. Key distinctions between traditional periodic complexes* of HSE and those we saw in EEE are the impersistence of the fixed periodicity on long term monitoring and the amplitude. In the usual 20-30 minute sample a periodic complex at fixed 3 or 4 second intervals may be confusing. The amplitude, however is usually 100-500uV in HSE and about 30uV on the very low voltage background in these two cases of EEE. *p554 in Niedermeyer's Electroencephalography , Sixth Edition, Schomer, DL and Lopes da Silva, FH eds Wolters Kluwer Lippincott Williams & Wilkins, 2011

**F17**

**EEG Scalp Potential Computer Simulation**
*Steven Tobochnik; Ellie Pavlick; Mercedes P. Jacobson, MD; Camilo A. Gutierrez, MD*

An understanding of spike fields is critical for accurate interpretation of the EEG. We developed a computer simulation tool that takes a user-defined scalp potential distribution as input and produces the associated EEG spike-wave complex in longitudinal bipolar, transverse bipolar, and referential montages simultaneously. Users choose single or multiple foci of maximum potential on a 2-dimensional electrode map to create EEG spikes with fields of variable complexity on an organized user-adjustable background. Distances between electrodes were determined by their coordinates in 3-dimensional space, and used to calculate normalized voltages that spread according to an exponential decay function. The length-constant used for the decay function can be adjusted by the user to manipulate the scalp potential spread and size of the EEG spike field. Using this simplified model, the simulation successfully translates a scalp potential input into the expected EEG. This simulation would be useful both as a teaching tool and for interpretation of EEG spikes with complex fields.

**F18**
**Automatic Spike Detection with Patient Specific Templates**
*Hannes Perko; Martin Weinkop; Manfred Hartmann; Gerhard Gritsch; Tilmann Kluge, PhD; Franz Fuerbass*

We present a novel method in the context of epilepsy diagnosis that automatically detects epileptic spikes in the electroencephalogram (EEG). In a first step our new approach detects spikes based on a non-restrictive definition of their morphology. The detected spikes are then subject to a hierarchical clustering. Representative group averages are presented to the user who can select groups of interest as templates which are used to refine the detection. In a second step, we derive a statistical description of the selected spikes and utilize it in a hypothesis testing. In contrast to the first step, all available EEG channels are included in order to detect spikes featuring a similar field as the selected groups. With this approach we were able to reject artifacts which are distributed arbitrarily over electrodes. Our results were obtained from the EEG of three patients with recording durations up to 4 hours and containing up to 128 spikes, which were marked by experienced EEG experts. On average a sensitivity of 69% with a false alarm rate of only 0.37 false alarms per minutes was achieved. Compared to the results only using step one, we significantly increased the sensitivity by 16% with constant false alarm rate.

**F19**
**Ictal Catatonia Associated with Segmental Catalepsy**
*Abdorasool Janati, MD; Naif S Alghasab, MD; Abdulrahman Mohammad Almalik, MD; Ghassab Alghassab, MD*

**Introduction:** Non-convulsive status epilepticus (NCSE) is an epileptic condition lasting more than 30 minutes in which continuous or recurrent seizure activity on the electroencephalogram (EEG) is associated with diverse clinical symptoms including alteration of mental state, abnormal behavior, perceptual disturbances or altered consciousness.
**Methods:** This was a case study conducted at King Khalid Hospital.
**Results:** Our patient presented with catatonia and segmental catalepsy associated with non-convulsive status epilepticus.
**Conclusion:** The simultaneous occurrence of non-convulsive status epilepticus and catatonia/catalepsy in our patient suggests a common pathophysiological mechanism. Furthermore, our data suggest that dysfunction of the posterior areas of the brain may be responsible for catalepsy.

**F20**
**Generalized Epileptiform Discharges with Pregabalin**
*Michael Mendoza, MD; Ilya Bragin, MD; Andrew Bragdon, MD*

Pregabalin is used to treat neuropathic pain, postherpetic neuralgia, partial seizures and restless leg syndrome (RLS). It acts on the alpha-2delta subunit of presynaptic voltage-gated calcium channels and is cleared almost entirely by the kidneys. Rarely, myoclonus and seizures have been reported in patients treated with pregabalin for partial seizures or neuropathic pain. To our knowledge, there has been no report of pregabalin-induced epileptiform discharges in a patient with end-stage renal disease (ESRD) being treated for RLS . A 56-year-old, non-epileptic, white male with ESRD (GFR 5 mL/min) on peritoneal dialysis was started on Pregabalin 75mg twice daily for RLS. He presented 5 days later with stuttering speech, myoclonus and ataxia. He had similar, but milder symptoms previously on gabapentin. The night of admission he had a generalized tonic-clonic seizure. The next day, an EEG showed generalized, bilaterally symmetrical spike-wave discharges including epileptiform K-complexes. Pregabalin was discontinued, he underwent peritoneal dialysis, and the myoclonus resolved by the next day. An EEG 5 weeks later showed complete resolution of the epileptiform discharges. Pregabalin may induce generalized epileptiform discharges, myoclonus and seizures even in the absence of epilepsy and independent of the indication for gabapentin. Renal failure likely increases the risk.

**F21**

**Ictal Asystole vs. Convulsive Syncope**

*Roland Hamilton, MD; Jonathan Edwards, MD; Nolan Williams, MD; Jay Madey, MD*

Ictal asystole is seizure-induced activation of the autonomic nervous system, which adversely affects cardiac innervation, leading to bradycardia and potentially lethal asystole. It is believed to be a contributing factor for sudden unexpected death in epilepsy. Convulsive syncope occurs when an individual experiences loss of consciousness (not related to epilepsy) followed by brief convulsions. The most common etiologies of convulsive syncope are cardiac arrhythmias and neurally mediated reflex. Distinguishing ictal asystole from convulsive syncope can be quite challenging for healthcare providers. Described here is a patient with a history of complex partial seizures presenting for medical evaluation of "syncope vs. seizure". Patient had multiple episodes of asystole which ultimately resulted in transcutaneous pacing and consideration of a cardiac pacemaker. Video electroencephalogram recording revealed seizure activity preceding his asystole suggesting ictal asystole as a possible etiology. However, the patient also had syncope with convulsion with no epileptic correlation on electroencephalogram, supporting the diagnosis of convulsive syncope. The medical evaluation of ictal asystole vs convulsive syncope will be reviewed, as well as the importance of making a timely and accurate diagnosis, to ensure that patients receive appropriate treatment for these potentially life threatening conditions.

**F22**

**Episodic Low Amplitude Events: Outcome Implications**

*Jeffrey Britton, MD; Amy Z Crepeau, MD; Elson Lee So, MD*

**Background:** Episodic low amplitude events (ELAEs) in coma have been reported to be associated with poor outcomes. We found ELAEs to be common in therapeutic hypothermia (TH) after cardiac arrest (CA), but the prognostic implication in this group of patients is unclear. We compared the prognostic value of ELAEs by comparing the seizure and mortality rates in TH and non-TH cohorts.
**Methods:** Patients with ELAEs were identified through query of our EEG report system and our TH database.
**Results:** 42 records with ELAEs were identified: 28 in the TH and 14 in the non-TH group. All TH and six non-TH patients were receiving sedation during the recording in which ELAEs were reported. Among TH patients, one had seizures, 3 (11%) died. Among non-TH patients, six had seizures, 5 (36%) died. There was a significantly higher proportion of seizures among non-TH patients ($p= 0.0054$), but no difference in mortality.
**Conclusions:** ELAEs have been described as being associated with a poor prognosis in comatose patients, but we did not reach the same conclusions. ELAEs were common in TH patients. Among non-TH patients identified, there was a higher proportion of seizures, but mortality was lower than previously reported.

**F23**

**Temporal Lobe Epilepsy and POTS in Temporal Lobe Cavernoma**

*Michael Mendoza, MD; Hyun Joo Sophie Cho, MD; Robert L. Beach, MD PhD*

Postural orthostatic tachycardia syndrome (POTS) is a disorder of orthostatic intolerance mostly affecting young female patients. We report the first case of coexistence of POTS and temporal lobe epilepsy in the setting of temporal lobe cavernous hemangioma. A 22 year-old female presented to the cardiology service with recurrent chest discomfort, nausea, diaphoresis, hot flash and dizziness on standing that started 15 months after giving birth. Comprehensive cardiac work-up including head-up tilt test confirmed POTS. She responded minimally to fludrocortisone and midodrine. At age of 28, she developed different types of episodes which comprised of few seconds of perseveration, blank stare and automatism which was associated with loss of consciousness at times preceded by hot flash, nausea and epigastric warm sensation. Video EEG revealed rhythmic sharp delta activity over the left sphenoidal and subtemporal electrodes followed by polymorphic slowing that corresponded to clinical seizures. MRI of the brain revealed a left medial anterior temporal cavernous hemangioma. She continued to have seizures due to poor tolerance to antiepileptic medication; therefore surgical removal of the hemangioma was planned. Temporal lobe epilepsy and POTS can present similar paroxysmal clinical events. It is important to differentiate these syndromes to offer appropriate therapy.

**F24**

**Physician Discussion Prior to Electromyography**

*Greg Thaera, MD; Amy Nielsen, DO; Srijana Zarkou, MD; Ales Hlubocky, MD; Mark A. Ross, MD*

**Background:** Patients are often apprehensive about nerve conduction studies (NCS) and electromyography (EMG). At our institution, we give a brochure to patients before testing. However, patients expressed that face-to-face time with a physician before these studies could be helpful. The aim of this study is determine whether physician discussion prior to NCS/EMG affects their tolerability.
**Methods:** Patients undergoing NCS/EMG in May 2011 were randomized to physician face-to-face visit with brochure versus brochure alone. The physician discussed the tests, allowing time for patient questions. Following testing, patients rated experience with

NCS/EMG on an ordinal scale. Patients in the study group also rated the helpfulness of physician discussion prior to testing. Statistical analysis was performed using Fisher's exact test.
**Results:** We enrolled 51 study and 53 control patients (n=102). 9% of study patients and 8% of controls found NCS unpleasant (p=0.73). Study patients more often reported EMG as better than expected (p=0.02). 94% found physician interaction helpful.
**Conclusions:** Face-to-face discussion with a physician prior to NCS/EMG is helpful for patients. The EMG was viewed to be a more positive experience in the study group. Electromyographers should consider addressing patient questions and concerns prior to the needle examination to optimize patient comfort.

**F25**
**Surgery for Catastrophic Epilepsy (CE) Caused by Malformations of Cortical Development (MCDs) in Infants Younger than 6 Months of Age**
*Pramote Laoprasert, MD; Andrew White, MD; Brent O'Neill, MD; Michael Handler, MD*

**Object:** To study efficacy of epilepsy surgery (ES) in infants younger than 6 months with CE caused by MCDs.
**Methods:** We retrospectively reviewed 14 infants with MCDs ages between 1 week and 6 months (median 2 months) who underwent ES for CE.
**Results:** The median age at surgery was 2 months. MCDs included 8 cortical dysplasia (CD), 5 hemimegalencephaly and 1 tuberous sclerosis. Hemisperectomy was performed in 9 and multilobar and focal resection in 5 patients. At median follow up of 70 months, 64% had seizure freedom (SF). SF was noted in hemispherectomy, focal and multilobar resection in 78%, 50% and 33% respectively. SF was noted in 83% of right hemispheric lesion (HL) and 50% in left HL. 14% of patients had normal development. 43% and 82% of patients with history of infantile spasms (IS) or Ohtahara syndrome (OS) and patients with no history of IS or OS had SF respectively.
**Conclusions:** Epilepsy surgery is effective in infants younger than 6 months with CE. Patients with hemispherectomy had the highest rate of SF. Most patient had DD despite having SF. Patients with right HL had a higher rate of SF. History of IS and OS is a poor prognostic factor.

**F26**
**LPD Modifiers and Seizure Risk in Critical Care Patients.**
*Louis Manganas, MD,PhD; Nicolas Gaspard, MD, PhD; NIshi Rampal, MD; Ognen A Petroff, MD; Lawrence J. Hirsch, MD*

**Objective:** The purpose of this study was to analyze the risk of seizures in a critical care population with lateralized periodic discharges (LPDs) with and without specific modifiers.
**Methods:** Patients from the Critical Care EEG database at Yale with LPDs were selected for the following modifiers: Rhythmic activity (R), Fast activity (F), Rhythmic and Fast activity (FR) and Lateralized Rhythmic Delta Activity (LRDA).
**Results:** Our findings show the probability of seizures (%) in patients with LPDs alone was 48%, (12/25), versus 83% (15/18) in patients with LPDs plus a modifier.
**Conclusion:** These preliminary results suggest that critical care patients with LPDs plus a modifier, carry a higher risk of developing seizures when compared to patients with LPDs alone.

**F27**
**Validation of Magnetoencephalography (MEG) as Presurgical Evaluaiton Tool in Pediatric Patients With Localization-Related Intractable Epilepsy.**
*Helen Barkan, MD, PhD*

**Objective:** Magnetoencephalography is employed increasingly for interictal source localization, however remains an expensive clinical modality, unvalidated due to limited available data, especially in pediatric surgical epilepsy patients. We compiled an unprecendented series of 59 pediatric surgical epilepsy patients in whom MEG was used to aid decision-making as to feasibility of surgery, and to guide intracranial implant placement. We attempt to validate its use.
**Methods:** Retrospective electronic chart analysis of patient data from the MEG database was performed by a team of Epileptologists and Neuropsychologists. Pre-surgical MEG reports, MEG images/composites, and intracranial video-electrocorticography reports were examined for concordance of location of "primary" and "secondary" interictal abnormalities and ictal onsets, with the criteria of hemispheric lateralization, lobar localization, gyral focal localization, judged by an expert. Patients were stratified into "lesional" (by MRI) and "nonlesional". Seizure outcomes and cognitive-functional outcomes were reconstructed from office notes and post-surgical neuropsychological evaluations.
**Results:** This preliminary analysis suggests that MEG is a valid pre-surgical evaluation tool in pediatric epilepsy surgery, that yields concordant findings with intracranial EEG, and allows for confident implant planning, and for improved localization and outcomes, particularly in "lesional" cases. IRB submitted to two institutions pending expedited approval

**F28**

**Ictal QTc Changes are Not Associated with Hypoxemia**

*Brian D Moseley, MD; Jeffrey W Britton, MD*

**Introduction:** It was recently reported that peri-ictal QTc prolongation is associated with hypoxemia, suggesting it may be a factor in sudden unexpected death in epilepsy (Seyal et al, 2011). Accordingly, we evaluated for associations between peri-ictal cardiac repolarization abnormalities and hypoxemia.
**Methods:** Patients evaluated in our epilepsy monitoring units were prospectively recruited. Peri-ictal oxygen saturation was recorded utilizing digital pulse oximeters. Ictal QTc values were calculated using the Bazett formula.
**Results:** Fifty eight seizures from 29 patients were analyzed. There was no significant difference between the minimum (396+/-47.8 versus 388+/-56.2 ms, p=0.54) and maximum (451+/-54.3 versus 450+/-55.8 ms, p=0.97) QTc values in seizures with and without peri-ictal hypoxemia. Seizures with peri-ictal hypoxemia were not more likely to be associated with QTc lengthening >=60 ms (3/18 with hypoxemia versus 6/40 without, p=1), clinically significant QTc prolongation (2/18 with hypoxemia versus 6/40 without, p=1), marked QT prolongation >=500 ms (3/18 with hypoxemia versus 8/40 without, p=1), QTc shortening >=60 ms (0/18 with hypoxemia versus 7/40 without, p=0.087), or markedly short QT intervals <=340 ms (1/18 with hypoxemia, 3/40 without, p=1).
**Conclusions:** Peri-ictal cardiac repolarization abnormalities are not associated with hypoxemia. This suggests factors other than hypoxia result in ictal cardiac repolarization abnormalities.

**F29**

**Consistent Localization in a Case of Ictal Whislting**

*Usman Moghal, MD; Evren Burakgazi-Dalkilic, MD*

Ictal whistling is a rare yet interesting automatism that has not been well localized. A handful of cases have been reported in literature localizing to the frontal and temporal lobes. We describe a patient with complex partial seizures of two different types, one of which includes ictal whistling, consistently localizing to the left posterior temporal and occipital lobes. We present a 28 year old female with a history of lupus and complex partial seizures since age eleven. The seizures did not consist of an aura and began with prominent whistling and loss of consciousness. Although there appeared to be an association with her menstrual cycle, her seizure frequency was minimal with keppra, vimpat, and phenobarbital. Whistling is complex, requiring oral, perioral and respiratory muscles. Complicated neuronal networks involving the inferior Rolandic cortex, cingulate cortex, basal ganglia, amygdala, thalamus, and cerebellum have been shown to be involved using functional imaging. As can be concluded from previous case reports and our patient, ictal whistling is a rare and interesting ictal phenomenon but not a good localizing sign. However we suggest that it may predominantly be a posterior temporal lobe phenomenon given the consistency at which our patient showed activity from that region.

