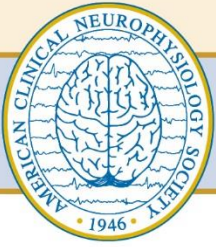
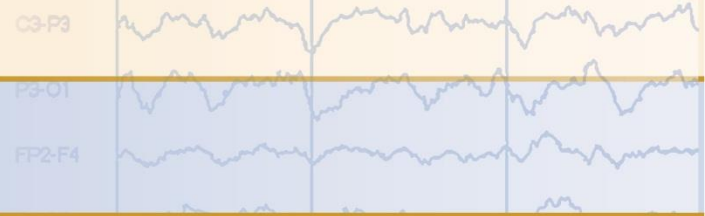


Video EEG for Epilepsy Classification in Adults

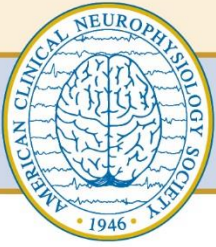
Daniel Weber, DO
Associate Professor
St. Louis University



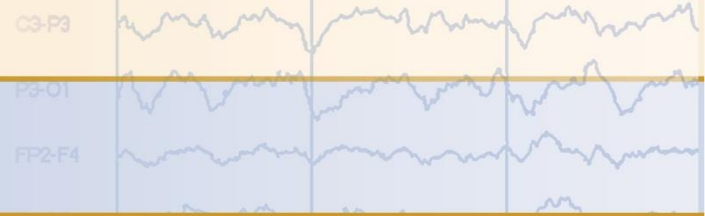
Disclosures



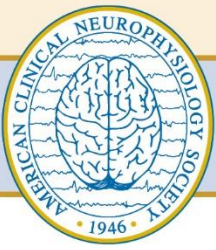
- Dr. Weber is on the Speaker Bureau for SK Life Science Inc.



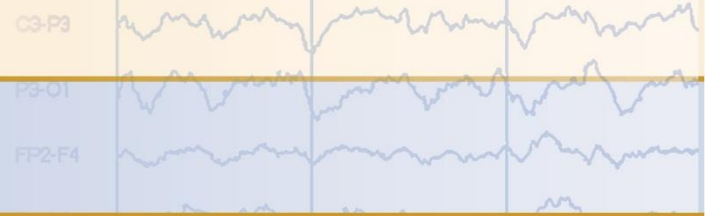
Objective



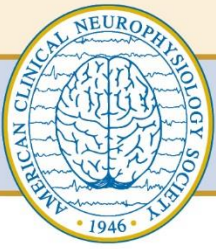
- Recognize the value of scalp video-EEG (vEEG) in classifying epileptic seizures in adults



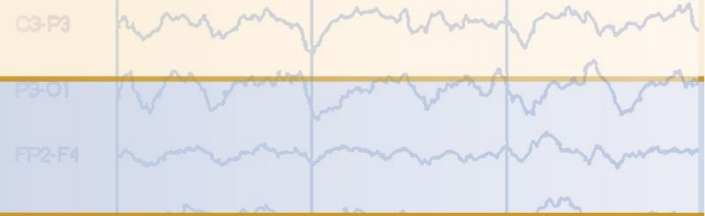
Objective



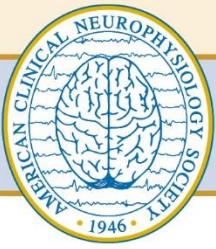
- When to vEEG
- Value of vEEG
 - Limitation of isolated clinical evaluation
 - Value of interictal epileptiform discharges (IED)
 - Does vEEG affect patient care
 - How long does it need to be
 - Ambulatory vs Inpatient
- Seizure Classification
- Semiology



