Impact of epileptic seizures in the neurological intensive care unit (NICU) on Glasgow Coma Scale (GCS)

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Background: Neurological patients frequently require glasgow coma scale monitoring at regular intervals. In intensive care units there are many patients admitted for monitoring of their consciousness. Seizures are associated with loss of consciousness if they are generalized. Quite often patients in the neurological intensive care units are monitored due to the underlying neurological disorder.The Glasgow coma scale is an extremely useful method of monitoring and prognosticating patients in the neurological ICU. Hence the occurrence of seizure with loss of consciousness might confound the assessment of Glasgow coma scale.

Materials and methods: It is a prospective observational study with a control arm. Subjects were enrolled if they had a seizure during admission to Intensive care unit (neurology and neurosurgery). Baseline GCS of all patients (n = 50) who develop/manifest a clinical seizure was monitored for 48 hours. Controls (n = 50) were matched with the baseline GCS of cases. The difference in GCS of both the patients at the specified interval was noted. Cases and controls are then compared on basis of their clinical profile and the assessment of GCS readings.

Results: Mean of the baseline GCS of cases was 10.44 (SD 3.79) and just after seizure was 5.82 (SD 2.96) at 2 hours was 7.8 (SD 3.87), at 4 hours was 8.48 (SD 4.21), 8 hours was 8.74 (SD 4.44), 12 hours was 8.9 (SD 4.59), 24 hours was 8.86 (SD 4.62) and at 48 hours was 9.06 (SD). In controls mean of the baseline GCS is 10.5 and it remained 10.5. The most common time interval when the patient did return to the baseline Glasgow coma scale rating was 2 hours.

Conclusion: Seizure will confound the GCS of a patient but maximum will return to baseline consciousness level. Some patients did not return to baseline GCS and presence of status epilepticus in infectious or inflammatory encephalitis was important treatable cause.

EEG Features for Outcome Prediction After Cardiac Arrest in Children

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Background: In-hospital cardiac arrest occurs in over 10,000 children per year in the United States, with high neurobehavioral morbidity amongst survivors. Early assessment of brain injury severity is important for neuroprognostication. However, clinical and resuscitation variables do not directly assess brain function and therefore may not optimally predict neurobehavioral outcomes. We aimed to determine which EEG features and feature combinations most accurately predicted short-term neurologic outcomes and survival in children resuscitated after cardiac arrest.

Methods: Prospective single-center observational study of children resuscitated from cardiac arrest who underwent conventional EEG monitoring with standardized EEG scoring. Logistic regression evaluated the marginal effect of each EEG variable or EEG variable combinations on the outcome. We identified the models with the highest areas under the receiver operating characteristic (AUROC), evaluated the optimal models using a 5-fold cross-validation approach, and calculated test characteristics.

Results: 89 children were evaluated. Unfavorable neurologic outcome (Pediatric Cerebral Performance Category score 4-6) occurred in 44 subjects (49%) including mortality in 30 subjects (34%). A model incorporating a four-level EEG Background Category (normal, slow-disorganized, discontinuous or burst-suppression, or attenuated-flat), Stage 2 Sleep Transients (present or absent), and Reactivity-Variability (present or absent) had the highest AUROC. Five-fold cross-validation for the optimal model predicting neurologic outcome indicated a mean AUROC of 0.75 (range 0.70-0.81) and predicting mortality indicated a mean AUROC of 0.84 (range 0.76-0.97). The specificity for unfavorable neurologic outcome and mortality were 95% and 97%, respectively. The positive predictive value for unfavorable neurologic outcome and mortality were both 86%.

Conclusions: The specificity of the optimal model using a combination of EEG features was high for unfavorable neurologic outcome and death. However, the positive predictive value was only 86% for both outcomes. Therefore, EEG data must be considered together with the overall clinical context.

Factors predicting cessation of status epilepticus in clinical practice – data from a prospective observational registry (SENSE)

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Background: Several randomized controlled trials of the efficacy of initial status epilepticus (SE) treatment have estimated success

rates of 40–80%. However, observational studies suggest lower proportions. We investigated the initial SE termination rate in a large multinational observational study, and explored variables associated with it.

Methods: Data of adults treated for SE were collected prospectively in centers in Germany, Austria, and Switzerland, during 4.5 years. Incident episodes of 1,049 patients were analyzed using uni- and multivariate statistics to determine factors predicting cessation of SE within 1 hour (for generalized convulsive SE, GCSE) and 12 hours (for non-GCSE) of initiating treatment.