**F30**

**A Case of Stimulus-Aborted Seizures: Rethinking Common Sense**

*Indranil Sen-Gupta, MD; Vivian Hoang, MD, MBA; James Chen, MD, PhD*

We describe a 51 year-old woman whose seizures were consistently aborted by auditory or visual stimuli. The patient was admitted for increasingly frequent episodes of nausea, alterations of consciousness, and variable right leg and hand twitching that were previously well controlled with anti-epileptic medications. Continuous video EEG monitoring demonstrated left temporal slowing, multifocal spikes involving the bilateral temporal and left frontal regions, and multiple poorly localized and poorly lateralized seizures characterized by rhythmic bifrontal and bitemporal slowing with subsequent diffuse spread. Clinically, the seizures manifested primarily as episodes of behavioral arrest that consistently and promptly resolved without a post-ictal period in response to sound or to people entering the patient's room. Admission PET suggested left anteromedial temporal hypometabolism; prior MRIs were unrevealing. The constellation of findings suggested the seizures likely involved the left insular region prior to rapid spread. To our knowledge, this is the first reported case of a seizure type other than absence demonstrating clearly abortive response to sensory stimuli. Moreover, the very act of evaluating the patient during ictal events concomitantly terminated her seizures (with the patient being instantly responsive and normally conversant), suggesting that bedside testing alone may prove misleading for assessing unusual seizures like these.

**F31**

**Characterization of Atypical Benign Partial Epilepsy Suggesting Structural and Genetic Origins**

*Cyrus Boelman, MD; Hiro Otsubo, MD*

Atypical benign partial epilepsy (ABPE) is a rare syndrome defined by the presence of atypical absences, atonic or negative myoclonic seizures with EEG findings of focal discharges and continuous spike-wave discharges in slow-wave sleep (CSWS). We reviewed EEG and clinical profiles of ABPE patients to understand the possible etiologies. All four ABPE cases (ages 7-9 years; 4 males) had negative myoclonus with atonic head and unilateral arm drop, lateralized central focal spike-wave discharges and CSWS starting

between 3-4 years of age. The awake backgrounds and sleep features were normal. MRI brain imaging revealed focal increased signal in 3 cases: case1, left amygadala; case 2, bilateral deep white matter and cortex of the left inferior temporal gyrus; case 3, left thalamus & fronto-parieto-occipital areas secondary to .a neonatal stroke. Case 4 had delayed myelination and prominent perisylvian sulci. Case 4 had a chromosomal deletion and systemic dysmorphisms. Cases 1, 3 & 4 were treated with Ethosuximide and responded excellently, including resolution of the CSWS patterns, after unsuccessful trials of other anticonvulsants. Neurodevelopment and epilepsy improvements were despite the presence of known structural brain abnormalities. These cases highlight the potential role of subcortical structures and genetic abnormalities in the development of APBE.

**F32**

**Parry-Romberg: A Rare Neurocutaneous Syndrome**

*Brian W Peterson, MD; Edward C Mader, MD; Piotr W. Olejniczak, MD*

Parry-Romberg syndrome, or progressive hemifacial atrophy, is a rare neurocutaneous syndrome characterized by loss of soft tissue on half of the face without muscle weakness. Associated features are variable, but can include ipsilateral brain and limb atrophy, migraine headache, trigeminal neuralgia, ocular abnormalities, and epilepsy1. This syndrome was first described in 1825 and remains poorly understood. Many theories exist about the etiology: they range from sympathetic hyperactivity/hypoactivity, trauma, and focal “en coup de sabre” scleroderma. Serial MRI scans show that over time, there are progressive changes in the ipsilateral cerebral hemisphere2. Our patient was first diagnosed with PRS after a fall with occipital trauma at age five. He subsequently developed a “red line” down the center of his face from his forehead to his chin, which marked the onset of right hemifacial atrophy. At age 23, the patient had his first seizure. EEG showed right frontal semi-regular slowing in the theta and delta frequency bands with superimposed high amplitude sharp waves and sharp-slow wave complexes. These EEG changes correlate with focal cerebral atrophy seen on MRI. Our patient’s seizures have become more frequent and disabling, but are significantly improved with a combination of phenytoin, levetiracetam, lacosamide, and diazepam.

**F33**

**Neocortical Ictal High Frequency Oscillations (HFOs) are a Surrogate Marker of Increased Action Potential Firing Rate and Synchrony**

*Shennan Aibel Weiss; Garrett Banks; Guy McKhann, III; Robert Goodman; Ronald G. Emerson, MD; Catherine Schevon, MD; Andrew Trevelyan*

Traditionally, the epileptogenic zone is characterized by the earliest and largest amplitude aberrant EEG activity in the Berger bands correlated with a clinical event. However, large EEG signals may arise from either focal discharges or by large synaptic currents that may prevent seizure spread in surrounding territories. It is not a simple matter to distinguish the core active regions from the surrounding territory. To overcome this ambiguity, we sought to identify EEG surrogate markers of increased action potentials in the underlying cortex. We analyzed ictal electrocorticography and micro-electrode array recordings from neocortex in four human patients. We demonstrate that ictal high frequency oscillation HFOs detected in layer 4/5 of epileptogenic cortex are correlated with increased action potential firing rate and synchrony. During seizure recruitment action potentials are phase locked to the HFO suggesting that action currents generate these HFOs. In contrast, post-recruitment HFO bursts precede strongly synchronized action potentials. These HFO bursts produce strong signals detectible on the cortical surface by electrocorticography. We conclude that ictal HFOs detected on the cortical surface are indicative of increased neuronal activation in the underlying cortex and can distinguish cortical regions recruited into a seizure from the penumbra.

**F34**

**Effect of Microradiosurgical Transections Upon Kainate Seizure Focus**

*David Anschel, MD; Alberto Bravin, PhD; Elke Brauer-Krisch, PhD; Geraldine Le Duc, PhD; Pantaleo Romanelli, MD*

Multiple subpial transections (MST) sever horizontal intracortical fibers involved in the propagation of seizures, while preserving vertical fibers which are essential for brain function. Less damaging to the brain than a traditional resection, MST still exposes patients to the risks of craniotomy. Microradiosurgery uses synchrotron generated sub-millimetric beams of radiation. Arrays of tightly spaced microbeams produce a lethal effect only to those cells directly in the beam path. Low energy x-rays used for microradiosurgery have a small tissue half-value layer making the technique ideal for treating superficial brain lesions. Video-EEG (VEEG) data was recorded immediately following kainate injected into sensorimotor cortex. Rats then underwent irradiation with an array of parallel microbeams delivered to the seizure focus.Subclinical electrographic ictal events remained frequent up to 10 hours post irradiation. More prolonged seizures exhibited typical rat complex partial seizure semiologies. These results demonstrate the feasibility of recording VEEG before and after precise microbeam irradiation from a synchrotron source; demonstrating a methodology which will be useful for future experiments serving to optimize microbeam doses and configuration in preparation for the treatment of epilepsy in humans. The results

show some promise that microradiosurgical MST can limit the spread of seizures without causing clinically evident neurological damage.

**F35**
**The Fallible Phase Reversal**
*Matthew A. Eccher, MD*

Cortical recording of upper limb SSEP is commonly utilized for confirmation of the location of the central sulcus. It may be underappreciated, that this technique is susceptible to error. Case 1: A 21 year old male with medically refractory nocturnal seizures and normal MRI underwent invasive EEG evaluation for epilepsy surgery. Epileptogenic zone included the entire temporal and occipital lobes. This region was hypometabolic on PET; patient had contralateral homonymous hemianopia; a posterior disconnection procedure was therefore elected. Negative phase reversal recorded from implanted EEG electrodes was repeated at the time of definitive epilepsy surgery, with plan to disconnect through the sulcation behind that identified as central sulcus. Postoperative MRI demonstrated that the disconnection had gone through central sulcus, not behind it. Case 2: A 42 year old female with new onset seizures underwent awake craniotomy for resection of a lesion immediately subjacent to central sulcus. SSEP phase reversal appeared anteriorly displaced. Subsequent functional electrical stimulation mapping yielded results more in keeping with expected anatomy. Conclusion: In the setting of physiologic and/or anatomic disturbances, the negative phase reversal of the SSEP can be misleading, and should not be used as the sole means of anatomic localization.

**F36**
**Large Amplitude Evoked Potentials (EPs) in 53 Non-Epileptic Patients**
*Guillermo Martin-Palomeque, MD; Pilar Pamplona-Valenzuela, MD; Antonio Castro-Ortiz, MD; Miguel Angel Saiz-Sepulveda, MD*

**Introduction:** Large amplitude EPs in non-epileptic patients are unusual and imply central nervous system (CNS) hyperexcitability due to various causes.
**Methods:** Retrospective chart review including history, physical examination, and imaging and diagnostic studies of non-epileptic patients with large amplitude somatosensory (SSEPs) and visual (VEPs) EPs during the past six years. Large amplitude EPs were defined as follows: VEPs (N75-P100) > 15 uV; and SSEPs (N20-P25) > 9 uV (7uV in patients over 70 years of age). Recording montage for VEPs was Oz-Cz and SSEPs C3'/C4-Fz.
**Results:** 53 patients (34 females, 19 males; ages 9-90 years) were identified. No CNS pathology was detected in 8 (sensitivity 85%). The remainder of the patients were diagnosed with new CNS disorders. The etiologies included: vascular (37%); myelopathies (13%); demyelinating (11%); space occupying lesions (8.7%); syringomyelia (8.7%); hydrocephalus (6.5%); B-12 deficiency (4.3%); multisystem atrophy (4.3%), Intracraneal Hypertension (4.3%) and; toxins (2.2%).
**Conclusion:** This study supports the notion that the presence of large amplitude EPs implies CNS hyperexcitability, with a sensitivity of 85% but relatively low specificity for specific etiologies given the wide number of pathologies. Nonetheless, these results confirm the utility of EP studies in patients with suspected CNS pathology.

**F37**
**Pulse-Train Stimulation Enhances SEP Amplitude**
*David Pinter, CINM; Jon Dizon, CINM; Ronald G. Emerson, MD*

High signal-to-noise ratio SEPs, important for effective intraoperative monitoring, can be difficult to obtain in patients with neurological abnormalities and when mechanical factors prevent adequate current from reaching the stimulated nerve. We describe the use of pulse-train stimulation to enhance SEP amplitude for intraoperative monitoring. In 4 patients with normal, readily elicited SEPs, pulse train stimulation (train = four 200-300 usec pulses, inter-pulse interval 1 msec) produced 1.5 – 2.5 fold augmentation of cortical SEP amplitudes compared to single pulse stimulation at submaximal intensities. At supra-maximal stimulation intensities, augmentation was negligible. Pulse-train stimulation also produced enhancement of subcortical SEPs in 2 of 3 normals. In 3 patients in whom SEPs to standard single pulse stimulation were not monitorable at baseline due to spinal cord compression, lumbar stenosis and leg edema, pulse-train stimulation elicited well-formed, monitorable cortical SEPs. We speculate that augmentation of SEPs by pulse-train stimulation likely results from temporal summation at one or more sites in the large fiber sensory pathways. Pulse-train stimulation appears to be potentially useful for enhancing the amplitude of SEPs that maybe otherwise difficult or impossible to monitor.

**F38**
**Single vs Train Stimulation for Identification of Malpositioned Pedicle Screws in Scoliosis Surgery**
*Gema de Blas, MD, PhD; Ignacio Regidor, MD, PhD; Elena Montes, MD; Lidia Cabañes-Martinez, MD; Carlos Barrios, MD, PhD; Jesús Burgos, MD, PhD; Jaime R. Lopez, MD*

**Introduction:** Pedicle screw placement carries a risk of breaching the pedicle and invading the spinal canal. Unfortunately, pedicle screw electrical single stimuli techniques may not identify malpositioned screws within the spinal canal (SC). **Methods:** Prospective study of single (SS) versus pulse-train stimuli (PTS) of pedicle screws in detecting screw SC invasion. 244 thoracic pedicle screws in 13 patients (11 females and 2 males; ages 10-26) were studied. Stimulation thresholds for ¡°safe¡± screw placement was >12 mA for SS and >30 mA for PTS. All patients were also monitored with somatosensory and transcranial motor evoked potentials. Final pedicle screw position was established by postoperative computer tomography. **Results:** Postoperative pedicle screw position was as follows: Intrapedicular-190; cortical breach without SC invasion-25; mild SC invasion-24; and severe SC invasion-5. SS technique detected 4 (13.8%) malpositioned screws intraoperatively but did not identify 25 within the SC. PTS threshold levels ¡Ü 30 mA correlated with SC invasion in 25 screws. The SS sensitivity and specificity was 14% and 99%; and 86% and 78% for the PTS. No patients suffered new neurologic deficits.
**Conclusion:** Our results indicate that the pulse-train stimulation technique is more accurate in detecting malpositioned pedicle screws when invading the spinal canal.

**F39**
**EEG Asymmetry with Cerebral Perfusion via Innominate Artery**
*Steven Tobochnik; T. Sloane Guy, MD, MBA; Sheela Pai, MD; Mercedes Jacobson, MD; Camilo A. Gutierrez, MD*

Intraoperative electroencephalogram (EEG) monitoring is increasingly used during aortic arch procedures for early detection of acute neurologic dysfunction. In those procedures involving cardiopulmonary bypass, increased neuroprotection may be gained by using hypothermic circulatory arrest and selective cerebral perfusion. Several techniques for cerebral perfusion exist yet no studies have noted distinct EEG patterns associated with different techniques. In this study, we reviewed EEG records of six aortic arch procedures that used cannulation of the innominate artery to provide selective antegrade cerebral perfusion (ACP). In each case, a transient hemispheric asymmetry was noted within 1-2 minutes of the start of head cooling, which consisted of enhanced suppression over the right compared to left hemisphere. The EEG returned to baseline during passive head rewarming in five cases, while a brief left-sided partial seizure occurred during rewarming in one case. These findings suggest that ACP using cannulation of the innominate artery results in enhanced cooling of the right hemisphere as detected by intraoperative EEG monitoring. Since ACP may be associated with risk of embolism, characterization of this finding is necessary to prevent misinterpretation of ischemia by EEG.

F40
**Prognostic Value of Intraoperative Monitoring in Peroneal Nerve Surgery**
*Paul Kwon, MD; Zhengyong Chen, DABNM; Al Llaguno, MD*

**Introduction:** Outcome following peroneal nerve (PN) repair surgery is variable. An intraoperative index for prognosis is desirable. Objectives: Investigate the correlation of intraoperative nerve action potentials (NAPs) and compound muscle action potentials (CMAPs) with prognosis.
**Methods:** Twelve patients underwent PN repair surgery. Preoperative ankle dorsiflexion was 0/5 in nine patients and 1/5 in three. Intraoperative NAPs were recorded on distal branches and CMAPs recorded from tibialis anterior following direct electrical stimulation proximal to the lesion. Postoperative follow-up ranged from 22 to 42 months.
**Results:** Surgical findings included two neuromas, a ganglion cyst, a synovial cyst and the remaining had scar tissue. Surgical repair procedures depended mainly on the results of the NAPs and CMAPs recordings. Both NAPs and CMAPs were present in all with 1/5 dorsiflexion and three additional patients. All but one of these patient achieved satisfactory recovery with 4+/5 dorsiflexion following external neurolysis. Three patients with 0/5 dorsiflexion but present NAPs attained fair recovery, 2-3/5, following neurolysis. The remaining three patients with absent NAPs and CMAPs received sural nerve grafts, among whom only 1 patient attained fair recovery.
**Conclusion:** Intraoperative NAPs and CMAPs are valuable for prognosis and pivotal in determining surgical management for PN repair surgery.

**F41**
**Intraoperative Neurophysiological Monitoring in Anterior Lumbar Interbody Fusion (ALIF) Surgery**
*Ilker Yaylali, MD, PhD; Jung Yoo, MD; Alex Ching, MD; Robert Hart, MD*

**Background:** Somatosensory evoked potential (SSEP) and motor evoked potentials (MEP) are frequently used to monitor neurological function during spinal deformity surgery.
**Methods:** A retrospective review of all patients undergoing ALIF with IONM from November 2008 to July 2010 was performed. Occurrence of post operative neurological deficit were calculated. Factors including gender, operative time, blood loss and number and levels of interbody fusion were analyzed as risk factors for inter-operational alerts.
**Results:** A total of 80 consecutive patients who underwent ALIF were studied. All 80 patients had SSEP and 45 patients had MEP as part of the intraoperative neuromonitoring. The remaining 35 patients did not have MEP due to neuro muscular blockade requested by

the exposure surgeon. No intraoperative changes in MEP were found. Nine(11.2%) patients experienced intraoperative changes in SSEP; none of these patients had new neurological deficits post-operatively. Increased risk of SSEP changes was seen in patients undergoing fusion of both L4/5 and L5/S1 (p=0.024) and longer surgical duration (p=0.036). No correlation was found between age and positive SSEP changes.
**Conclusion:** The duration of surgery and concurrent fusion of both the L4/5 and L5/S1 levels were significant risk factors for SSEP changes leading to intraoperative alerts.

