FRONTAL & TEMPORAL LOBE EPILEPSY

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Pretest

1. A complex partial seizure (CPS) may exhibit which of the following manifestations
    a. a blank stare with impairment of awareness and responsiveness
    b. lip smacking, chewing, or swallowing movements
    c. postictal confusion and disorientation
    d. all of the above are correct
    e. only a and c are correct
2. A simple partial seizure (SPS) or "aura" involving the medial temporal lobe (uncus, amygdala, and hippocampus) might be manifested by which of the following symptoms:
    a. a disagreeable smell (olfactory hallucination)
    b. a feeling of intense familiarity (deja vu)
    c. an unprovoked sudden feeling of fear
    d. a rising uncomfortable (butterflies, nausea) epigastric sensation
    e. all of the above are correct
    f. only a, b, and c are correct
3. A 42-year-old man presents with a three-year history of frequent episodes of confusion, agitation, unresponsiveness, which occur exclusively from sleep. The episodes last about 40 seconds, tend to occur towards the second half of the night, and the patient has no memory of them. His wife reports that the patient is seen fighting and hitting during these episodes. The patient is admitted for an overnight video EEG monitoring study. The best differential diagnosis should include:
    a. Confusional arousal versus
    b. REM sleep behavior disorder
    c. mesial temporal lobe epilepsy
    d. hypermotor seizure from frontal lobe epilepsy
    e. only b and d are correct
    f. all of the above are correct

Pretest - Question # 4

Watch the Test Video #1 and select the most likely diagnosis for the patient

a. Pseudoseizure
b. Temporal lobe seizure
c. Frontal lobe seizure
d. REM behavior disorder
e. None of the above

Pretest - Question #5

Watch the Test Video #2 and select the most likely diagnosis for the patient

a. Right temporal lobe seizure
b. Left temporal lobe seizure
c. Right frontal lobe seizure
d. Left frontal lobe seizure
e. Infantile spasms

Seizures and Epilepsy

- An epileptic seizure is the result of a temporary physiologic dysfunction of the brain caused by a self-limited, abnormal, hypersynchronous electrical discharge of cortical neurons
- Seizure is a brief synchronized discharges of neurons causing excessive electrical activity in the brain
- Seizures can be secondary to many transient conditions, e.g., toxic/metabolic conditions, trauma (impact seizure) and may not have occurred in absence of those circumstances

Epilepsy

- Epilepsy is defined as two or more seizures without any clear-cut precipitating factors
- About 40 million people are affected worldwide
- In United States, about 6.5 persons per 1,000 population are affected with recurrent unprovoked seizures, so-called *active epilepsy*
- It affects males 1.1 to 1.5 times more often than females
- Incidence rates are highest among young children and the elderly

Classification of Epilepsies

1. Localization – related (focal, partial, local) epilepsies and syndromes
2. Generalized epilepsies and syndromes
3. Epilepsies and syndromes undetermined whether focal or generalized
4. Special syndromes