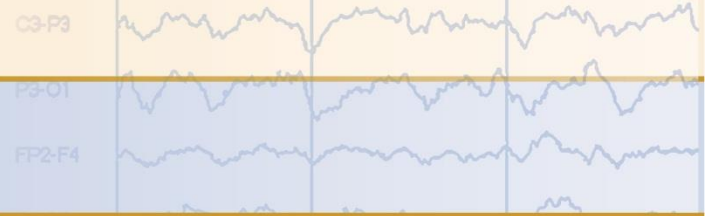
When to vEEG



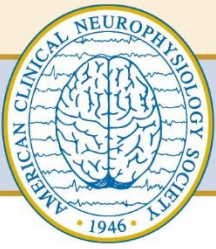
- Diagnosis of paroxysmal events
- Classification of seizure types
- Pre-surgical evaluation
- Evaluation for subclinical seizures



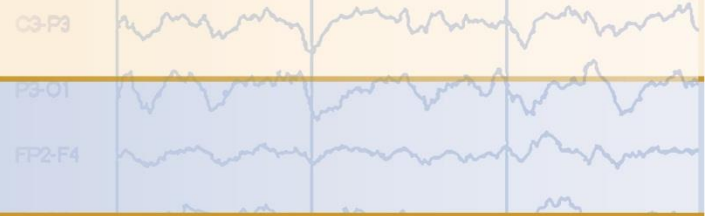
When to vEEG



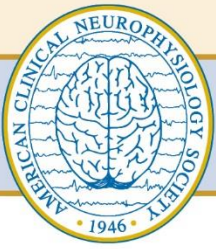
- **Cascino G. Clinical Indications and Diagnostic Yield of Video-Electroencephalographic Monitoring in Patients With Seizures and Spells. 2002**
- Limitation of Outpatient Routine EEG
 - Sampling effect
 - EEG may be altered by antiepileptic medications
 - Specific EEG changes may only occur in deeper stages of NREM
 - Incorrect interpretation of nonspecific and non-epileptiform findings
 - Inter-ictal EEG alone may lead to errors in diagnostic classification
- Limitation of vEEG
 - Simple partial seizures and aura may not have EEG changes
 - Extratemporal, especially frontal onset seizures, may not have EEG changes
 - No typical clinical spells during prolonged EEG recordings



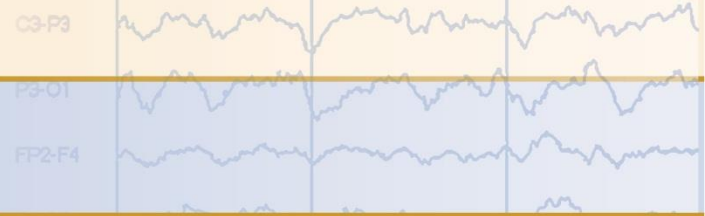
Value of vEEG



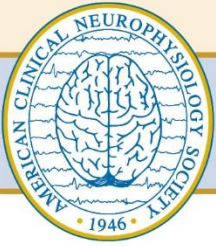
- Clinical evaluation is limited
- Expert epileptologist review of clinical semiology yielded high sensitivity (96%) but low specificity (50%) (Deacon 2003)
- In line with common finding of 30% of patients referred to EMU for refractory epilepsy will have non-epileptic conditions (Bendadis 2004)



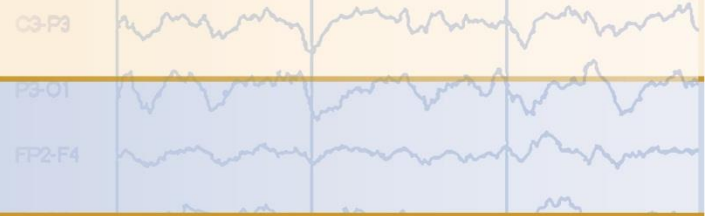
Value of vEEG



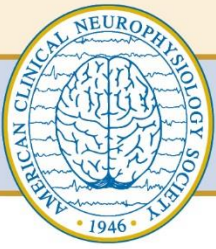
- In some cases, ictal EEG may be unnecessary (Alvim 2018)
 - Unilateral MTS patients with consistent semiology and ipsilateral IED
 - Engel I outcome in 76.74% (66) with ictal EEG vs 87.5% (70) without ($p = 0.11$)
- However IED can be misleading (Friedman 2009)
 - 12% with epilepsy had no IED
 - 17% with NEE had IED