**F42**
**Dorsal Column Mapping in Intramedullary Spinal Cord Resection**
*Emily B Kale; Aatif M. Husain, MD*

**Introduction:** Intramedullary spinal cord tumor resection requires a myelotomy placed along the dorsal median sulcus (DMS) to minimize injury to the dorsal columns. Neurophysiologic mapping of the dorsal columns provides more sensitive localization of the DMS than visual identification.
**Methods:** Stimulation for dorsal column mapping (DCM) is performed by the surgeon with evoked potential recordings from the scalp and peripheral. After exposure, the surgeon stimulates the dorsal column. Lateralized stimulation of the dorsal column evokes a response that is recorded from the ipsilateral peripheral nerve and contralateral scalp. The point at which the responses transition from one side to the other is the location of the DMS. Details of the monitoring methodology will be discussed.
**Results:** A review of the outcomes of the 11 out of 91 patients undergoing resection of intramedullary spinal cord tumors with DCM, revealed only 1 (9%) with postoperative worsening of neurologic symptoms. Conversely 80 out of 91 patients under went resection with no mapping and 40(50%) of those experienced postoperative worsening of neurologic symptoms.
**Conclusions:** DCM was successfully minimized postoperative posterior column dysfunction in the majority of patients. Better definition of the DMS may help reduce the morbidity of this procedure.

**F43**
**Intraoperative Monitoring During Removal of Optical Nerve Schwannoma**
*Daniel San Juan Orta, MD; Manuel E Cortes, MD; Martha Tena Suck, MD; Adolfo Jose Orozco Garduno, MD; Alejandro Jesus Lopez Pizano, MD; Jonathan Villanueva Dominguez, MD; Maricarmen Fernandez GA, MD*

**Background:** Recently have demonstrated the possibility of obtain VEPs directly from stimulation of the optic nerve (ON) during the resection of central skull base tumors to prevent postoperative visual deterioration. However, this type of intraoperative monitoring (IOM) has been rarely used in clinical practice.
Objective: Describe the first case of IOM during removal of the ON schwannoma to preserve the vision.
**Methods:** We used Nicolet Endeavour CR to performed scalp VEPs (O1-O2, O1-OZ and O2-OZ) stimulating binocularly with flash goggles and direct epidural ON stimulation delivering a rectangular current pulse (intensity 0.2-5.0mA; duration 0.3ms; rate 4.1Hz).
**Results:** Thirty year-old women with one year of repetitive amaurotic events on the left eye (LE). The pre-operative ophthalmologic examination showed on the LE; visual acuity 20/80 and proptosis. She underwent surgery through left orbito-zygomatic approach. We recorded scalp VEPs only by direct epidural stimulation and during the resection the amplitude decreased 30-40% and returned to the baseline after the neurosurgeon stopped or changed the resection pathway. In the follow-up, the patient didn´t have any visual loss and the tumor was resected (95%).
**Conclusion:** Direct epidural electrical stimulation of the ON could be help to prevent vision loss during the resection of ON schwannoma.

**F44**
**Direct Cortical Stimulation for Cranial Nerve Motor Evoked Potentials**
*Daniel Lai; Viet Nguyen, MD; Leslie Lee, MD; Gary Steinberg; Sungho Cho; Jaime R. Lopez, MD*

**Objectives:** Monitoring motor evoked potentials during intracranial surgery can help reduce post-operative morbidity. To increase the definition of area at risk, the authors recorded and characterized compound muscle action potentials (CMAPs) innervated by cranial nerves following direct focal cortical stimulation.
**Methods:** This is a retrospective review of thirty-one cases of moyamoya revascularization surgeries. During the operation, an electrode stimulation strip was placed on the cortex, and CMAPs were recorded from muscles of the face, tongue, and hand using needle electrodes. CMAPs recorded from bulbar muscles were analyzed for amplitudes and latencies.
**Results:** Reliable potentials were obtained in eighteen cases. Genioglossus was the most reproducible CMAP and with the shortest latency. A wide range of onset latencies were observed for each muscle CMAP, and longer latencies corresponded with increased stimulation trains and interstimulus intervals (ISI). Each muscle group had some latency variability without an absolute onset. Stimulus

intensity does not appear to correlate with latency. There appears to be a general trend of higher CMAP amplitude with increased stimulus intensity.
**Conclusions:** Stimulation train and ISI are the primary variables which influence CMAP latency. Increased stimulus intensity generally results in larger amplitudes suggesting increased recruitment without clear latency change.

**F45**
**IOM in Cervical Spine Surgeries: Cost-Benefit Analysis**
*John P. Ney, MD MPH*

**Purpose:** Construct a probabilistic cost-benefit model for intraoperative neurophysiological monitoring (IOM) in cervical spinal surgeries.
**Methods:** A decision-model was based on sensitivity, specificity, IOM cost, prevention rate given IOM alert, post-operative spinal cord injury and C5 radiculopathy rates in pooled estimates from published literature with lifetime post-operative costs (health care+lost wages and benefits) compiled using Markov modeling of spinal injury data. Results from Monte Carlo simulation with 10,000 replications were analyzed for cost outcomes and relationship of input variables to outcomes.
**Results:** IOM saved $9748 (95% CI $5466-$14029) for the reference case 50 year-old patient with spinal cord injury rate of 0.29%, C5 radiculopathy rate of 4.2%,multimodal IOM 2009 Medicare reimbursement rate of $1,535, 52.4% prevention rate given an IOM alert at 94.3% sensitivity and 95.6% specificity. In linear predictions from the simulated data, IOM remained cost-saving at cervical radiculopathy rates as low as 2.4%(p=0.25) and for IOM sensitivity of 76%(p=0.02), specificity of 90%(p=0.001), and IOM cost of up to $9600 per surgery (95% CI $2100-$16600).
**Conclusions:** Intraoperative monitoring is net cost-saving for cervical spinal surgeries in a theoretical economic model based on the current published literature.

**F46**
**Analysis of Motor Evoked Potentials to Predict Deficits**
*Jaime R. Lopez, MD; Scheherazade T. Le, MD; Alexander Ekwuemre; Leslie Lee, MD; Viet Nguyen, MD; Sungho C. Cho, MD*

The aim of this study is to identify neurophysiologic parameters of transcranial motor evoked potentials (TcMEPs) that predict early motor compromise during spinal surgeries. The ultimate goal is to enhance real-time intraoperative neurophysiologic monitoring (IONM) feedback to prevent irreversible postoperative deficits with earlier treatment intervention. Although a 50% amplitude decrease in somatosensory evoked potentials(SSEPs) correlates with potentially reversible spinal cord injury, there are no corresponding standardized warning criteria for TcMEPs; surgeons may be alerted to a significant change only after the TcMEPs are unobtainable. Eleven true-positive cases in 2011-2012 were identified wherein TcMEPs changes occurred and the patient had a new postoperative motor deficit. TcMEP latency, amplitude, duration, turns, phases, area-under-the-curve(AUC) and intraoperative-spinal-cord-index(ISCI) were measured for each muscle group before complete TcMEP loss. Among the 11 cases there were 18 muscle groups monitored: 5 TcMEPs increased in latency, 10 decreased in amplitude, 8 decreased in AUC, and 9 decreased in ISCI. There was a trend towards a smaller and simpler waveform before complete TcMEP loss. TcMEPs should be obtained more frequently during IONM to increase the sensitivity of detecting impending motor compromise. Further research on TcMEP characteristics is warranted to identify early warning neurophysiologic criteria that precede irreversible corticospinal tract injury.

**F47**
**Focal High Frequency Oscillations With Generalized Seizures**
*Jeffrey R Tenney, MD, PhD; Hisako Fujiwara, EEGT; Douglas F Rose, MD; Nat Hemasilpin, MS*

**Background:** Absence seizures are characterized by briefly impaired consciousness with diffuse 3 Hz spike and wave discharges on EEG. High frequency oscillations (HFOs) are promising biomarkers of the seizure onset zone. This goal of this study was to use MEG to evaluate whether HFOs occur during childhood absence seizures and where the sources localize.
**Methods:** Children, aged 6 to 12 years old, with newly diagnosed and untreated absence seizures were recruited and MEG recordings were conducted on a 275 channel CTF magnetometer. Time-frequency analysis using short time fast Fourier transform (STFFT) was completed during absence seizures at 1-20Hz, 20-70Hz, 70-150Hz, and 150-300Hz. Source localization was then completed using a sLORETA algorithm for the first generalized spike and slow wave complex.
**Results:** Twelve children were recruited and forty-four absence seizures occurred during MEG recording. Time-frequency analysis with STFFT showed significant power density in the 1-20Hz, 20-70Hz, and 70-150Hz bandwidths. Source localized preferentially in the parietal region at 1-20Hz and to the lateral inferior frontal region at 20-70Hz and 70-150Hz.
**Conclusions:** Using MEG, we have been able to detect focal ictal HFOs in children with untreated absence seizures. These areas could be components of the network responsible for generating absence seizures.

**F48**

**Mantle Cell Lymphoma Presenting as Chronic Inflammatory Demyelinating Polyneuropathy (CIDP)**

*Reuben Mari Valenzuela, MD; Gregory M Blume, MD*

**Background:** Mantle cell Lymphoma is the rarest of the non-hodgkin's lymphoma (NHL) comprising about 6% of NHL cases. There are only about 15,000 cases in the U.S. Patients are typically in their 60s presenting with fever, night sweats and weight loss. Through our extensive literature search, we found no reported case of mantle cell lymphoma presenting as CIDP.
**Objective:** To report a rare case of mantle cell lymphoma presenting as CIDP.
**Design:** This is a case report
**Results:** A seventy year-old right-handed Caucasian male was admitted with a four-week history of ascending symmetric type weakness, tingling in fingers and dysphagia. MRI of the cervical spine showed multiple lymph nodes and subsequent biopsy was consistent with mantel cell lymphoma. Nerve conduction study was consistent with CIDP. Despite aggressive chemotherapy (R-CHOP), patient succumbed a few months later.
**Conclusion:** Mantle cell Lymphoma is the rarest of the non-hodgkin's lymphoma (NHL) and to our knowledge there has been no reported case of mantle cell lymphoma presenting as CIDP. The cause is unknown and no inherited predisposition has been identified, although over expression of cyclin gene has been reported. Median survival time is about 3-6 years even with extensive chemotherapy.

**F49**

**Median Motor Axon Properties are Altered in Chronic Stroke Survivors**

*Cliff Klein, PhD; William Z Rymer, MD, PhD; Morris A. Fisher, MD*

The study of axon properties in-vivo may provide important insights into motoneuron adaptation following central nervous system lesions. We compared motor axon properties of the paretic and non-paretic limbs in 20 persons (58±8 y) who had unilateral hemiparesis due to chronic stroke (12±7 y). The median nerve was stimulated while monitoring the threshold current required to evoke a 40% compound muscle action potential of the abductor pollicis brevis. The TROND protocol was applied to record stimulus-response, strength duration time constant, threshold electrotonus, current-threshold relation, and the recovery cycle. There was less accommodation to 100-200 ms subthreshold hyperpolarizing currents in the paretic than the nonparetic axons ($P<0.05$), but this difference disappeared during longer lasting (300 ms) currents. This finding may indicate a slower activation of inwardly rectifying current through hyperpolarization-activated cyclic nucleotide-gated (HCN) channels in paretic axons. In the recovery cycle, refractoriness and the relative refractory period were greater, whereas superexcitability and subexcitability were less, in the paretic compared to the nonparetic axons ($P<0.001$). The altered excitability of the paretic axons during the recovery cycle may reflect reduced sodium conductance due to a compensatory down-regulation of sodium channel expression resulting from heightened motoneuron reflex activity following stroke.

**F50**

**Somatosensory and Motor Evoked Potentials to Predict Post-Operative Neurologic Worsening in Patients who Undergo Spinal Cord Tumor (SCT) Resection: A Retrospective Chart Review**

*Mesha-Gay Melanie Brown, MD; Steven R. Messe, MD; Michael L. McGarvey, MD*

**Objective:** To determine predictors of neurologic worsening after spinal cord tumor (SCT) resection in patients monitored using somatosensory evoked potentials (SEPs) with/without motor evoked potentials (MEPs).
**Methods:** We reviewed a consecutive series of 134 SCT resections monitored with SEP or SEP/MEP. Our outcome of interest was > 2 point increase in the National Institute of Health Stroke Scale (NIHSS) comparing postoperative status at discharge to preoperative status. Univariate and multivariate analyses identified predictors of worsened neurologic function.
**Results:** Persistent SEP changes occurred in 9/134 (7%), persistent MEP changes occurred in 6/31 (19%), and 17 patients (13%) had a worsening of > 2 on their NIHSS. Worsened neurologic status was associated with persistent SEP changes (44% vs 10%, p=0.02) but not MEP changes (33% vs 28%, p=1.0). Sensitivity/specificity were 24%/93% for SEP changes, and 22%/82% for MEP changes. In multivariate analysis only younger age (OR=0.94, 95%CI 0.89-0.98, p=0.005) and intramedullary tumor location (OR 5.2, 95%CI 1.6-16.7, p=0.006) were associated with worsened neurologic status.
**Conclusions:** Younger age and intramedullary tumor location were the strongest predictors of worsened neurologic status post-procedure. SSEP performed better than MEP but both had a high false negative rate, leading to low sensitivities.

**F51**

**Sleep Characteristics in the Neurological Intensive Care Unit**

*Brandon Foreman, MD; Jan Claassen, MD, PhD; Carl W. Bazil, MD*

**Background:** Sleep is an important yet understudied physiologic parameter in ICUs. Medical/surgical ICU patients have fragmented, non-restorative sleep. Traditional sleep scoring is not feasible in up to 40%. Sleep in the neurological ICU has not been well described.
**Methods:** Adult neurological ICU patients undergoing continuous electroencephalography were recruited for a randomized, controlled trial of sleep interventions. A sleep montage including electromyography and flow was used to score sleep per American Academy of Sleep Medicine criteria. We used this data to quantify sleep stages and to examine characteristics associated with sleep not meeting criteria for traditional scoring.
**Results:** 12 patients were enrolled. Mean age was 57.9; 60% were intubated and 60% were stuporous/comatose. Total sleep times averaged 7 hours over a 19 hour period with mean of 85 awakenings. Slow-wave sleep was 4% of total sleep time and rapid-eye movement sleep was <1%. 70% of studies did not meet scoring criteria; this was associated with worse injury severity, worse neurological exam, intubation, and absent posterior dominant rhythm.
**Conclusions:** Patients in the neurological ICU have fragmented, non-restorative sleep similar to patients in other ICUs. A substantial proportion have sleep that is not scorable by traditional criteria; these patients have worse neurological status.

**F52**
**Propagation of Seizures in a Case of Lesional Mid-Cingulate Gyrus Epilepsy Studied by Stereo-EEG**
*Rafeed Alkawadri; Andreas V Alexopoulos*

Literature on the propagation of seizures arising from the cingulate gyrus is limited, as cingulate coverage with interhemispheric subdural electrodes is usually challenging and incomplete due to inherent anatomical and vascular limitations. The bulk of the available literature on the connectivity of the cingulate gyrus is based on studies done on rhesus monkeys. Little is available on the connectivity of the cingulate gyrus in humans. We present a case of lesional mid-cingulate gyrus epilepsy confirmed by stereotactically placed intracranial depth electrodes. Hypermotor symptomatology was seen during the first 7 seconds of seizure onset while the seizure was still confined to the mid-cingulate gyrus contacts. Patient had brief contralateral clonic movements as seizure propagated to the primary motor cortex. There was high concordance between the primary propagation contacts as delineated by intracranial EEG and the contacts with higher coherence values in the connectivity matrix. Interestingly, cingulate-extra-cingulate connectivity and spread to the primary motor, premotor and prefrontal cortex was seen prior to the spread to other cingulate contacts, of which one was less than 18 mm away from the onset contact. This report is one of few in the published literature documenting propagation of seizures arising from the mid-cingulate cortex in humans. As illustrated by this data hypermotor semiology results from direct activation of cingulate cortex. Subsequent seizure propagation in this patient activated an extensive extra-cingulate rather than an intra-cingulate epileptogenic network. Further studies exploring functional, electrophysiological and anatomical connectivity of the cingulate cortex in humans are needed.