Classification of Epilepsies

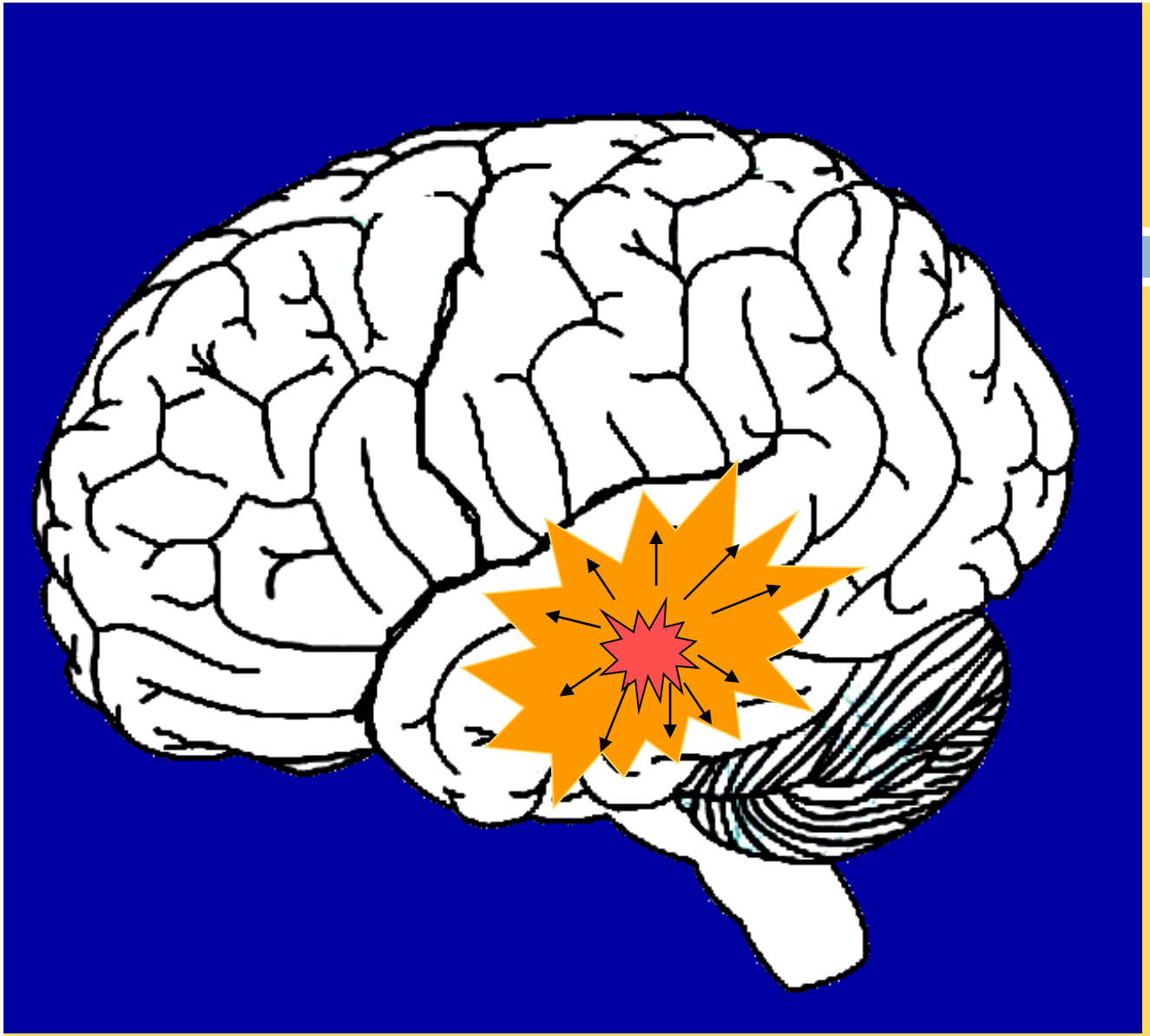
Localization – related epilepsies

Seizures start from a location in the brain and may spread to involve other areas

1.1 **Idiopathic :** cause is not known but occur in a particular pattern or a syndrome that is recognizable, e.g., benign childhood rolandic epilepsy

1.2 **Symptomatic :** cause is known, e.g., tumor, also includes reflex epilepsies

1.3 **Cryptogenic :** presumed symptomatic but cause is unknown



Partial Seizure

EEG	Definition	Measures	Comments
Irritative zone	Area that generate interictal spikes	EEG (invasive and non-invasive)	zone is smaller during wakefulness and REM
Ictal onset zone	Area where seizures are generated (includes area of early propagation)	EEG (invasive and non-invasive)	
Epileptogenic lesion	Structural abnormality of brain directly responsible for seizure	Structural imaging or tissue pathology	
Symptomatogenic zone	Portion of brain that produces the initial clinical symptomatology	Behavioral observation and history	
Functional deficit zone	Clinical area of nonepileptic dysfunction	Neurologic exam, neuropsych eval., EEG, PET, SPECT	
Epileptogenic zone	Area of brain necessary and sufficient for initiating seizures and whose removal or disconnection is necessary to abolish seizures		

Localization of localization-related seizures

- Why is it important to know where the seizures are originating?
- Diagnosis of localization of seizures on the basis of semiology is helpful
- The semiology can be determined by careful history and description from the witnesses
- Reliability of just historical information is limited because
  - Patient may have impairment of consciousness and/or memory
  - Witness may not have observed the entire episode, may be too upset and may remember only part of the details

Localization of localization-related seizures

- Semiologic features can be grouped into
  - Motor signs (positive or negative)
  - Automatism
  - Autonomic signs
  - Peri-ictal speech signs

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Value of positive and negative motor signs

Sign	Hemisphere of Sz onset	Observed rate	Positive Predictive value
Positive Motor signs			
Early non-forced head turn	Ipsilateral	30%	
Late contraversive forced head turn	Contralateral	25-50%	
Late ipsiversive head turn	Ipsilateral		
Eye deviation	Contralateral	Rarely solitary	High if occipital
Focal clonic	Contralateral	30%	> 95%
Asymmetric clonic ending	Ipsilateral	70% of 2^0 GTCS	83%
Dystonic limb	Contralateral	67%	93%
Tonic limb	Contralateral	13%	85%
Complex postures			
M2E and fencing	Contralateral		
"Figure of 4" sign	Contra to extended limb	70% of GTCS of TLE, 31% of GTCS in extratemporal	89%
Negative Motor signs			
Ictal paresis or immobile limb	Contralateral	5% of CPS	100%
Todd's paralysis	Contralateral	13% of partial szs	80-100%