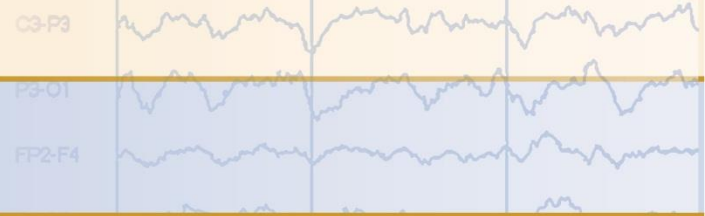
Value of vEEG



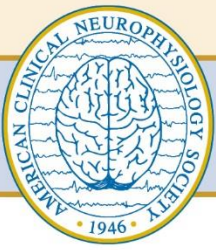
- Video EEG is useful in coming to a definitive diagnosis
- Video EEG can frequently lead to changes in management



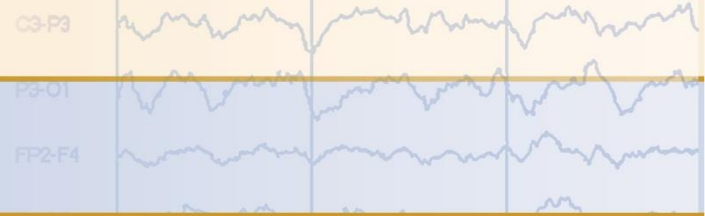
Value of vEEG



- **Smolowitz et al. Diagnostic Utility of an Epilepsy Monitoring Unit. 2007**
- Retrospective review of 213 admissions (196 patients) and 3-year post-discharge review
- Mean length of stay 6.6 days (Median: 5 days)
- Admission Impact
 - Definitive diagnosis-87.8% (n = 187/213)
 - Change in antiepileptics-79.3% (n = 169/213)

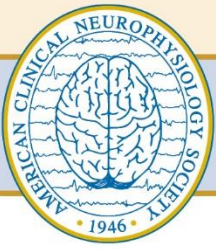


Value of vEEG

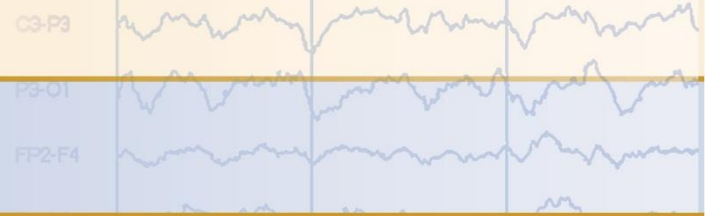


- **Lobello et al. Video/EEG monitoring in the evaluation of paroxysmal behavioral events: Duration, effectiveness, and limitations. 2007**
- Retrospective review of 199 admissions for event classification
- Captured event 83.9% 167/199
- Definitive diagnosis 75.9% 151/199

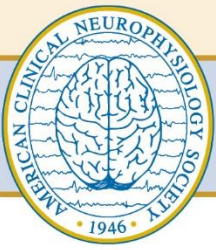
- 37% with the diagnosis of PNES had historical external report of “epileptiform” baseline EEG



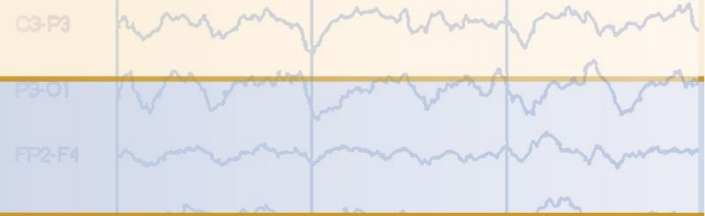
Value of vEEG



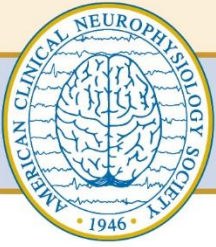
- **Zarkou et al. Indeterminate EMU admissions: Does repeating the admission help? 2011**
- Reviewed 534 EMU admissions for classification/diagnosis
- Diagnosis made on 1st admission in 80% (428/534)
- Diagnosis made on 2nd admission in 62% (8/13)
- No further diagnosis made upon further admissions in the study