**F53**
**Video-EEG of Extra-temporal Lobe Epilepsy in Older Adults**
*Adriana S. Tanner, MD; Kathryn McDonald, RN; Yvan Tran, MD; Kristina Karanec, DO*
**Rationale:** There is a paucity of clinical and EEG information about extra-temporal lobe epilepsy in elderly patients.
**Methods:** Retrospective review of adult patients admitted to our Epilepsy Monitoring Unit (EMU) between 2006 and 2011.
**Results:** We identified six patients with extra-temporal lobe epilepsy. Their mean age was 63.5± 6.8 years. 83% of the patients were women. These patients accounted for 5.7% of elderly patients admitted (105 patients), but only 0.5% of all admissions to the EMU during the study period. Altogether, 33 seizures were recorded in this group: the seizure semiology included hypermotor seizures (69%), Complex Partial seizures (21%), Right face tonic followed by right face clonic seizures (3%), left versive seizures (3%) and complex motor seizures (3%). Auras were rare, and only one unclassified aura was recorded. The location of the interictal epileptiform discharges was: right frontal (16%), right fronto-central (16%), right parieto-occipital (16%), left frontal (16%) and left temporo-parietal (33%).
**Conclusions:** Elderly patients with extra-temporal lobe epilepsy accounted for a small percentage of patients admitted to our EMU. This may reflect the fact that older adults continue to represent a minority of all admissions to EMUs and that there is a lower frequency of extra-temporal lobe epilepsies

**F54**
**Electroencephalographic Features of Dravet Syndrome**
*Se Hee Kim, MD; Linda Laux, MD; Sookyong Koh, MD/PhD; Anne T Berg, PhD; Douglas R. Nordli Jr., MD*

**Objective:** Patients with Dravet syndrome (DS) have pleomorphic seizure types including both generalized and focal seizures.
**Methods:** Sixty-nine overnight video-EEG in 52 children and adolescents with DS (24 male, 38 female) were reviewed. **Background:** Interictal abnormalities and clinical electrographic seizures were analyzed.
**Results:** The median age at the time of the study was 2.9 years (0.8 – 19.4 years). Background activity was normal in 13 (25%) patients while 36 (69.2%) had diffuse slowing. Interictal epileptiform patterns: (1) generalized (33/52, 63.5%); (2) multifocal (25/52,

69.4%); (3) focal (22/52, 42.3%,). Ictal patterns: (1) myoclonic (24/52, 46.2%); absence (10/52, 19.2%); eyelid flutter (6/52, 11.5%); convulsive (generalized, focal) (5/52, 9.6%); partial seizure with intermixed myoclonic jerks (2/52, 3.8%). Thirteen convulsive or partial seizures were captured in 6 patients. Purely focal or generalized convulsive seizures with corresponding focal or generalized ictal pattern were uncommon (3/13, 23.1%). Seizure semiology was more typically complex with both generalized and focal components which could correspond to complex ictal patterns of both generalized and focal features (10/13, 76.9%).
**Conclusion:** Seizures in DS can be complex with both focal and generalized clinical features and ictal EEG patterns. Those seizures cannot be classified in the current ILAE seizure classification system.

**F55**
**Web Technology to Facilitate an Interactive EEG Teaching**
*Jonathan J. Halford, MD; Chad G. Waters; William O. Tatum, MD; Brian C. Dean*

In an educational session at ACNS 2012, approximately 40 attendees were given wireless voting devices and shown a series of 12 carefully-selected paroxysmal events using the web-based EEG visualization platform called EEGNet. Participants were shown a ten second EEG page and asked to specify if a particular event (in the middle of the EEG page) was normal, artifactual, or epileptiform. After voting on each event, the audience was shown the final vote tally along with the votes of a group of 11 American Board of Clinical Neurophysiology certified academic clinical neurophysiologist, who had scored these events previously. A short discussion followed where an expert panel of three academic epileptologists explained their opinions and discussed how they would interpret the events. Of the 12 total events, 7 had reasonably high agreement (more than 75% of the attendees agreeing with the three expert panelists). Two of the experts were in full agreement between themselves, and one of the experts differed from the other two panelists in two of the events. The web-based format allow realistic rendering of the EEG waveforms and made it possible to illustrate audience opinion and opinion of academic clinical neurophysiologists in real time, creating a stimulating educational environment.

**S1**
**Autonomic Dysfunction in Adult Onset Alexander Disease: A Case Report and Review of the LIterature**
*Scott D. Spritzer, DO; Brent P. Goodman, MD*

**Background:** Alexander disease (AxD) is an astrogliopathy, resulting from a mutation in the glial fibrillary astrocytic protein (GFAP) gene. Different clinical subtypes have been described based upon the age at which symptoms begin. Patients with the adult onset form, can develop a, spastic paraparesis, palatal myoclonus, ataxia, and bulbar weakness. Autonomic nervous system (ANS) dysfunction has also been reported as a potential manifestation of adult onset AxD.
**Objective:** We report a case of adult onset AxD with symptoms of autonomic impairment that underwent formal autonomic testing. Additionally, a literature search was conducted to review the frequency and pattern of autonomic dysfunction in this patient population.
**Results:** A 51 year-old patient was diagnosed with AxD at the age of 47, following an 8 year history of vertigo, diplopia, and sleep disturbance. The patient developed several autonomic symptoms over his clinical course. Autonomic testing demonstrated OH on tilt-table testing with absent late phase II and IV responses during the Valsalva maneuver, severe cardiovagal impairment, and preserved postganglionic sympathetic sudomotor function. These findings were consistent with central autonomic failure. The most common autonomic symptoms reported in other AxD cases include constipation, urinary incontinence, and sphincter dysfunction. To our knowledge, this is the first report of formal autonomic testing in AxD. **Conclusion:** Symptoms of ANS impairment can occur in patients with AxD, and can include orthostatic hypotension and bowel/bladder dysfunction. Autonomic testing in our patient suggests impairment in central autonomic pathways.

**S2**
**Safety of Electrical Cardioversion Using Continuous EEG with Uunderlying Cerebral Edema**
*Tariq Janjua, MD; Eric Nussbaum, MD; Jodie Lowary, CNP*
**Introduction:** During electrical cardioversion procedures it is not clear if there is a risk of seizure in patients with cerebral edema with focal mass effect. The use of continuous EEG can help to monitor for signs of electric changes in real time, allowing for the procedure to be done safely.
**Methods:** A cardioversion procedure was done on a 76 year old woman with new atrial fibrillation and pervious insertion of a demand pacemaker for sick sinus syndrome. Due to rapid heart rate, cardioversion was selected. She had a left dominant side partial meningioma with associated cerebral edema. A continuous EEG was done during the procedure to observe real time EEG for any risk of seizures. Pacemaker was disabled with a magnet. EEG recordings, radiological images and pacemaker data are presented.
**Results:** The EEG was read at all times to watch for any signs of electric seizures. Peri-shock EEG showed no ictal changes. Patient converted to sinus rhythm followed by a successful surgical procedure for meningioma.
**Conclusion:** The ability to watch for seizures with continuous EEG during a cardioversion procedure in patients with a low seizure threshold adds to the safety and security of both the patient and health care providers.

**S3**
**From BICS to BISE**
*Asma Zakaria, MD; Nishi Rampal, MD*

A 54 year old woman with primary CNS lymphoma and recent whole brain radiation therapy presented to the hospital with altered mental status and a witnessed generalized seizure. MRI brain did not show acute pathology or recurrence and cEEG was initiated. Two independent epileptogenic foci evolved over 3 days from rhythmic delta activity to cyclic seizures and then status epilepticus on the left and periodic discharges to cyclic seizures and status epilepticus on the right. This progression of epilepsy evolved into bilateral independent and simultaneous cyclic seizures, culminating in bilateral independent and overlapping status epilepticus. This case is different from the previously described ping pong seizures in that the foci are not time locked to each other. Each focus has its own automaticity and refractory period with seizures occurring independent of any contribution from the contralateral side. Both hemispheres seize simultaneously but independently and eventually progress to status epilepticus which burns out into bilateral independent periodic discharges. To our knowledge this is the first reported case of bilateral independent cyclic seizures (BICS) with progression to bilateral independent status epilepticus (BISE).

**S4**
**Dense Array EEG in Intensive Care Patients**
*Elaine T Kiriakopoulos, MD; Donald Tucker, PhD; Marie Terrill, PhD; Donald Schomer, MD; Elizabeth Bachman, MPH; Susan T Herman, MD*

**Background:** Critically ill patients are at risk for primary and secondary brain injuries (e.g. seizures and ischemia) causing permanent neurologic disability. Continuous EEG monitoring can detect injuries at a potentially reversible stage. Dense array EEG (dEEG) with electrical source imaging allows for more precise localization of abnormal cortical regions, but has not been used previously in the ICU. We aimed to demonstrate feasibility of dEEG in ICU patients with acute cerebral injury.
**Methods:** We recorded dEEG using a 256-electrode HydroCel Geodesic Sensor Net (HCGSN, Electrical Geodesics, Inc., Eugene, OR).
**Results:** Patients (n=16) recorded with dEEG in the ICU setting included cerebral ischemia (5), closed head injury (1), status epilepticus (1), post cardiac arrest (1), intracerebral hemorrhage (1), encephalitis (5), and metabolic encephalopathy (2). Sample recordings and source localization results of triphasic waves and periodic lateralized epileptiform discharges will be presented. dEEG recordings were technically adequate despite the electrically hostile ICU environment. Sensor net placement using saline as electrolyte was rapid, generally requiring less than 5 minutes.
**Conclusion:** In this pilot study, we have demonstrated feasibility of dEEG recording and source localization in the ICU. Future work will extend recording times to 24 hours and correlate EEG findings with MRI.

**S5**
**An Abbreviated EEG Montage for Rapid Assessment of Electrographic Cerebral Activity In Acutely Hospitalized Adult Patients**
*Keith Dombrowski, MD; Brian Mace, BS; Saurabh R Sinha, MD, PhD; William Gallentine, MD; Christopher Skidmore, MD; Karl Sanzenbacher, MD; Brad Kolls, MD, PhD*

**Introduction:** Increased continuous EEG utilization has generated an interest in faster acquisition and interpretation of EEG data using limited electrode arrays (LEA) coupled with quantitative algorithms. The aim of the current project was to test a novel LEA, quantify any error rate imparted by the reduction in electrodes, and determine if multiple montages could correct this error.
**Methods:** Four experienced neurophysiologists reviewed 250 de-identified EEG segments that were reformatted into an 8 electrode array containing a lateral chain and central electrode bilaterally. In phase 1, segments were interpreted in a single AP bipolar montage. In phase 2, fifty frequently misread segments were reinterpreted using five additional montages.
**Results:** In phase 1, 1000 EEG interpretations were reviewed yielding an approximate sensitivity of 70-75% for seizure, PEDs, and normal with specificities greater than 90%. In phase 2, 150 EEG interpretations were collected with no significant improvement noted in the detection of any EEG finding.
**Conclusions:** This trial suggests that LEAs contain a base error rate that cannot be corrected with additional montages. The implication of these results suggests that if LEA's are to be leveraged for rapid EEG acquisition and algorithm development, the LEA-specific error rate needs to be established first.

**S6**
**Role of Neuromonitoring in the Acute Phase After External Carotid to Internal Carotid Arterial (ECIC) Bypass Surgery**
*Tariq Janjua, MD*

**Introduction:** Along with clinical examination and radiological studies, the care of post ECIC bypass patients usually involves blood pressure control, fluids, electrolytes and good medical preventive care in the neuroICU. We describe the role of neurophysiogical monitoring for bizarre behavior in a patient after a 2nd bypass procedure.
**Methods:** Continuous non-video EEG monitoring was used after an elective left side ECIC bypass procedure in a patient with mild aphasia and bizarre behavior.
**Result:** A 64 year old patient with a diagnosis of Moyamoya was admitted for an elective left ECIC bypass procedure. A year ago she underwent right side bypass. Folowing the first procedure she developed confusion which resolved with antiepileptic medications. Within 24 hours after the 2nd procedure, she developed confusion and word finding difficulty. cEEG showed diffusely slow background activity associated with left hemispheric sharp activity. She was given levetiracetam 250 mg every morning and 500 mg every evening, oxcarbazepine 600 mg twice daily and phenytoin 250 mg every night with resolution of her partial aphasia and confusion. EEG findings and radiological studies are presented.
**Conclusion:** Neurophysiological monitoring should be considered in patients after neurovascular procedures like ECIC bypass if there is any change in neurological presentation.

**S7**
**DETECTing Seizures Among Comatose Children: Interim Results**
*Eric Payne, MD; Kristin McBain, MSc; James S Hutchison, MD; Chris Parshuram, MD; Carter Snead, MD; Rohit Sharma, RET; Xiu Yan Zhao, MSc; Helena Frndova, MSc; Margaret Wilkinson, MSc; Maureen Dennis, PhD; Nicholas S. Abend, MD; William Gallentine, DO; Kendall Nash, MD; Cecil D Hahn, MD MPH*

The prospective multicenter DETECT study aims to characterize the prevalence of and risk factors for electrographic seizures (ES) among comatose children in the ICU and determine the impact of ES on outcome. Critically ill children with coma (GCS <=8) of any etiology receive 48 hours of EEG monitoring on a research and/or clinical basis. Here we report interim results from the first 120 subjects enrolled at The Hospital for Sick Children, Toronto. The median duration of monitoring was 48h (10h-1441h), mean age was 6.3y (1d-17.6y) and 53 subjects were male. ES occurred in 30 subjects (25%), including 24 (20%) who experienced some nonconvulsive seizures (NCS) and 9 (7.5%) who experienced entirely NCS. Electrographic status epilepticus occurred in 9 subjects (7.5%), all of whom experienced mainly NCS. The mean interval between cEEG onset and first ES was 6.3h (5s-32h). Univariate analyses comparing children who did/did not experience ES identified several predictors of ES: younger age (mean 3.5y vs. 7.3y; p=0.0003), recent clinical seizures (p=0.0011), interictal epileptiform discharges (p<0.001), and periodic discharges (p=0.0014). With the addition of 3 U.S. children's hospitals, we anticipate doubling the sample to 240 subjects. Functional and neuropsychological outcomes will be assessed at 6 months post discharge.

**S8**
**SIRPIDs: Prevalence and Outcomes in Critically-Ill Patients**
*Amanda F Van Straten, MD; Ryan Hakimi, DO; Andrea S Hakimi, DO*

**Objectives:** To determine the prevalence, associated factors, and outcomes as defined by discharge disposition of stimulus-induced rhythmic, periodic, or ictal discharges (SIRPIDs) on long-term video-EEG (VEEG) in critically-ill patients.
**Methods:** Following IRB approval, we retrospectively reviewed patient characteristics and VEEG findings of all consecutive critical care unit patients that underwent VEEG monitoring between January and September 2012.
**Results:** The prevalence of SIRPIDs was 10.5% (4 of 38 patients). Factors associated with SIRPIDs versus non-SIRPIDs patients included subclinical status epilepticus occurring at any time during the patients intensive care unit stay (100% vs 17.7%, p=0.003), longer total VEEG recording time (261 vs 51.7 hours, p=0.010), and acute traumatic brain injury (75.0% vs 20.6%, p=0.035). Sex, age, a history of epilepsy, and background rhythm reactivity on VEEG did not correlate with the presence of SIRPIDs. In addition, the presence or absence of SIRPIDs had no bearing on discharge disposition.
**Conclusion:** This small series suggests that the presence of subclinical status epilepticus, lengthier VEEG recording times, and acute traumatic brain injury correlated with the presence of SIRPIDs. The presence of SIRPIDs did not correlate with outcome.

**S9**
**Early Recognition of Medical Complications in RSE Can Save Lives**
*Emitseilu Kevin Iluonakhamhe, MD; Asma Zakaria, MD*

Three patients with no prior history of seizures who were admitted to our neuro-critical care unit between March 2010 and January 2012 for cryptogenic refractory status epilepticus lasting between 20-81 days. A broad range of anti-epileptic agents such as phenytoin, levetiracetam, valproic acid, topiramate, felbamate, phenobarbital, lacosamide as well as infusions of propofol, ketamine, midazolam, lorazepam and pentobarbital were utilized. High dose steroids, plasma exchange, epilepsy surgery and inhaled anesthetics were

employed in some patients. Complications observed included drug induced paralytic ileus, small bowel ischemia, severe metabolic acidosis due to propylene glycol toxicity, lactic acidosis, acute renal failure requiring continuous veno-venous hemodialysis (CVVHD), septic shock, drug induced pancreatitis, cerebral ischemia, ventilator associated pneumonia and critical illness myopathy and neuropathy. These obstacles in the management of status epilepticus are often iatrogenic and contribute to overall morbidity and mortality. Furthermore, some of these conditions and treatments interfere with drug absorption, metabolism and binding, making the management of status epilepticus all the more challenging. Two of the three patients in our cases series survived and eventually returned home. Patients with status epilepticus face a myriad of challenges but foreseeing these impediments and their early aggressive management can improve outcomes tremendously.