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Watch video # 1

Value of Automatism

Automatism	Location	Positive predictive value
Unilateral limb automatism	Ipsilateral	90%
Unilateral eye blink	Ipsilateral	83%
Postictal cough	40% TLE, 0% NES/FLE	
Postictal nose wiping	50% TLE, 10% FLE	90%
Bipedal automatism	30% FLE, 10% TLE	
Ictal spitting or drinking	Asso with Rt TLE	Rare
Automatism with preserved responsiveness	Nondominant TLE or Extratemporal on either side	
Gelastic seizures	Hypothalamic, rarely Medial temporal or cingulate	

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Temporal lobe epilepsy

Temporal lobe epilepsy

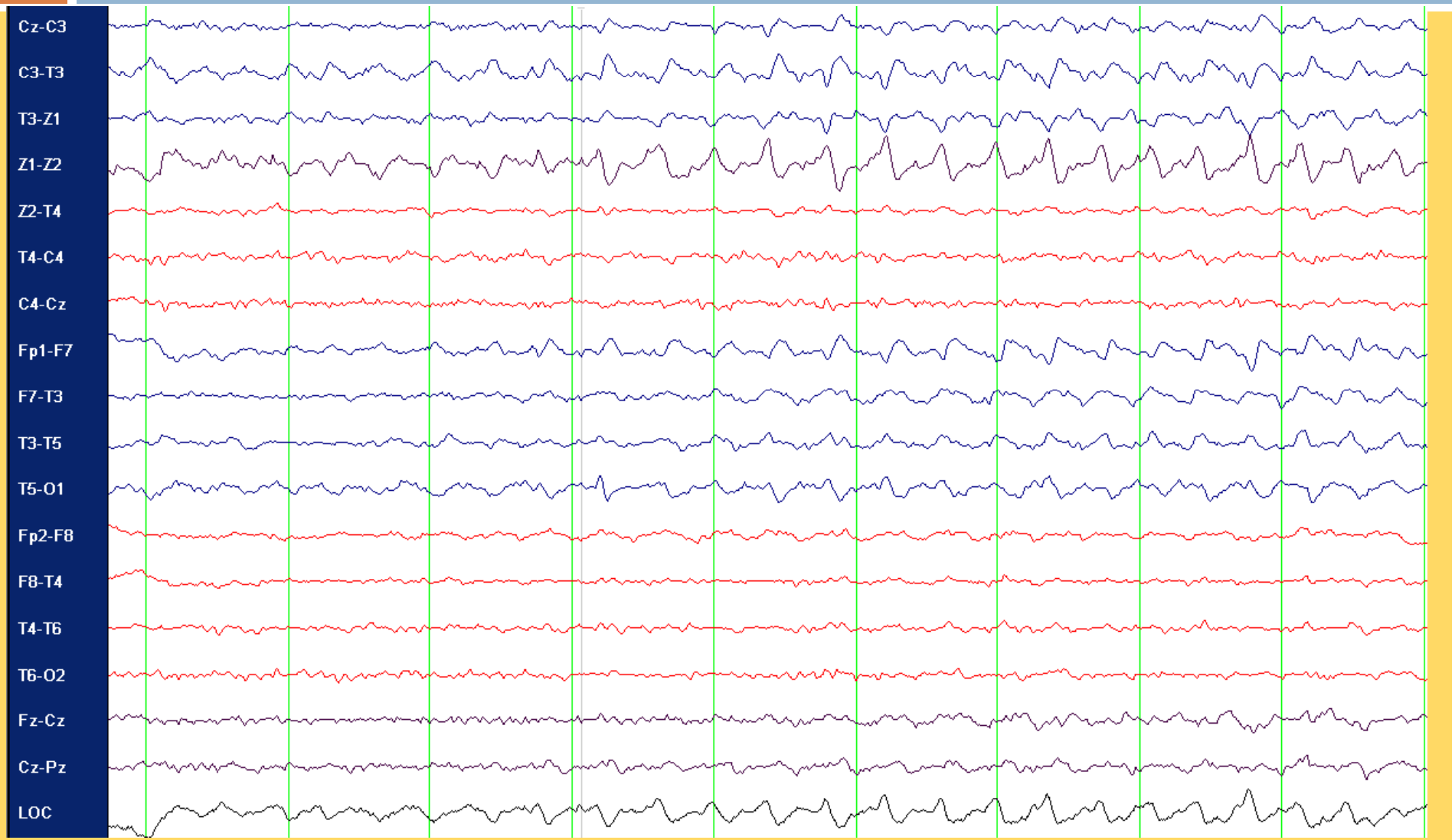
- Simple partial seizures of temporal lobe onset are characterized by autonomic or psychic symptoms, auditory or olfactory phenomena
- Complex partial seizures usually show motor arrest, orobuccal automatism, eye blinking with post-ictal confusion and associated with amnesia