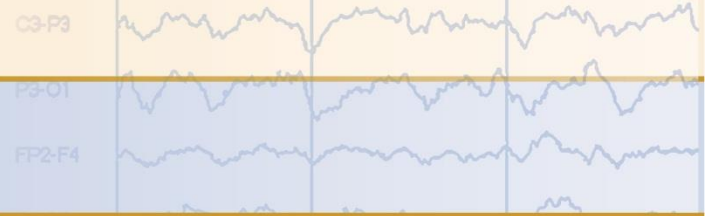
Value of vEEG



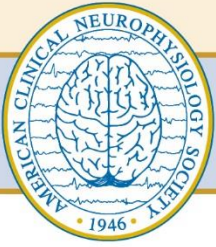
- **Muniz et al. Repeating video/EEG monitoring: Why and with what results? 2010**
- Of 1063 EMU studies from 2005-2008 only 46 were repeat studies
- Question answered in 35/43 (81.4%)
- Of 9 patients with normal first study 7 (78%) were diagnosed by second study
- Most common reasons for repeat study were focal discharges with no events captured (14) and normal with no events (9)



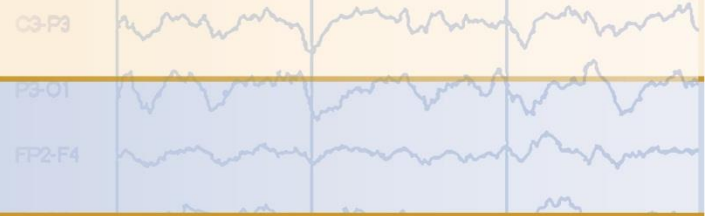
Duration of vEEG



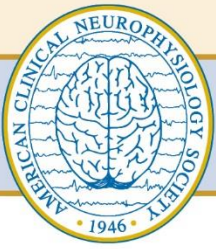
- Mean time to first ES 2.8 days (Ghougassian 2004), 3.1 days (Friedman 2009)
- Mean time to first NEE 2.9 days (Friedman 2009)



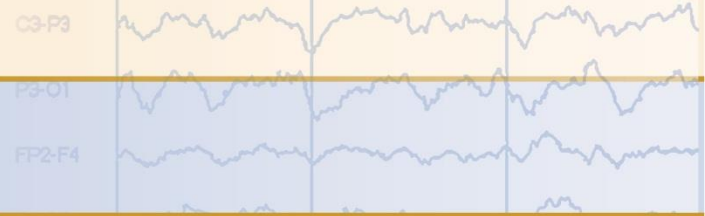
Duration of vEEG



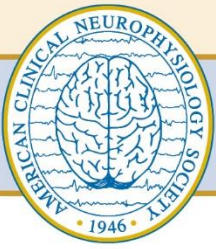
- No significant time difference between first event in ES vs PNES (Woollacott 2010)
- No significant association with reported seizure frequency (Eisenman 2005)
 - 2.13 days in high frequency (24.1/month) vs 2.78 days in low frequency (2.2/month) group