**S10**

**cEEG monitoring: A Survey of Neurophysiologists & Neurointensivists**

*Jay Gavvala, MD; Nicholas S. Abend, MD; Suzette M. LaRoche, MD; Irena Garic, RN, MPH; Susan T. Herman, MD; Jan Claassen, MD, PhD; Cecil D Hahn, MD, MPH; Michael Macken, MD; Stephan Schuele, MD MPh; Elizabeth Gerard, MD; Critical Care EEG Monitoring Research Consortium*

Increasing data is available regarding the utility of continuous EEG monitoring (cEEG) in critically ill adults, yet it remains unclear how this data has translated to clinical practice. We aimed to describe current practice among neurophysiologists and neurointensivists. Ninety-five physicians completed the ongoing online survey. Ninety-eight percent identify their institution as a tertiary care center. Half of the respondents provide EEG interpretation, 36% provide care in the ICU and 14% are involved in both. EEG technologists are available 24/7 at 84.7% of institutions (18.6% in-house, 66.1% on-call). cEEG is commonly utilized to detect non-convulsive seizures in encephalopathic patients with clinical seizures (95%), involuntary movements (88%), cerebral hemorrhage (80%), TBI (78%) and cardiac arrest (76%). Practice was more variable for patients with encephalopathy and tumors, stroke, and metabolic encephalopathy (53-67%). cEEG is used by 63% to monitor burst-suppression and 19% to monitor for vasospasm. Forty-eight percent of physicians monitor comatose patients for 24 hours and 34% monitor for 48 hours; however, 26% would increase the length of monitoring given unlimited resources. Practices are similar among initial respondents from tertiary care centers regarding primary indications for cEEG. However, there is wide variability regarding recommended duration of monitoring and secondary indications for cEEG.

**S11**

**Lateralized Infraslow Oscillations on Scalp EEG in Acute Brain Injury**

*Nicolas Gaspard, MD PhD; Nishi Rampal, MD; Ognen AC Petroff; Lawrence J. Hirsch*

**Background:** Infraslow oscillations (<0.5Hz; ISO) are involved in physiological processes and modulate normal cortical activity. With the exception of ISO associated with cortical spreading depressions, very little is known of potential pathological ISO.
**Methods:** We reviewed 30 consecutive continuous EEG recordings in patients with acute brain injury acquired with DC-coupled amplifiers and Ag/AgCl electrodes. ISO were defined as reproducible waveforms with a period > 2 second (frequency < 0.5Hz) and a physiologic field.
**Results:** We identified ISO lateralizing to the side of the injury in 2 frequency bands: 0.2 to 0.5Hz (26 patients) and 0.02 to 0.1Hz (17 patients). Both types of activity exhibited broad fields that usually comprised the field of conventional EEG abnormalities. Periodic discharges and seizures tended to be more frequent in patients with 0.02 to 0.1Hz oscillations (RR 4.6, p-value 0.1 and RR 3.8, p-value 0.18, respectively; Fisher exact test). The amplitude and frequency of periodic discharges were modulated by these activities.
**Conclusions:** We report a high incidence of lateralized ISO on scalp EEG after acute brain injury. Our data also suggest that they might modulate cortical excitability and indicate an increased risk for seizures. Further work is needed to unravel their pathophysiology and clinical relevance.

**S12**

**Quantitative EEG Measures of Laterality Show High Test-Retest Reliability**

*Joshua Ewen, MD; Balaji Lakshmanan, MS; Cathy Bachur, BA; Kira Lanier, BA; Brian Caffo, PhD; Eric H.W. Kossoff, MD; Nathan E. Crone, MD; Anne M Comi, MD*

Work from our laboratory has demonstrated the utility of quantitative analysis of the EEG signal in determining which infants with port-wine birthmark (PWB) are at the highest risk of developing the intracranial involvement consistent with Sturge-Weber syndrome (SWS). We are further interested in extending these techniques to determine which individuals with known SWS are at high risk for neurological deterioration. As a preliminary step, we sought to assess the test-retest reliability of our quantitative metrics. Nine subjects (ages 5.2-91.5 years; mean=8 years) underwent two EEGs within the same day. Fast-fourier transform assessed amplitude of the signal in each of the four classical frequency bands. A Laterality Score ([L-R]/[L+R]) quantified degree of asymmetry in each of the four frequency bands plus a total of all bands, per the technique in Ewen et al, 2009. Intra-Class Correlation (ICC) was used to evaluate

test-retest reliability. The laterality score of the frequency bands (including Total) ranged from 0.94 to 0.97, suggesting high test-retest reliability of these signal analysis metrics.

**S13**

**EEG Source Imaging of Interictal Spikes in a Patient with Focal Cortical Dysplasia**

*Octavian V Lie, MD, PhD ; Jose E Cavazos, MD, PhD*

**Rationale:** Postoperative seizures occur in approximately 30-60% of epilepsy surgery patients. EEG source imaging (ESI) of scalp interictal spikes may improve epileptogenic zone localization and postoperative seizure outcome. This study is the first step of a detailed study assessing the accuracy of various ESI methods, an area of limited exploration thus far.
**Methods:** A patient with pharmacoresistant epilepsy underwent a right fronto-parieto-temporal resection disclosing changes of focal cortical dysplasia ILAE type 2b. Preoperatively, clinical, neuroimaging (structural brain MRI and MEG), and neurophysiological (scalp EEG, extraoperative eletrocorticography, motor and sensory electrical stimulation mapping) information was used to define the resection location and extent. The patient was rendered free of disabling seizures at one year postoperatively (ILAE outcome class 2). We retrospectively averaged 105 interictal spikes with similar scalp topography recorded with conventional 10-20 system electrodes. For ESI, we computed two individual forward models (SMAC and BEM) combined with two inverse methods (LAURA and sLORETA), respectively, applied at the mid-upswing time frame of the averaged spike.
**Results:** SMAC-LAURA and BEM-sLORETA produced maximal source solutions within the resection volume, and less than 2.5 cm from the resection centroid.
**Conclusions:** Comparing ESI methodology may lead to an improved noninvasive definition of the epileptogenic zone.

**S14**

**In-Hospital Encephalopathy: An EEG Microstate Analysis**

*Rani Sarkis; Jong Woo Lee, MD, PhD*

**Introduction:** Acute alteration in mental status (AMS) is present in up to 30% in medical units and is associated with increased health care costs, and increased mortality. EEG microstate analysis examines the brain's temporal evolution of topographic changes, and has been utilized to assess spontaneous conscious cognitive activity. We examine changes in EEG microstate analysis in patients with AMS in the hospital.
**Methods:** Encephalopathic hospitalized patients age<60 with no known cerebral lesions, a nonfocal EEG, and AMS were compared to a control group with a normal EEG and no AMS. Six second artifact free EEG samples following an eyeblink were analyzed.
**Results:** A total of 20 control subjects and 16 encephalopathic subjects were identified. Four stable microstates consistent with published literature were observed in controls. These microstates were observed in only 38% of patients. Using a limit of 4 microstates, the average variance explained by the 4 microstates was 73.5±6.5% in controls and 65.3±7.0% in encephalopathic patients ($p<0.001$).
**Conclusion:** EEG analysis of microstates in inpatients with AMS reveals a decrease in microstate stability, indicating a breakdown of underlying electrophysiological processes. These preliminary findings may provide objective measures to assess hospital encephalopathy, and may be used in future prognostic models.

**S15**

**EEG Abnormalities in Psychopath and Non-Psychopath Violent Offenders**

*Ana A Calzada-Reyes, MD; Alfredo Alvarez, PhD; Mitchell Valdes-Sosa, PhD; Lidice Galin-Garcia, PhD*

To find electrophysiological differences specifically related to the psychopathy construct and independent of the violent behavior. The current investigation compares the QEEG and the current source density measures of violent psychopath offenders to a non-psychopath violent group. The resting EEG activity and LORETA for the EEG spectral fast bands were evaluated in 58 violent offenders, 31 with and 27 without psychopathy according to the Hare Psychopathy Checklist e Revised. All subjects were assessed using the DSM IV-R criteria. The EEG visual inspection characteristics and the use of frequency domain quantitative analysis techniques are described. QEEG analysis showed a pattern of excess of beta activity on the left parieto-temporal regions and bilateral occipital areas and decrease of alpha band on the left centro-temporal and parieto-central derivations in the psychopath group. LORETA signified an increase of beta activity (17.18 Hz) in psychopath group relative to a non-psychopath group within fronto-temporo-limbic regions. These findings indicate that QEEG analysis and techniques of source localization may reveal differences in brain electrical activity among offenders with psychopathy, which was not obvious to visual inspection. Taken together, these results suggest that abnormalities in a fronto-temporo-limbic network play a relevant role in the neurobiological basis of psychopathy.

**S16**

**Significance of Rapid Bilateral Eye Blinking During Partial Seizures**

*Prasuna Latha Velur, MD; Giridhar Kalamangalam, MD, MBBS, Dphi*

**Rationale:** Rapid bilateral eye blinking (RBEB) is commonly seen during generalized absence seizures, and is the defining character of seizures in the Jeavons syndrome. Complex partial seizures (CPSs) in focal epilepsy are usually associated with the opposite semiology – fixed staring – though we have also observed RBEB in CPSs. In this pilot study we surveyed the electroclinical associations of RBEB in a cohort of patients with proven focal epilepsy exhibiting CPSs.
**Methods:** We retrospectively reviewed scalp video-EEG monitoring seizure data on all patients with proven partial epilepsy and CPSs encountered over a 12-month period (year 2009). Seizures with RBEB were identified by obvious excessive eyeblink artifact on the EEG that lasted ≥ 10 seconds at any time during the seizure. The total number of eye blinks for the duration of the seizure, as well as the 10-second epoch with the highest number of eye blinks (peak blink rate) was noted.The ictal EEG of each seizure (whether with RBEB or not) was classified as having a lateralized or nonlateralized onset pattern.
**Results:** 156 partial seizures (n=156) were recorded in 41 patients (N=41) that fit the above criteria. Ninety-one seizures (n1=91) had clearly lateralized ictal EEG onsets; the remainder (n2 = 65) had nonlateralized onsets. Four patients had 8 seizures (m=8) that showed RBEB; in each such seizure, RBEB was confirmed by peak eye blink rates during the seizure significantly higher than at baseline ($p < 0.01$). Assuming N and n as population figures, the probabilities of a random seizure having lateralized versus nonlateralized onset were n1/N ≈ 0.58 versus n2/N ≈ 0.42. Thus, the probability of m seizures with RBEB all having nonlateralized onset was (0.42)8 ≈ 0.001.
**Conclusions:** (i) RBEB, a semiological feature often seen in seizures arising in generalized epilepsy syndromes, may occur rarely in seizures in focal epilepsy (4/41 ≈ 10% of patients and 8/156 ≈ 5% of seizures, in this series). (ii) There is a statistically significant association between seizures with RBEB and a diffuse (nonlateralized) ictal EEG pattern at onset. This observation argues for direct bihemispheric propagation of seizures with RBEB, or alternatively, preferential spread of such seizures to regions (e.g. the orbital and medial frontal cortices) that secondarily project to widespread brain areas. Functional imaging studies demonstrate medial and orbital frontal activation with spontaneous eye blinking (Tsubota et al, Exp Eye Res 69(1):1-7, 1999; Yoon et al, Neurosc Lett 381(1-2):26-30, 2005). These brain areas are also among those that display an early increase in the BOLD signal during generalized spike-wave paroxysms in simultaneous EEG-fMRI studies (Benuzzi et al, Epilepsia 53(4):622-30, 2012). (iii) It is plausible that in CPSs with RBEB, seizure spread occurs early to 'eye-blink eloquent' brain areas that results in both rapid eye blinking as well as a diffuse ictal EEG. The further associations of RBEB with epilepsy syndrome and treatment responsiveness will be investigated in a larger study that confirms these preliminary findings.

**S17**
**EEG as a Biomarker: Pre-Hypsarhythmia Predicts West Syndrome**
*John J. Millichap, MD; Sookyong Koh, MD, PhD; Douglas R. Nordli Jr., MD*

**Objective:** Assess serial EEG as a biomarker to predict West syndrome (WS).
**Background:** Retrospective studies describe a specific EEG background, pre-hypsarhythmia (focal or multifocal epileptiform discharges) that appears 3-6 weeks prior to hypsarhythmia.
**Design/Methods:** A longitudinal prospective cohort study. Subjects with neonatal hypoxic ischemic encephalopathy (HIE) were followed prospectively with serial monthly EEG from ages 3- 7 months. EEGs analyzed and assigned a type: Type 0: Normal for age. Type 1: background normal or mildly abnormal; focal or multifocal epileptiform discharges < 50% of non-REM sleep record; Type 2 (prehypsarhythmia): background abnormal; focal or multifocal epileptiform discharges > 50% of non-REM sleep record; Type 3 (hypsarhythmia): chaotic, high-voltage (>200 uV) epileptiform discharges.
**Results:** Twelve subjects have been enrolled thus far and followed until 9 months old. Six subjects (50%) had abnormal EEGs at 3 months old. Of those 6, two subjects (33%) had pre-hypsarhythmia. Of those 2 with pre-hypsarhythmia, 2 (100%) developed infantile spasms. The remaining subjects are seizure-free with Type 0-1 EEG.
**Conclusions:** These preliminary results suggest that a specific EEG pattern, prehypsarhythmia, appears prior to the development of hypsarhythmia. Identification of an EEG biomarker to predict WS may allow for pre-emptive treatment and prevention of epilepsy.

**S18**
**DIAGNOSTIC OUTCOME OF EXPLORATORY INTRACRANIAL EEG RECORDING**
*Ricky W Lee, MD; Greg A. Worrell, MD, PhD; Elaine C. Wirrell, MD; Gregory Cascino, MD; W. Richard Marsh, MD; Nicholas M Wetjen, MD; Elson L So, MD*

Noninvasive investigations of extratemporal lobe epilepsy sometimes result in indeterminate seizure lateralization. Therefore, bilateral exploratory intracranial electrode implantation (EXPIEEG) is sometimes performed, before more electrodes are implanted for precise seizure localization. Between 1997 and 2010, ten patients underwent EXPIEEG at our institution. Four (40%) were found to have lateralized seizure onset. Compared with non-lateralizing EXPIEEG, there was a trend for lateralizing EXPIEEG to have less implanted electrode strips (5.3 strips vs. 9.5 strips; $p=0.05$), but not significantly less electrode contacts (38 electrodes vs. 72 electrodes; $p=0.092$). 75% of patients with regional but not lateralized scalp seizure onset (e.g. bifrontal, or midline frontocentral) had lateralizing

EXPIEEG, vs. only 16.7% of the patients with generalized or indeterminate scalp seizure onset, but the difference did not reach significance (p=0.19). Furthermore, focal seizure semiology, symmetry of implantation or positive SPECT finding had no association with the yield of EXPIEEG. Due to the small sample size in this study, brain MRI and interictal scalp EEG findings did not yield meaningful data. In conclusion, this study showed that the yield of EXPIEEG is low (<50%). The small number of patients in our study limits our ability to determine factors that contribute to the yield.

**S19**

**Triphasic waves: EEG, clinical and imaging characteristics**

*Peter W. Kaplan, MB, FRCP; Raoul Sutter, MD*

**Objectives:** To characterize triphasic waves (TWs) and clinical/neuroradiological correlates in encephalopathic patients.
Methods: 9-year cohort study of consecutive encephalopathic patients with semiquantitative assessment of electrographic TWs characteristics (frequency, amplitudes, location, direction of time lag), background activity and reactivity to stimulation/arousal. Clinical conditions, neuroimaging, and outcome (Glasgow Outcome Score (GOS) and death) were assessed.
**Results:** 105 adult patients with TWs were identified. EEGs were performed because of mental status change (100%), emergence of delirium (16%) and suspected seizures (13%). 59% of patients had infections, 50% renal insufficiency, 25% dementia, and 18% respiratory failure. Intensive care was required in 81%. Neuroradiological studies revealed white matter lesions in 60%, cerebral atrophy in 55%, ischemic stroke and intracerebral hemorrhage in 14% each. 84% had ≥2 of the major clinical and/or neuroradiological abnormalities. Outcome was unfavorable (GOS1-3) in 68% and mortality 20%. Background activity and TWs characteristics were not associated with outcome. Absence of background reactivity was associated with death (OR4.3, 95%CI 1.5-12.5, p=0.007).
**Conclusions:** In contrast to earlier studies with a high mortality, death occurred in our cohort in 20%. The only EEG feature associated with death was the absence of background reactivity;increased frequency, lag direction and TW amplitudes were not.