Results: The median age at SE onset was 70 years; the most frequent etiology was remote (32%), followed by acute (31%), or a combination of acute and remote factors (10%). Semiology was generalized convulsive in 43%, focal motor in 28%, and non-convulsive in 29%. Median latency between SE onset and first treatment was 30 minutes in GCSE and 150 minutes in non-GCSE. The first intravenous compound was a benzodiazepine in 86% in GCSE, and 73% in non-GCSE. Bolus doses of the first treatment step were lower than recommended by current guidelines in 76% of the GCSE patients and 78% of the non-GCSE patients. In 319 GCSE patients (70%), SE was ongoing 1 hour after initiating treatment, and in 342 non-GCSE patients (58%) 12 hours after initiating treatment. Multivariate Cox regression demonstrated that the use of benzodiazepines as first treatment step, and a higher cumulative dose of anticonvulsants within the first period of treatment were associated with shorter time to cessation of SE for both groups.

Conclusions: In clinical practice, treatment guidelines were not followed in a substantial proportion of patients. Our data suggest that benzodiazepines should be used as first treatment step and with a sufficient cumulative dose.

Long term cognitive outcome in adult and adolescent FIRES and NORSE patients

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Background: Febrile illness related epilepsy syndrome (FIRES) is a rare and devastating subtype of new onset refractory status epilepticus (NORSE). Little is known about the long term outcome in adolescent and adult survivors. The aim of this pilot study was to identify factors associated with the long-term outcome in important aspects of daily life and cognition.

Methods: Retrospective chart review 2005-2019, clinical interview during routine visits and follow-up between 3 to 5 years after onset. Assessment of various clinical and outcome parameters: global assessment of severity of epilepsy (GASE), modified Rankin scale (MRS) and scores of independence for neurologic and geriatric rehabilitation (SINGER). Results are reported as means (with lower - upper 95% confidence intervals) or frequencies.

Results: We identified 9 patients who fulfilled the criteria of FIRES syndrome survivors. Only two were diagnosed with FIRES at the time, the others as autoimmune encephalitis. Mean age at onset was 27 years (range, 17-37). One patient developed non convulsive, prolonged refractory SE (PRSE), two persistent refractory SE (PRSE) and six persistent, super refractory SE (PSRSE). CSF pleocytosis was reported in 8/9 cases with 63 (4-123) leukocytes/μl. All patients received benzodiazepines and intravenous anticonvulsants prior to anesthetics and intubation. They spent 53 days (27-79) in intensive care. They were seen by us 21 (2-40) months after discharge from the ICU. Outcomes varied with a favorable outcome (MRS=1) in one case, moderate outcomes in seven cases (MRS=2-3) and unfavorable outcome (MRS=4) in one case. One patient had a mild epilepsy (GASE=3), three had moderate epilepsy (GASE=4) and two more severe outcomes (GASE=5-6). Long term SINGER assessment included 7/9 patients. Two patients reported mild, three moderate and three only mild cognitive impairment. Problems with interpersonal communication were reported in two cases.

Conclusions: Long term evaluation of cognitive outcome in patients with FIRES showed that the majority of patients lost independence in daily functioning due to persisting seizures and cognitive. As the condition is very rare, we propose collaborative projects, to investigate factors for a favorable / unfavorable long-term outcome in NORSE/ FIRES survivors.

Terminating pattern of ictal high-frequency oscillations is associated with short-term recurrence of seizures

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Purpose: It is not uncommon to meet a patient who experiences short-term seizure recurrence after long-term seizure freedom. In case of seizure recurring within a short interval as status epilepticus (SE), that will be life-threatening. Pathologic high-frequency oscillations (HFOs) encompassing ripples (80–200 Hz) and fast ripples (250–500 Hz) have been linked to ictogenesis. And the amount of interictal HFOs is now known to associate with seizure frequency. In the animal studies, especially a 4 aminopyridine (4 AP)-induced status epilepticus, fast ripples in hippocampus occurred at higher rates than ripples during the ictal and postictal periods. In this study, our objective is to address the mutual interaction of ripple and fast ripple in the seizure offset.

Methods: Ictal electrocorticographies (ECoGs) in the seizure-onset zone from patients with staged approach for epilepsy surgery. We only selected ictal ECoGs from patients who had frequent seizure occurrence with different interictal intervals for the study demand. We categorized high frequency of seizure occurrence (inter-seizure interval less than 4 hours) as clustered seizure group and lower reoccurrence (seizure separated by over 4 hours) as isolated seizure group. Signals derived from subdural grid and/or depth electrodes (Ad-Tech Medical Instrument Corporation, Racine, WI, USA) were sampled by 4 kHz (EBNeuro S.p.A., Italy). The ECoG signals from the SOZ-channel were first low-pass, filtered at 500 Hz and then down sampled to 2 kHz to prevent aliasing. The distribution of ripples and fast ripples during the ictal and postictal periods was averaged for these 2 groups. The ictal period of the selected seizures was normalized into 100 bins. To account