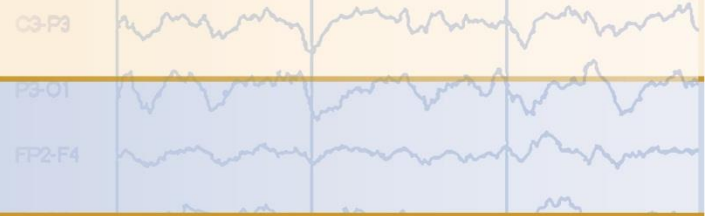
Duration of vEEG



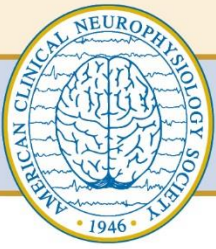
- May be affected by medication weaning protocols
- Rate of AED weaning may affect vEEG duration (Kumar 2018)
 - Time to first seizure 2.9 vs 4.6 days in rapid vs slow wean
 - No difference in diagnostic yield (95.7% vs 97.1%)
 - Increase risk of seizure clusters in rapid wean (11.9% vs 2.9%)



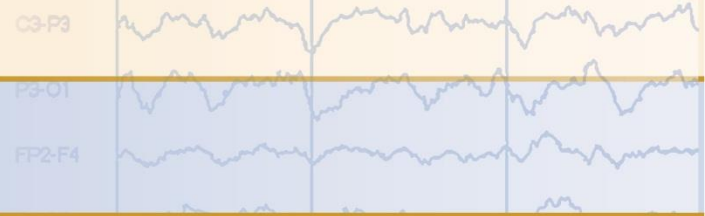
Ambulatory vs Inpatient



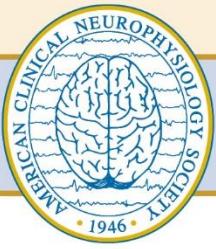
- Ambulatory EEG may be useful for
 - Patients with frequent events
 - Patients not on AED
 - To assess for subclinical events on AED
- 4-5 day ambulatory EEG with 68% diagnostic yield (Faulkner 2012)
 - 87% of events seen by 72 hours, 100% by 96 hours



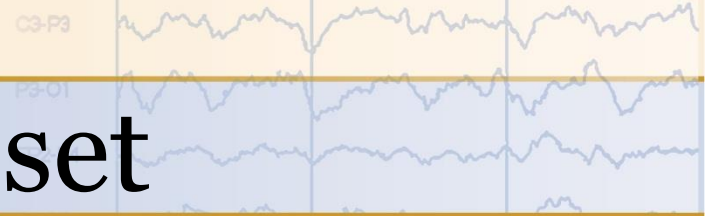
Epilepsy Classification



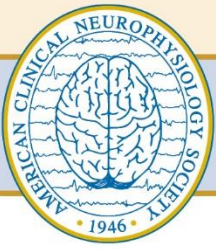
- ILAE 2017 criteria for classification of seizures (Fisher 2017)
- Allows more specific classification based on observed semiology
- Benefits from observation of video recording of event



2017 Seizure Classification-Onset

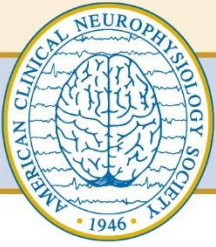


- Focal – originating within networks limited to one hemisphere
- Generalized – originating at some point within, and rapidly engaging, bilaterally distributed networks
- Unknown – less than 80% certain about onset based on available information



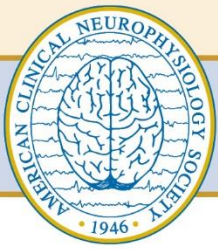
2017 Seizure Classification-Focal Onset

- Comment on awareness
 - Aware
 - Impaired awareness
- Motor vs nonmotor signs at symptom onset
 - Described by most prominent symptoms at onset
- For example:
 - a focal seizure starting with prominent fear followed by impairment of awareness and subsequent motor symptoms would be classified as:
 - Focal emotional seizure with impairment of awareness
- Focal to bilateral tonic-clonic seizure