**S20**

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*Raoul Sutter, MD; Peter W. Kaplan, MB, FRCP*

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**S21**

**Clinical, Imaging and EEG Correlates in Encephalopathy**

*Raoul Sutter, MD; Peter W. Kaplan, MB, BS, FRCP; Robert D. Stevens, MD*

**Objectives:** To identify associations among encephalopathy EEG patterns, clinical and neuroradiological abnormalities, and outcome in encephalopathy patients.
**Methods:** 5-year cohort study of EEGs of 154 encephalopathic patients that were classified into five predefined patterns: persistent background slowing (theta, theta/delta, delta) with or without episodic transients (i.e., triphasic waves [TWs] or frontal intermittent delta activity [FIRDA]). Associations among EEG patterns, clinical pathologic conditions, blood tests, neuroimaging, and outcome were evaluated. Glasgow Outcome Score >3 at discharge was defined as favorable and 1-3 as unfavorable outcome.
**Results:** In multivariable analyses, theta pattern was associated with brain atrophy (OR 2.6, p=0.020); theta/delta with intracerebral hemorrhages (OR 6.8, p=0.005); FIRDA with previous cerebrovascular accidents (OR 2.7, p=0.004); TWs with liver or multi-organ failure (OR 6, p=0.004; OR 4, p=0.039); and delta activity with alcohol/drug abuse, and HIV-infection (OR 3.8, p=0.003; OR 9, p=0.004). TWs were associated with death (OR 4.5, p=0.005); theta/delta with unfavorable, and FIRDA with favorable outcome (OR 2.5, p=0.033; OR 4.8, p=0.004).

**Conclusions:** Well-defined EEG patterns in encephalopathy are associated with specific pathological conditions and outcome. Prospective studies are needed to clarify the contributions of respective pathologic conditions to specific EEG encephalopathy patterns.

**S22**

**EEG and MRI Patterns in Encephalopathy**

*Angela Wabulya, MD; Ronald P. Lesser, MD; Rafael Llinas, MD; Peter W. Kaplan, MB, FRCP*

**Introduction:** Using histology and EEG, Gloor et al reported paroxysmal synchronous discharges (PSDs) in cortical grey (CG) and "sub cortical" grey (SCG) matter pathology, non-paroxysmal polymorphous delta activity (NPDs) in white matter(WM) pathology, a combination of PSDs and NPDs in CG, SCG and WM pathology and cortical background slowing (BGS) in all patients with encephalopathy.
**Methods:** Retrospective case control study; we blindly reviewed EEG and MRI data acquired within 4 days of each other of 47 cases (encephalopathy on EEG) and 41 controls (normal EEG). Age range: 18-89 years with 46 women and 39 men.
**Results:** 75% of cases with PSD+BGS had SCG lesions; while 25% had CG lesions. 0% of cases had PSD+BGS and SCG+CG compared to 25% reported by Gloor etal. 72% of cases had WM lesions vs. 48.8% controls. 4.6% cases had NPD; of these 50% had WM and BGS+NPD while the remaining 50% had NPD without WM lesions. 93.6% of cases had EEG BG slowing (BGS).
**Conclusion:** EEG PSD were found with either CG or SCG MRI abnormality. A combination of CG and SCG MRI abnormality was not necessary to predict EEG PSD. Findings in NPDs were similar to what Gloor et al described.

**S23**

**Alternating Low Frequency EEG Pattern in Critically Ill Patients**

*Hiba Arif, MD; Suzette M. LaRoche, MD*

**Background:** We describe the occurrence of a novel EEG pattern in critically ill patients consisting of regular intervals of generalized, high amplitude delta activity alternating with regular intervals of low amplitude theta frequencies.
**Methods:** Patients with an alternating low frequency (ALF) EEG pattern were identified and compared to all patients undergoing continuous EEG monitoring over a 3-year period.
**Results:** An alternating low frequency (ALF) pattern was noted in 30 patients. Electrographic seizures were seen in 33.3% (10) with ALF compared to 18.1% of the general cEEG population. Lateralized periodic discharges (LPDs) were present in 73.3% (22) vs.8.6% and generalized periodic discharges (GPDs) in 56.7% (17) vs. 11.2%. Subarachnoid hemorrhage (SAH) was the primary diagnosis in 36.7 vs. 16.5%. At discharge, poor outcome (expired or discharged to hospice, long term care or subacute nursing facility) was seen in 53% of both patient groups.
**Conclusions:** In this small cohort of patients, electrographic seizures and periodic discharges were seen more frequently in patients with ALF compared to the general cEEG population and SAH was more prevalent. However, there was no difference in outcome between patient groups. Further study regarding the clinical significance of this pattern is warranted.

**S24**

**Myopathy Masquerading as Bilateral Anterior Interosseous Syndrome**

*Elizabeth Ann Mauricio, MD; Elliot Dimberg, MD; Devon I. Rubin, MD*

**Background:** We report a patient who presented with suspected bilateral anterior interosseous neuropathies (AION) but electrodiagnostic studies identified a myopathy, consistent clinically with inclusion body myositis.
**Case Report:** A 79 year old woman was referred for EMG following orthopedic consultation for bilateral AIONs. She had a 3 year history of difficulty flexing the distal thumb, index, and middle fingers (right > left). A cricopharyngeal myotomy was performed for dysphagia several years prior; she had no other complaints. Examination demonstrated bilaterally severe weakness in flexor digitorum profundus (digits 2 and 3) and flexor pollicis longus, mild weakness in FDP digits 4 and 5 and the flexor digitorum superficialis, and normal strength in other muscles.
**Results:** Median and ulnar nerve conduction studies were normal. Needle examination revealed scattered fibrillation potentials and short duration, polyphasic motor unit potentials in multiple upper and lower extremity muscles. The flexor digitorum profundus demonstrated a combination of rapid and reduced recruitment in different areas of the muscle. The findings were consistent with a chronic myopathy.
**Conclusion:** This case demonstrates a unique pattern of weakness clinically mimicking AIONs in a patient with a chronic myopathy. The importance of a careful needle EMG to confirm a myopathy is exemplified.

**S25**

**Gadolinium-Induced Refractory Nonconvulsive Status Epilepticus**

*Nasheed Jamal, MD; Saumya Gill, MD; Claude Wasterlain, MD*

Intrathecal administration of high-dose gadolinium can lead to neurological complications, including encephalopathy, seizures, rigidity, and optic nerve atrophy. Here, we present a case of refractory nonconvulsive status epilepticus following accidental injection of gadolinium via an external ventricular drain prior to an MRI brain scan. The patient is a 59 yo male, who was status post right temporal craniotomy for microsurgical resection of large right tentorial meningioma post endovascular coil embolization of feeder vessels to right tentorial meningioma, who received an intrathecal administration of 10mL volume of gadolinium via an external ventricular drain and subsequently became hypertensive and unresponsive. Continuous EEG revealed nonconvulsive status epilepticus (NCSE) likely from an epileptogenic zone at the right temporal region (T4) with some spread to the right frontal region (F4). His seizures continued for 7 weeks despite a treatment regimen that, in various combinations, included: levetiracetam, phenytoin, valproic acid, midazolam, propofol, pentobarbital, ketamine, lacosamide, topiramate. Phenobarbital infusion and subsequent prolonged burst suppression finally halted the seizures. At discharge, the patient was able to follow simple commands intermittently. This case thus demonstrates that CNS infusion of high-dose gadolinium may lead to refractory nonconvulsive status epilepticus.

**S26**

**Early Use of Newer Anti-Seizure Agents in the Treatment of Status Epilepticus (SE)**

*Uma Menon, MD; Fawad Khan, MD; Vivek Sabharwal, MD; Arash Afshinnik, MD; Eugene Ramsay, MD*

**Background:** Limited information is available regarding the use of newer anti-seizure agents Levetiracetam and Lacosamide as initial treatment of status epilepticus. Availability of parenteral forms with good pharmacokinetics and safety profile make the newer agents logical choices for early rather than later use.
**Methods:** We conducted a retrospective analysis of the agents used for convulsive and non-convulsive status epilepticus in our institution during one month, to assess the utility and efficacy of Levetiracetam and Lacosamide combined as initial agents for status epilepticus. Propofol and Ketamine were used when appropriate and other anti-seizure agents were infrequently used.
**Results:** In the ten patients identified, 5 with convulsive and 5 with non-convulsive SE, the combination of Levetiracetam and Lacosamide was used as first line agents after Benzodiazepines failed. Five patients required additional Propofol and two required Ketamine. The combination resulted in resolution of SE in all patients except one with withdrawal of care. No significant drug adverse effects were observed.
**Consclusions:** Although status epilepticus can be appropriately and favorably managed with different combinations of anti-seizure agents, our goal was to evaluate the use of Levetiracetam and Lacosamide in combination as a good alternative to the older agents as an effective first line treatment.

**S27**

**Psychogenic Non-Epileptic Seizures: Comparison of Clinical Manifestations between Afro-American and Caucasian Female Patients**

*Abuhuziefa Abubakr, MB FRCP; Ilse Wambacq, PhD; Hanna Goerres, BS*

**Rationale:** Psychogenic non-epileptic seizures (PNES) represent an important alternative diagnosis for refractory epilepsy. In various series, the frequency of PNES range between 10-40%. However the frequency and clinical manifestations are not well characterized in AAF (Afro-American females). Therefore we compared various clinical findings between women of AAF and Caucasian descends admitted to the EMU.
**Methods:** Retrospective chart review of all patients admitted to the EMU between January 2010 and December 2011 were included. Female patients 18 years or older with the diagnosis of PNES were selected. The demographic information, age of onset, seizures duration, frequency and clinical characteristic were evaluated.
**Results:** There were 18 AAF with mean age of 44.9 years (age range (18-72 yrs) and 27 Caucasian females (CF) with mean age of 37.6 years (age range 18-83yrs). There were 13 AAF (72%) and 23 CF (85%) under 50 years of age. Six AAF and twelve CF were younger than 35 yrs at seizure onset; seven AAF and eleven CF were between 35-50 yrs at seizure onset and five AAF and four CF were older than 50 yrs at seizure onset. The duration of PNES was less than one year in 6 AAF and 9 CF, between 1-5 yrs in 6 AAF and 8 CF and more than 5 yrs in 6 AAF and 10 CF. Daily /Weekly seizures occurred in 50% of AAF and 78% of CF which is significantly different between the two groups ($P < 0.05$). Sixteen of AAF (88%) and 18 CF (66%) were on 1-2 AEDs, but only 4 CF were on > 3 AEDs. There were 13 AAF (72%) and 15 CF (55%) with seizures lasting < 5 minutes. However, seizures with the duration between 5-10 minutes occurred in 17% of AAF and 26% of CF and seizures with duration >10 minutes in 11% and 19% respectively. The clinical manifestation of seizures with limpness and unresponsiveness occurred in 5 AAF and 7 CF. However, predominant motor manifestations occurred in 12 AAF and 19 CF and this was the most frequent clinical manifestation in both groups. Pelvic thrusting occurred in 4 AAF and 9 CF and it was twice as frequent in CF. Vocalization occurred in 2 AAF and 4 CF.
**Conclusion:** The clinical manifestations of PNES between AAF and CF were similar with exceptions that in AAF the seizures were significantly less frequent and there was a tendency

**S28**

**A Case of Very Prolonged Todd's Paralysis for 15 Days**

*Hyun Joo Sophie Cho, MD; Robert L. Beach, MD, PhD*

**Background:** Todd's paralysis is a condition characterized by transient post-ictal focal neurological deficits. The mechanism underlying Todd's paralysis remains uncertain. The longest duration of reported Todd's paralysis was 36 hours.
**Objectives:** Here we describe the case of 58 year-old-man who presented with prolonged Todd's paralysis lasting for 15 days.
**Methods and Results:** A 58 year-old man with history of complex partial epilepsy from right frontal lobe metastatic lung cancer was admitted to our hospital for breakthrough seizure. On exam, he had global aphasia, right side face, arm and leg flaccid paralysis and right hemianopsia. 2 MRIs of the brain were negative for acute stroke in 10 days. Continuous EEG showed marked asymmetry, with reduced amplitude on the left, but no seizure or epileptiform discharges. SPECT obtained on day 7 showed relative increased perfusion within the left parietal lobe. The aphasia, right hemianopsia and facial palsy started resolving on day 10. Right arm and leg paralysis started improving on hospital day 15.
**Conclusions:** This is the first case in which Todd's paralysis lasted for 15 days. The mechanism of this prolonged Todd's paralysis is unclear. We speculate that our patient had mismatched cerebral perfusion and metabolic activity by altered cerebrovascular autoregulation.

**S29**

**Epilepsy Associated with Perisylvian Migrational Defects: Widely Divergent Clinical Outcomes**

*Olimpia Carbunar, MD, MS; Alma Bicknese, MD*

Perisylvian migrational defects have been linked to multiple genes, although most cases still do not have an identified etiology. It is often assumed incorrectly that patients will have poor outcome with intractable seizures and developmental delay. We present two cases with similar perisylvian migrational defects, but with different clinical phenotypes and different EEG patterns. Our first patient had oral motor dysfunction with pseudobulbar signs, developmental delay and refractory seizures. Our second patient had normal development and exam, and mild epilepsy that went into remission. Migrational defects involving the insular cortex are associated with dysarthria and difficulties with palatal and lingual movements. There is a high association with epilepsy and it may be difficult to control. However, others lack dysarthria and may have mild or no epilepsy. Clinicians and epileptologists should aware of the wide clinical spectrum of these disorders and their clinical implication when discussing outcome with patients and their families.

**S30**

**Comorbidities May Help Predict Outcomes in Status Epilepticus**

*Lukas Clark, MD; Makoto Kawai, MD; Amit Verma, MBBS*

This case-control study examined whether common co-morbid conditions > help predict outcomes in status epilepticus. Patients with either > partial or generalized status epilepticus were selected based on EEG > review of 710 continuous recordings at The Methodist Hospital from > January 2008 through January 2012. In all, 59 patients were included > (23 men, 36 women, mean age=59.6), of which 51 were noted to be in > partial status epilepticus, and another 8 were in generalized > non-convulsive status epilepticus. Prognosis at the time of discharge > was classified with the Glasgow-Pittsburgh Cerebral Performance > Category (CPC). These CPC scores were compared with control populations using the Kruskal-Wallis test for statistical significance. > Hepatic dysfunction in 7 patients (with and without renal > insufficiency) correlated with poorer outcomes compared to controls. > (median CPC = 5 (5,5), mean = 4.71, compared with median CPC in controls = 2 (2,3), mean = 2.38). > Generalized status epilepticus patients also faired worse than their > partial status epilepticus counterparts (p=0.00299). Other factors, > including renal insufficiency (p=0.075), heart failure (p=0.492), > intracerebral hemorrhage (p=0.991), stroke (p=0.607), tumor (p=0.585), > hypertension (p=0.974), diabetes mellitus (0.273), urinary tract > infection (p=0.18), and obesity > (p=0.516) failed to achieve statistical significance.

**S31**

**Hippocampography & Lesional Dominant Neocortical TLE Surgery**

*Marcus Ng, MD, FRCPC; Ronan Kilbride, MD; Mirela Simon, MD; Emad Eskandar, MD; Andrew J Cole, MD, FRCPC*

Symptomatic lesions account for a large proportion of temporal lobe epilepsy (TLE) cases. Not uncommonly these lesions are located outside the hippocampus in temporal neocortex. When epilepsy is medically refractory, the treatment of choice is surgery. Resection usually includes the mesially located hippocampus, especially if the hippocampal electrocorticogram ("hippocampogram") demonstrates epileptiform abnormalities. However hippocampectomy in the dominant hemisphere entails considerable risk to neuropsychological function, such as memory, in addition to the general hazard of more extensive neurosurgery. We sought to determine the relation between seizure freedom and findings on electrocorticography in dominant temporal neocortical lesional epilepsy cases and to determine whether hippocampal recording is helpful in determining extent of hippocampal resection in patients

with neocortical lesions. In a retrospective chart review, we found 6 patients who underwent hippocampography during surgery. We will present the hippocampography, radiology, pathology, extent of resection, and Engel score for each patient. We will interpret these findings in relation to the role of hippocampography and hippocampectomy in achieving seizure freedom for these patients.

**S32**

**Continuing Challenges in Diagnosing Frontal Lobe Epilepsy**

*Rajbeer Singh Sangha; Robert L. Beach, MD PhD*

**Introduction:** Frontal Lobe epilepsy is difficult to diagnose due to the unusual presentations and lack of a post ictal period that characterizes temporal lobe epilepsy.
**Results:** 33 y/o female with vigorous motor seizures was admitted after multiple EEGs couldn't were negative. VEEG captured clinical events, only be clearly identified as seizures after AEDs were stopped and multiple events with stereotypical semiology, but poorly localizing rhythmic theta or alpha activity were captured. She presented several years later to a different epileptologist, with spells of unresponsiveness, "shaking and thrashing". Suspicion for psychogenic non-epileptic seizures prompted VEEG monitoring. After 2 vigorous spells she classified as nonepileptic and her AEDS were reduced. Later the patient presented in complex partial status. On VEEG, suspicious poorly localizing activity in the left frontal central head region suggested insular onset. Her AEDs were modified with improved control.
**Conclusion:** Despite multiple VEEG recordings, diagnosis of frontal lobe epilepsy can be markedly difficult. The diagnosis may require characterization of stereotypical behavior from multiple events in the absence of clear ictal electrographic abnormalities.

**S33**

**Reorganization of the Background ECoG Underlies Afterdischarge**

*Giridhar Kalamangalam, MD DPhil*

Afterdischarges (ADs) are runs of focal epileptiform activity following cortical electrical stimulation (CES). AD occurrence depends on stimulus intensity, brain location and pre-existing low-frequency power in the background electrocorticogram (ECoG); how ADs occur following CES however remains unclear. We reviewed extraoperative CES ECoG data following 1079 bipolar stimuli in four patients undergoing presurgical subdural grid evaluation. Thirty-eight ADs lasting ~ 8 seconds were analyzed for spectral content, and compared to those from length-matched segments of baseline ECoG and following subthreshold stimuli. A consistent relation of AD-to-baseline spectra was found, in one of three ways: (i) a "condensing" relation, with AD and baseline spectral peaks appearing at the same locations, but AD peaks showing less dispersal; (ii) condensation plus harmonics, with additional peaks appeared at selected harmonics and (iii) harmonic-dominant, with high harmonic content and minimal condensed peak power. Spectra of epochs following subthreshold stimuli differed from baseline in a similar though less prominent fashion. Thus ADs, rather than representing de novo change, fundamentally arise from a "reorganization" of background brain rhythms, comprising "condensation" of pre-existing peaks and a process generating higher harmonics of the condensed peaks. Possible underlying neurophysiological mechanisms and a quantitative model for this phenomenon are proposed.

**S34**

**Oxygen Saturation in Epileptic and Non-Epileptic Convulsive Spells**

*Gowri Lakshminarayan, MD; Bruce J. Fisch, MD*

Patients with psychogenic non-epileptic seizures (PNES) that present with attacks in the emergency department are frequently misdiagnosed, resulting in the administration of antiepileptic medication, occasionally with intubation and general anesthesia. We hypothesized that oxygen monitoring might be helpful to emergency physicians and first responders in distinguishing epileptic from non-epileptic attacks. To test this hypothesis we performed an unblinded, retrospective study of the variability of oxygen saturation in the pre-ictal (30 sec before onset), ictal, early post-ictal (30 sec) and late postictal (up to 3 min) phases in patients undergoing video EEG monitoring during convulsive epileptic (12 patients, 15 seizures) and non-epileptic spells (7 patients, 10 attacks).
**Results:** The lowest desaturation in the PNES group was 86% (in 2 of 10 attacks; nadir > 90% in 6 of 10). All epileptic seizures had a nadir below 90% with 10 of 15 <= 80% (lowest recorded 64%). In 8 of 10 PNES attacks the lowest saturation was in the ictal period, vs 12 of 15 epileptic seizures with the nadir during the postictal period (example below).
**Conclusion:** The temporal pattern and degree of O2 desaturation may be diagnostically useful in distinguishing epileptic from PNES convulsive attacks.

**S35**

**PESSt and H Reflex in 24 Patients with Urinary Incontinence Before Lumbosacra Trauma. Comparative Study at Three Months.**

*Teresa Maria Montes de Oca Domingo; Juan Manuel Rojas de Dios; Javier Enrique Garcia Cordero; Idalme Padron Lopez; Gladys Maya Morales; Olga Gonzalez Perez*

Urinary incontinence (UI) is defined as a condition in which involuntary loss of urine is a social or hygienic problem and is objectively demonstrable. Spinal cord lesions can alter sympathetic and parasympathetic tone resulting in urinary incontinence. If the sacral cord is involved, like S2-S5 nerves can causes bladder dysfunction and urinary incontinence or retention can be with an unfavourable prognostic.
**Objectives:** Analysis of H Reflex and PESSt of nerve tibials in patients with urinary incontinence transitory posttraumatic of column lumbosacra without section medullar in initial stages and study comparative at three months. Methods: Study of H Reflex and PESSt with analysis of central conduction in 24 patients, between 24-42 years of age with urinary incontinence transitory posttraumatic of column lumbosacra without section medullar in initial stages (21 days of trauma).
**Results:** H Reflex was absent bilateral in 18 patients and slowed down in the rest. PESSt and TCC was absent in 21 patients. The comparative study in 3 months, demonstrates H Reflex absent in 12 patients and the PESSt in 15 patients.
**Conclusion:** The alterations in initial stages of this pathology could evaluate the susceptibility of urodynamic in the incontinence urinary in the course of affections medullar

**S36**
**Simultaneous EEG and fMRI Correlation of Focal Slowing in Temporal Lobe Epilepsy**
*Rohit A. Marawar, MD; Hsiang J Yeh, BS; Christopher Carnabatu, BS; Gautam Tammewar; John M. Stern, MD*

**Objective:** Characterize the focal abnormality of temporal lobe epilepsy (TLE) with fMRI through EEG evidence of continual dysfunction instead of episodic epileptiform discharges.
**Background:** Simultaneous EEG and fMRI (SEM) studies in TLE have correlated spikes with fMRI, but spike yield and significant results are limited.
**Methods:** 11 Left TLE, 8 Right TLE and 14 controls underwent SEM. We measured power spectral analysis in delta band in selected electrodes representing temporal lobes bilaterally. Average power of 2 second epochs was convolved and correlated to yield fMRI maps which were then coregistered on MRI images.
**Results:** Controls' temporal delta activity showed extensive activation of bilateral temporal, occipital and parietal lobes with minimal activation of frontal lobes and thalamus without significant difference between left and right sided electrodes. Subtraction images of control greater than LTLE showed activation of bilateral anterior temporal lobes while LTLE greater than control showed activation of thalamus.
**Conclusions:** Temporal region delta generation is a function of diffuse network in normal subjects. This network is disrupted in LTLE with a shift of functional activity from temporal lobes to thalamus.

**S37**
**Interventional Neuroradiology Intraprocedural Clot Series**
*David S. Gloss, MD Brian Alkire, CNIM*

We performed an IRB approved retrospective chart review at Barrow Neurologic Institute from 2006-2012, looking for intraprocedural clot formed during interventional neuroradiology procedures (including coils, stenting, vasospasm procedures), which included intraoperative monitoring. We found 15 such cases. In 6, SSEPs dropped significantly in amplitude before the clot was seen on angiogram, allowing recognition of the clot and intervention more quickly than if there were not monitoring. In another seven, it is unknown if the SSEP change happned before being seen on angiogram. In all 15 cases, there were significant amplitude drops in SSEPs. In addition, in two of the cases, there was a significant increase in latency. In 13 of the 15 cases, there was at least partial recovery after intervention on the clot; for example, injecting abciximab directly on the clot. In 6 cases, the baseline waves returned, in 7, there was partial recovery. In 2 cases, the waves remained absent. This retrospective series needs to be verified with a prospective cohort, but it suggests that monitoring interventional radiology procedures is a safe and effective way to determine the occurrence of intraprocedural clot formation, which may allow for intervention before would have otherwise been noticed on the angiogram.

**S38**
**Multi-Myotomal MEPs Can Improve the Identification of Segmental Spinal Cord Injury During Surgical Instrumentation**
*Jose Fernandez, Dr; Alfredo Traba, Dr; Oscar Riquelme, Dr; Azucena Garcia, Ddr; Jose Luis Gonzalez, Dr*

Motor evoked potentials (MEPs) have gained increased recognition as an essential component of multimodality intraoperative monitoring (IOM) during spinal surgeries with deformity correction. Although the critical period of MEPs monitoring have been traditionally considered the deformity correction, several reports have shown spinal cord injury during instrumentation. In this context multi-myotomal MEPs recordings may be usefully. We report two cases of abrupt MEPs loss after screws were placed at T7 and T9

pedicles. MEPs were bilaterally recorded from abductor pollicis brevis, mid - axillary chest at upper and mid thoracic levels, external oblique abdominis, vastus lateralis, tibialis anterior and abductor hallucis muscles. In both patients instrumentation of the pedicle resulted in loss or reduced amplitud of lower limbs MEPs. External oblique abdominis MEPs were loss only after T7 instrumentation. Abductor pollicis brevis and mid axillary chest MEPs were stable and unchanged throughout the surgical course. Pedicle screw removal resulted in total or partial reversal of MEPS changes. There were no postoperative neurologic deficits. These results suggest that multi-myotomal MEPs monitoring during segmental instrumentation can detect reversible spinal cord injury, minimizing postoperative deficits.

**S39**

**Critical Intraoperative Neurophysiologic Monitoring (IONM) Changes Associated with Patient Positioning Maneuvers**

*Leslie H. Lee, MD; S. Charles Cho, MD; Viet Nguyen, MD; John Ratliff, MD; Jongsoo Park, MD; Griffith Harsh, MD; Jaime R. Lopez, MD*

**Introduction:** Positioning maneuvers during surgical cases can place the patient at risk for spinal cord and/or peripheral nerve injury. Initial transition of the patient from the supine to prone position, as well as passive neck flexion or extension, are potentially high risk portions of the procedure, especially during spine surgeries. The role of IONM in helping to prevent such injuries is emphasized.
**Methods:** We present a series of six cases where critical IONM changes were identified and resolved following modification of patient positioning in cervical spine (5) and intracranial (1) procedures.
**Results:** Significant IONM changes were observed during the initial prone positioning onto the surgical table in four spine cases, while in another case changes occurred with passive neck extension while supine. During an intracranial surgery IONM changes were observed during tumor resection that resolved with modification of neck positioning. In all cases prompt identification of IONM changes enabled rapid assessment and repositioning of the patient, which largely resolved all neurophysiologic changes and correlated with no new sustained postoperative deficits.
**Conclusion:** This series highlights the importance of appropriately instituting IONM early, prior to patient positioning, to facilitate the prompt identification of potentially reversible changes that may indicate impending positioning-related injuries.

**S40**

**Neurophisiologic Detection of the Spinal Cord Lesion Level.**

*Lidia Cabanes-Martinez, MD; Gema de Blas, MD, PhD; Elena Montes, MD; Nelson Cuellar, MD; Jesus Burgos, MD, PhD; Carlos Correa, DMV; Jaime R. Lopez, MD*

**Introduction:** In our experience, most of the spinal cord injuries in spinal surgeries have compressive mechanical causes. Localization of the lesion level would allow immediate decompression, improving the chances of recovery.
**Material And Methods:** In five experimental pigs the thoracic spinal cord was exposed in three segments via bilateral laminectomies. Four sublaminar epidural catheters were placed at T3, T3, T11 and L1. The following techniques were performed: spinal cord to spinal cord evoked potential (EP), D-wave recordings and somatosensory epidural EP. Then, the spinal cord was severed at the T8 level, and the neurophysiologic protocol was repeated.
**Results:** In all cases, the cord to cord EP was absent when stimulating the two levels above the lesion and recording at the two distal levels. The epidural sensory EP was normal in the two distal levels, and absent in the proximal levels. D wave was present in all cases at the two levels proximal to the lesion, and absent in the distal ones.
**Conclusions:** It is possible to identify the level of the spinal cord lesion by neurophysiologic techniques. The cord to cord, D-wave and sensory epidural potentials recorded at different levels allow us to exactly identify the injury level.

**S41**

**Reversible Intraoperative Neurophysiologic Monitoring (IONM) Changes Associated with Surgical Retraction**

*Leslie H. Lee, MD; S. Charles Cho, MD; Viet Nguyen, MD; Gary K. Steinberg, MD, PhD; Steven D. Chang, MD; Robert Dodd, MD, PhD; Stephen Ryu, MD; Jaime R. Lopez, MD*

**Introduction:** Inadvertent retraction-related injuries are a known risk of intracranial surgical procedures. Retraction in the vicinity of critical neural tissue and vascular structures may result in compression, stretch, or steno-occlusive ischemic injuries that are unexpected, and may not be recognized until the postoperative period. The role of intraoperative neurophysiologic monitoring (IONM) in helping to prevent such injuries is highlighted.
**Methods:** We present a series of eight intracranial surgical cases where IONM changes occurred in association with retractor placement and positioning, procedures that include resection of tumor (3) and vascular malformations (2), and aneurysm clipping (3).
**Results:** In the three aneurysm cases significant IONM changes occurred following retractor placement, but prior to any planned intervention. In all remaining cases changes occurred during the interventional period that also coincided with the placement or positioning of retractors. Most commonly transcranial motor evoked potentials were primarily affected. In all cases prompt identification

of these IONM changes led to rapid surgical assessment and eventual removal or repositioning of retractors, which resolved neurophysiologic changes and correlated with no new sustained postoperative deficits.
**Conclusion:** This case series highlights the importance of IONM in the early identification of potentially reversible changes that may correlate with impending retraction-related injuries.

**S42**
**Impact of Technique Employed in Motor Evoked Potential Studies of the External Anal Sphincter on Obtaining Reliable Responses.**
*Hos Loftus, MD; Benjamin Cohen, MS, CNIM*

**Background:** The best method to obtain motor evoked potentials in the external anal sphincter (EAS) has not been established in literature. This review was performed to examine the relationship between the technique and responses.
**Methods:** The data from a series of 16 cases which has EAS included in transcranial motor evoked potentials for spine surgeries were analyzed retrospectively.
**Results:** 6 cases had a single EAS channel among either right or left side channels; 3 had the same channel checked with stimulation of both sides; 7 had independent right and left channels. Of first group, 4 had responses initially; 2 were initially unobtainable but later emerged. Of second group, 1 had no responses; 1 had no responses initially but they emerged bilaterally; 1 had responses only on one side. Of third group, 2 had no responses; 2 had no responses initially, which later emerged bilaterally; 1 had responses on one side and the other later emerged; 1 was absent initially, only one side emerged later. Of 10 cases that had responses checked bilaterally, 4 had responses only on one side for part of, or the entire, study.
**Conclusion:** Checking EAS motors bilaterally may be more helpful in obtaining responses.

**S43**
**Epidural Recording: New Technique for Malpositioned Pedicle Screw Detection**
*Nelson Cuallar, MD; Gema de Blas, MD, PhD; Lidia Cabanes-Martinez, MD; Jesus Burgos, MD, PhD; Miguel Anton, MD; Eduardo Hevia, MD; Carlos Barrios, MD, PhD*

**Introduction:** Available methods for screw monitoring fail to detect approximately 15% of the malpositioned screws. We have developed a new method based on spinal cord recording in response to pedicle screw electrical stimulation.
**Patients and Methods:** We studied 123 thoracic screws from 6 patients with idiopathic scoliosis. Following the classic single pulse stimulation of the screws, we performed train stimulation using 4 stimuli, 0.2 sec duration, 500 Hz rate, with a decreasing intensity from 30mA. The response was recorded with two epidural catheters placed cranial and caudally. Additionally, the placement of the screws was guided by intraoperative imaging techniques. After surgery, a CT scan was performed.
**Results:** 6 screws were removed due to malpositioning according to conventional screw neurophysiologic monitoring techniques. 99 screws (84.6%) showed correct placement by CT imaging, while 18 (15.4%) were invading the canal. Of these, 7 (39%) showed an epidural response with a threshold below 15mA, indicating proximity or contact with neural structures. 11 screws showed normal thresholds. None of these patients have had postoperative symptoms.
**Conclusions:** The data from this technique suggests an approximately 40% improved rate in detecting malpositioned pedicle screws.

**S44**
**SSEPs: A Comparison of Cervical Spine Dysfunction**
*Vivian Hoang, MD, MBA; Michael Dorsi, MD; Langston Holly, MD; Marc R. Nuwer, MD, PhD*

Cervical stenosis leading to myelopathy is one of the leading causes of spinal cord dysfunction. Many patients with cervical spine disease often have to proceed to surgical procedures to alleviate their symptoms. At our institution, many of the surgical cervical spine procedures are monitored intra-operatively by somatosensory evoked potentials (SEP) obtained from all four extremities. We are interested in the difference in SEP latencies of cervical myelopathy patients as compared to other cervical procedure patients. Using cervical radiculopathy patients who receive surgery as a comparison group, we analyzed the absolute latencies of the lower extremities' SEP with adjustment for a patient's height. This data was then compared to normative data for absolute lower extremity latencies adjusted for height. Our preliminary data from 109 cervical myelopathy patients and 25 cervical radiculopathy patients indicates that the myelopathy patients had mildly greater absolute latency (mean = 46.32) as compared to the radiculopathy patients (mean = 42.07). When these latencies were adjusted for height and compared to normative data, the latencies from the myelopathy patients were more often prolonged or at the higher limits of normal. As a next step, we plan to assess whether these SEP findings correlate with MRI and functional status.