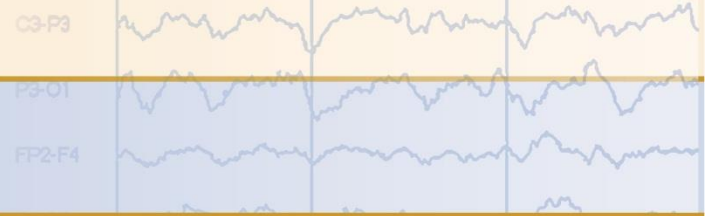


2017 Seizure Classification-Generalized

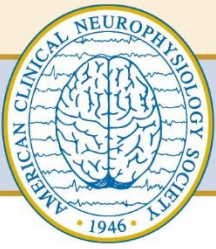
- Motor
 - Tonic-clonic
 - Clonic
 - Tonic
 - Myoclonic
 - Myoclonic-tonic-clonic
 - Myoclonic-atonic
 - Atonic
 - Epileptic spasms
- Non-motor (absence)
 - Typical
 - Atypical
 - Myoclonic
 - Eyelid myoclonia



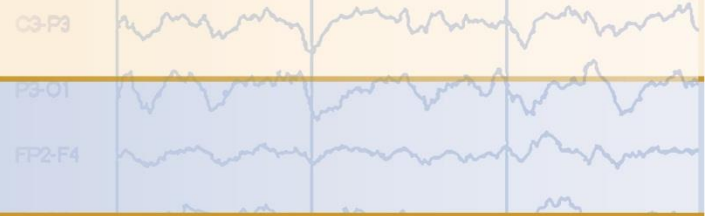
Semiology



- Accurate documentation of semiology is important
- Reviewing multiple events on prolonged vEEG allows assessment of consistent findings
- Sequence of symptoms important to assess propagation patterns

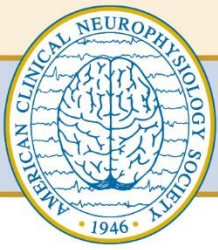


Semiology

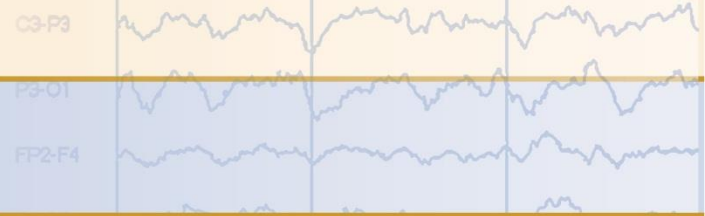


Lateralizing Semiology	Ipsilateral	Contralateral	PPV (%)
Focal clonic		X	>95
Dystonic limb		X	93
M2E and fencing		X	90
“Figure 4” sign		X (to extended limb)	89
Tonic limb		X	85
Asymmetric clonic ending	X		83
Ictal paresis		X	100
Todd paresis		X	80-100
Unilateral limb automatism	X		90
Unilateral eye blinks	X		83
Postictal nose wiping	X		90

Adapted from So 2006

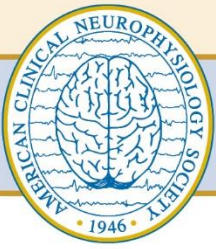


Semiology

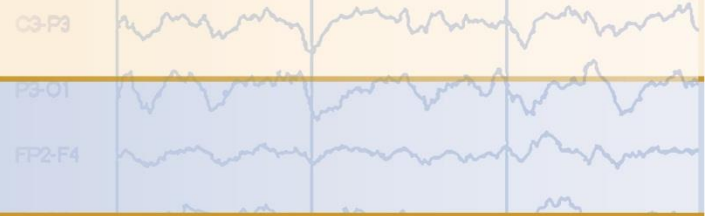


Localizing Semiology	Localization
Postictal cough	Temporal
Postictal nose wiping	Temporal (50) > Frontal (10)
Bipedal automatisms	Frontal (30) > Temporal (10)
Ictal spitting or drinking	Right temporal
Gelastic seizure	Hypothalamic (also mesial temporal or cingulate)
Ictus emeticus	Right temporal
Ictal urinary urge	Right temporal
Piloerection	Left temporal
Ictal speech preservation	83% PPV for non-dominant in TLE
Postictal dysphasia	90% PPV for dominant involvement

Adapted from So 2006



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