**S45**
**IOM for Intracranial Aneurysms: The Michigan Experience**

*Kinshuk Sahaya, MD; Aditya S Pandey, MD; Brian R. Bush, BS; Daniela Minecan, MD*

**Objective/ Methods:** Present the association between neurological outcome of patients with intra-cranial aneurysms (ruptured/un-ruptured) and intraoperative monitoring (IOM) during endovascular/transcranial repair. Standard IOM practices were followed. The cases associated with IOM changes were retrospectively mined from our database.
**Results:** 406 subjects underwent 470 procedures. Total 331 (70.4%) procedures were performed on patients with unruptured aneurysms. Endovascular procedures were performed in 56.8% cases. Somatosensory evoked potentials (SSEP) were used in all patients and EEG, brainstem EP (BAEP) in 99.14% and 23.19% respectively. EMG, visual EP (VEP) and motor EP (TcMEP) were rarely used. Changes occurred in 4.4% of procedures. Majority (85.7%) were detected on SSEPs followed by BAEP. 11 (52.4%) were reversible, while 10 were not or only partially reversible. 10 patients experienced immediate post-operative deficits, while 11 had none. Amongst patients without deficits, the changes were either reversible (81.8%) or partially reversible (18.2%). Amongst patients with deficits, 60% of changes were irreversible, 20% partially reversible and 20% reversible.
**Conclusion:** SSEPs remain the most effective modality to detect changes during aneurysm repair. Irreversible changes exclusively occurred in patients with immediate post-operative deficits while reversible changes were higher in patients without post-operative deficits. Partially reversible changes were comparable in both groups.

**S46**
**Contralateral Response to Lumbar Pedicle Screw Stimulation**
*Parastou Shilian, DO; Adel Olshansky, MD; Andres A Gonzalez, MD,*

**Goal:** To report an intriguing finding observed during pedicle screw triggered electromyography (tEMG).
**Background:** Lumbosacral surgery often involves placement of screws into the pedicle wall to provide stability and/or to correct deformity. Neuromonitoring including tEMG is used to assure the correct placement of pedicle screws and to avoid injury to the nearby neuronal and vascular structures. Case description: Patient underwent posteriolateral fusion with instrumentation, L2 to L5. Following screw placement tEMG was performed. Right L2 screw stimulation, an EMG response was seen in the right vastus medialis with threshold of 9mA. Stimulation of the left L2 pedicle screw stimulation showed no responses ipsilaterally, but an EMG response was seen in the right vastus medialis with the same threshold of 9mA. Electrodes were checked for connection to appropriate side. Intraoperative radiograph showed the tip of the right L2 pedicle screw projecting medially and appearing to abut the tip of the left L2 pedicle screw. Right L2 screw was repositioned with pedicle screw stimulation having a threshold above 20 mA bilaterally.
**Discussion:** A contralateral EMG response was seen with pedicle screw stimulation with the same threshold as the ipsilateral breached pedicle screw. This observation should raise the possibility of a hardware bridge.

**S47**
**Median Nerve SEPs in Carotid Surgery: Does Reference Choice Matter?**
*Stephen Fried, MD; Diane Smith, CNIM; Alan D. Legatt, MD, PhD*

Median nerve somatosensory evoked-potential (SEP) monitoring is commonly used during carotid endarterectomy surgery in order to permit selective shunting in only those patients who are determined to have inadequate collateral flow following carotid cross-clamping. The N20 component is recorded from the CPc (contralateral centroparietal) electrode; either CPi (ipsilateral centroparietal) or FPz (forehead) can be used as the reference. Due to the distribution of the subcortically-generated N18 component, the CPc-FPz derivation might record both the N20 and N18 components, and might therefore inadequately detect hemispheric ischemia following carotid cross-clamping. We compared SEPs recorded using these two derivations during 38 carotid endarterectomies, in order to assess their ability to detect neurophysiologic changes after carotid cross-clamping. Although, as expected, the baseline N20 component was significantly larger when recorded with the CPc-FPz derivation than with the CPc-CPi derivation (3.1 μV vs. 2.4 μV in the hemisphere ipsilateral to the clamped carotid, $p<0.001$), there was no significant difference in the post-clamp amplitude decline between the two derivations (8.7% vs. 8.6%, $p=0.82$). We conclude that CPc-FPz is an acceptable derivation for recording post-clamp hemispheric SEP changes during carotid endarterectomy surgery, and may be advantageous because it provides a larger-amplitude SEP than the CPc-CPi derivation.

**S48**
**Comparison of Continuous 32 Channel EEG Monitoring and SSEPs Monitoring with Burst Suppression during Carotid Endarterectomy (CEA) in Predicting Surgical Outcome**
*Anishee Shah, MD; Robert Zelaya, Technician; Evgeny Tsimerinov, MD; Abirami Muthukumaran, MD;, Lilit Mnatsakanyan, MD*

**Objective:** To re-present with the addition of 16 patients the reliability of different monitoring methods during carotid endarterectomy.
**Background:** Carotid endarterectomy (CEA) is a commonly performed procedure. Various intraoperative monitoring (IOM) modalities are used to detect early signs of ischemia during the critical portions of a surgical procedure. Continuous EEG (cEEG) can detect the

earliest changes while burst suppression during clamping (sEEG) offers theoretical benefit of neuroprotection. Somatosensory evoked potentials (SSEPs) have been shown to be more sensitive and specific in detecting changes but with a time lag in detecting the changes during acquisition of the data. To date, there are no established guidelines for the best IOM approach during CEA.
**Methods:** 38 individuals with symptomatic and asymptomatic carotid stenosis who underwent carotid endarterectomy at Cedars Sinai Medical Center. Neurological function and intraoperative neurophysiologic monitoring data were obtained from medical records and retrospectively reviewed. Subjects were divided into 2 non-randomized groups based on surgeons' preference, either cEEG or burst-suppression EEG with SSEP monitoring during clamping. Primary outcome was measured by comparing the neurological functions at baseline, post-anesthesia recovery, and discharge. Intraoperative changes were identified and correlated to primary outcome for analysis.
**Results:** Both cEEG and sEEG+SSEPs were shown to reliably monitor electrophysiologic changes during CEA in our study.

**S49**
**Long-Term Evolution of Pedicle Screws Placed in the Spinal Canal During Scoliosis Surgery**
*Sergio Garcia-Urquiza, MD; Lidia Cabañes, MD; Nelson Cuallar, MD; Maria Soledad del Cura, MD; Elena Montes, MD; Ignacio Regidor, MD, PhD; Carlos Barrios, MD, PhD; Gema de Blas, MD, PhD; Jesus Burgos, MD, PhD*

**Introduction:** According to the literature, 10-15% of thoracic pedicle screws are malpositioned, even when using current methods of intraoperative neurophysiologic monitoring (IONM). This occurs more frequently at the convexity of the apex of the curve. Patients and methods: Between 2005 and 2009 we performed postoperative CT scans on 28 patients who underwent scoliosis surgery. All screws were placed by the hand-free technique, and three methods (palpation, radioscopy and IONM) were performed to asses proper screw placement. In 8 patients, we found 11 screws invading the spinal canal to more than 4mm, all of them asymptomatic. We carried out radiological, neurophysiological, and clinical follow-up for an average period of 46 months, until the end of the child's growth period.
**Results:** The 11 screws within the canal were placed at the convexity of the apex. The triggered-EMG mean threshold was 12.48 mA (9.5-18 mA). Postoperatively, we did not find any change on the screw placement. Patients stayed asymptomatic, their neurological examination remained normal and their somatosensory evoked potentials showed no changes.
**Conclusions:** In our series, patients with pedicle screws placed within the canal were asymptomatic in the immediate postoperative period and did not develop long- term clinical symptoms.

**S50**
**Complementary Nature of MEG/EEG & SISCOM in Epilepsy Surgery**
*Michael A. Stein, MD; Travis R. Stoub, PhD; Marvin A. Rossi, MD, PhD*

MEG/EEG source localization and SISCOM are functional neuroimaging modalities that can provide localizing information in planning epilepsy surgery when the standard evaluation including MRI, continuous video-EEG monitoring, and neurocognitive evaluation is non-diagnostic. Although others have compared their relative sensitivities (Knowlton RC et al., 2008, Seo JH et al., 2011), this study presents a case series (n=35) analyzing coregistered MEG/EEG and SISCOM data with emphasis on their complementary nature. Since MEG/EEG and SISCOM provide similar but also unique information, we argue that using both in conjunction adds localizing power in planning for epilepsy surgery which should lead to improved outcomes. Both tests have high spatial resolution. Advantages of SISCOM are that it is an ictal measure, and it can localize deep sources. MEG/EEG has advantages of being a direct measure of neuronal function, and having high temporal resolution. When used together MEG/EEG-SISCOM provides information on both ictal and interictal localization with high spatial and temporal resolution. We also show how the shortcomings of one modality can be compensated for with information from the other. Finally a model incorporating MEG/EEG-SISCOM into planning for intracranial electrode placement that minimizes the extent of necessary electrode coverage and hence associated morbidity and mortality is presented.

**S51**
**Does a Focal Irritative Zone in MEG Always Correlate with the ECoG Interictal or Ictal Onset Zone?**
*Angela Y Peters, MD; Paul House, MD; Michael E. Funke, MD; Pegah Afra, MD*

**Background:** MEG, a reliable indicator of the irritative zone (IrZ), is currently used for planning of intracranial grid and strip placement. The correlation of focal IrZ as demonstrated by MEG to a focal ictal onset zone (IOZ) as demonstrated by intracranial EEG (ICEEG) is unclear.
**Methods:** Two patients with non-lesional neocortical epilepsy with focal MEG- IrZ underwent ECoG with grids and strips. Please see table-1 for localization of IrZ by MEG, and IrZ/IOZ by scalp-EEG/ICEEG, and table-2 for grid locations.
**Results:** Both patients had diffuse/regional-IOZ that were inclusive but not limited to the MEG-IrZ. Patient-1 had a large resection with complete removal of IOZ with Engel class-Ia outcome at 3 years. Patient-2 had MEG guided review of MRI pointing to a focal cortical dysplasia underwent initial lesionectomy resulting in complete removal of MEG-IrZ. She had a transient Engel-Ia outcome followed by

Engel III. Shortly thereafter she had ICEEG showed a regional IOZ that was only partially resectable due to intervening eloquent cortex resulting in Engel III outcome.
**Conclusion:** These cases suggest that focal IrZ by MEG does not always predict a focal IOZ. Therefore MEG cannot be used to determine extent of coverage needed by intracranial grid and strips.

**S52**
**Presurgical Functional Mapping of M1 and S1 with Dense-Array EEG**
*Kyle Morgan, BS; Don Tucker, PhD; Phan Luu, PhD; Mark Dow, MS*

To minimize post-surgical functional deficits, presurgical localization of critical functions is required to guide surgical resections. Functional localization can be obtained using non-invasive technologies, such as fMRI, or invasive intracranial EEG (icEEG) recordings. Data from fMRI do not have the temporal resolution required for mapping of rapidly evolving functional processes and icEEG recordings cannot cover the entire brain. Dense-array EEG (dEEG) has both the ability to spatially and temporally localize activity from the entire cortical surface. In this study, we present localization results for primary motor (M1) and somatosensory (S1) functions using dEEG and compare these results against fMRI data from the same four subjects. To localize the dEEG data, individual head models are constructed. These head models accurately describe the geometry of the different head tissues and their conductivities, the location of potential source generators, and the EEG sensor positions on the scalp surface. Results show that with dEEG and accurate head models, M1 and S1 can be reliably localized in all subjects and that M1 and S1 can be separated. The results are consistent with the fMRI findings but they also provide millisecond-by-millisecond mapping of the functional time course to reveal when M1 and S1 are functionally activated

**S53**
**Hypersomnia in Patients with Epilepsy and Comorbid Obstructive Sleep Apnea Hypopnea Syndrome**
*Douglas McKay Wallace, MD; Carolina Valdes, MD; Adriana Escandon-Sandino, MD; William K. Wohlgemuth, PhD*

**Background:** Both obstructive sleep apnea-hypopnea syndrome (OSAHS) and anti-epileptic drugs (AED) are known to cause sleepiness, but the independent contribution of each in epilepsy patients is unknown. Our aim was to characterize predictors of hypersomnia in patients with epilepsy and OSAHS.
**Methods/Design:** Subjects were patients from the Miami VA Epilepsy clinic with comorbid OSAHS. Demographics, seizure characteristics/treatment, and polysomnography (PSG) variables were extracted from the medical record on PSG date. Hypersomnia was assessed with Epworth Sleepiness Scale (ESS) on the PSG night. In this cross-sectional analysis significant correlations between ESS and patient demographic/treatment factors were used to identify variables associated with hypersomnia. Linear regression analysis with these variables was performed to predict hypersomnia.
**Results:** Seventy-seven individuals (95% male, age 56±13 years) met study criteria. Mean apnea-hypopnea index and ESS were 34 ± 29 events/hr and 10.8 ± 5.3, respectively. Age, Charlson comorbidity index, body mass index (BMI) and topiramate use were significantly correlated with hypersomnia. In a linear regression model with these 4 variables and AHI, only topiramate use (p=.01) and BMI (p=.005) predicted hypersomnia.
**Conclusions:** Topiramate and BMI, but not AHI, predict hypersomnia in epilepsy patients with untreated OSAHS. These factors may influence choice on AED in this patient population.

**S54**
**Quantification and Localization of Ictal Onset EEG Sources on LTM Recordings**
*Pedro E Coutin-Churchman, MD PhD; Marc R Nuwer, MD PhD*

Ictal video-electroencephalography (EEG) is commonly used to establish ictal onset-zone location, but surface topography does not necessarily correspond to actual source locations. EEG Source localization (ESL) of interictal spikes has been extensively studied and has been shown to have reasonable correspondence with epileptogenic foci. Ictal activity is more challenging but if it sources can be localized they should have a greater sensitivity and specificity. In this work we present the preliminary results of ESL during the first second of ictal onset activity on all seizures recorded during several days of LTM recording in 10 patients using two different strategies: frequency domain and time domain analysis. The results are compared to the standard consensus based on interictal ESL, interictal MEG, PET-MRI and clinical assessment during Epilepsy surgery workout.

**S55**
**Hidden Value of EKG when Video-EEG calls the diagnosis into question**
*Divya Singhal, MD; Heather McKee, MD; Meriem Bensalem, MD*

**Rationale:** To report two cases of atypical spells presenting with bradycardia and normal EEG and highlight the relevance of concomitant electrocardiographic (EKG) recording when diagnosis remains an enigma despite continuous video EEG monitoring (vEEG). Background: vEEG is considered to be the gold standard of diagnosing epilepsy. However, when clinical evidence points to potential epilepsy, veeg alone may not be sufficient to preclude the diagnosis. Arrythmogenic seizures can present with normal background EEG when there is a deep frontal lobe focus and conversely, vEEG with concomitant EKG recording can aid in diagnosis of non-epileptic neurogenic arrhythmias.
**Case reports:** 41-year-old lady with intractable partial epilepsy underwent vEEG: stereotypic dystonic posturing episodes occurring out of sleep with concomitant bradycardia were documented on vEEG. Diagnosis of simple partial arrhythmogenic seizures was made and they responded to antiepileptic medication adjustment. 30-year-old gentleman presented with episodes of non-positional paroxysmal syncope refractory to antiepileptic medication. vEEG demonstrated bradycardia with no EEG change. MRI brain and Cervical-spine was pursued and revealed a Chiari I malformation. Posterior fossa decompression led to resolution of these cerebellar fits of Hughling Jackson.
**Conclusions:** These two cases of arrhythmogenic spells emphasize the importance of astute observation of EKG changes in presence of normal EEG.

**S56**
**EEGNET: A Web Platform for Collaborative EEG Research**
*Chad G. Water; Brian C. Dean; Jonathan J. Halford, MD*

EEG research is often impeded due to a lack of large-scale standardized data sets that can be used for training and validating algorithms. To address this issue, we have developed EEGnet, a web-based platform that enables a distributed team of experts to assemble and annotate events in large scalp EEG datasets in a streamlined fashion. EEGnet supports most features of modern digital EEG visualization software, such as multiple montages, digital filtering, and gain adjustment. It allows annotation of segments of EEG signals in single channels or annotation of epochs encompassing all channels. EEGnet supports the visualization of short EEG files and also long EEG files, up to 24 hours in length, but only for data in a 10-20 montage (with one ECG channel). Advanced visualization capabilities are provided for displaying the output of automated interpretation algorithms and comparing these results with annotations from human experts. We hope to make the EEG research community more aware of EEGnet as a means of facilitating large-scale collaborative research initiatives, and to obtain feedback from ACNS attendees as to how EEGnet can best be extended to play a potential role in their research plans.