Temporal lobe epilepsy

- Medial temporal lobe (hippocampal-amygdalo) onset usually associated with rising epigasttric sensation, nausea, autonomic signs/symptoms e.g., borborygmi, belching, pallor, flushing of face, fullness of face, pupillary dilatation, fear, panic, olfactory-gustatory hallucination
- Lateral temporal onset associated with auditory hallucinations or illusion, visual misperception, dreamy state, may have formed visual hallucinations in case of temporo-occipital junction onset

Watch video # 3

EEG in Temporal lobe epilepsy



Watch video # 5

Frontal lobe Epilepsy

Clinical diagnosis

- Frontal lobe epilepsy is characterized are partial or complex partial, often with secondary generalization,
- Typically, the seizures occur without warning, are short and are followed by very rapid recovery
- The seizures are frequently nocturnal, and may occur in clusters of 5-6 per night, usually with partial recovery between
- Status epilepticus is also common with FLE compared to other localization related epilepsies
- Clinical manifestations tend to reflect the specific area of seizure onset and range from behavioral to motor or tonic/postural changes

Clinical Diagnosis

- Seizures may arise from any of the frontal lobe areas,
  - Orbitofrontal
  - Frontopolar
  - Dorsolateral
  - Opercular
  - Supplementary motor area
  - Motor cortex
  - Cingulate gyrus

Etiology

- Disease conditions commonly associated with frontal lobe epilepsy are frequently symptomatic, including congenital causes such as cortical dysgenesis, gliosis, or vascular malformations; neoplasms; head trauma; infections; and anoxia
- With recent advances in genetic analysis, an expanded number of genetically inherited frontal lobe epilepsy syndromes have been described. Many of these syndromes are characterized by autosomal dominant inheritance

- The exact incidence of frontal lobe epilepsy is not known. In most centers frontal lobe epilepsy accounts for 20-30% of operative procedures involving intractable epilepsy
- Symptomatic frontal lobe epilepsy may affect patients of all ages
- In a large series of cases, mean subject age was 28.5 years with age of epilepsy onset 9.3 years for left frontal epilepsy and 11.1 years for right frontal epilepsy

Prominent speech disturbances	May indicate dominant hemisphere involvement
Supplementary motor area (SMA)	Typically involve unilateral or asymmetric bilateral tonic posturing; (fencing posture) may be associated with facial grimacing, vocalization, or speech arrest; seizures frequently preceded by a somatosensory aura; complex automatisms such as kicking, laughing, or pelvic thrusting may be present; responsiveness often preserved
Primary motor cortex	Usually simple partial motor seizures with clonic or myoclonic movements and preserved consciousness; Jacksonian spread, and secondary GTCS is frequent; speech arrest and contralateral versive or dystonic posturing may be present
Medial frontal, cingulate gyrus, orbitofrontal, or frontopolar regions	Complex behavioral events of motor agitation and gestural automatisms; viscerosensory symptoms and strong emotional feelings; motor activity repetitive and may involve pelvic thrusting, pedaling, or thrashing (hypermotor), often accompanied by vocalizations or laughter/crying; seizures often bizarre and may be diagnosed incorrectly as psychogenic.
Dorsolateral cortex	Tonic posturing or clonic movements often associated with either contralateral head and eye deviation, or less commonly, ipsilateral head turn
Operculum (insular)	Swallowing, salivation, mastication, epigastric aura, fear, and speech arrest often associated with clonic facial movements; gustatory hallucinations also may occur (can easily be confused with temporal lobe epilepsy)
Nonlocalizable frontal seizures	Rare, manifesting as brief staring spells accompanied by generalized spike/wave on EEG, which may be difficult to distinguish from primarily generalized absence seizures; may present as generalized tonic-clonic seizures without obvious focal onset
Nocturnal frontal lobe epilepsy	Autosomal dominant inheritance; seizures occur mainly during sleep; characterized by marked motor manifestations, including dystonic posturing, jerking, bending, and rocking; difficult to distinguish from parasomnias

SMA seizure

- Typically involve unilateral or asymmetric bilateral tonic posturing; (fencing posture) may be associated with facial grimacing, vocalization, or speech arrest; seizures frequently preceded by a somatosensory aura; complex automatisms such as kicking, laughing, or pelvic thrusting may be present; responsiveness often preserved
- Watch video # 4

Primary motor cortex

- Usually simple partial motor seizures with clonic or myoclonic movements and preserved consciousness; Jacksonian spread, and secondary GTCS is frequent; speech arrest and contralateral versive or dystonic posturing may be present
- Watch video # 2

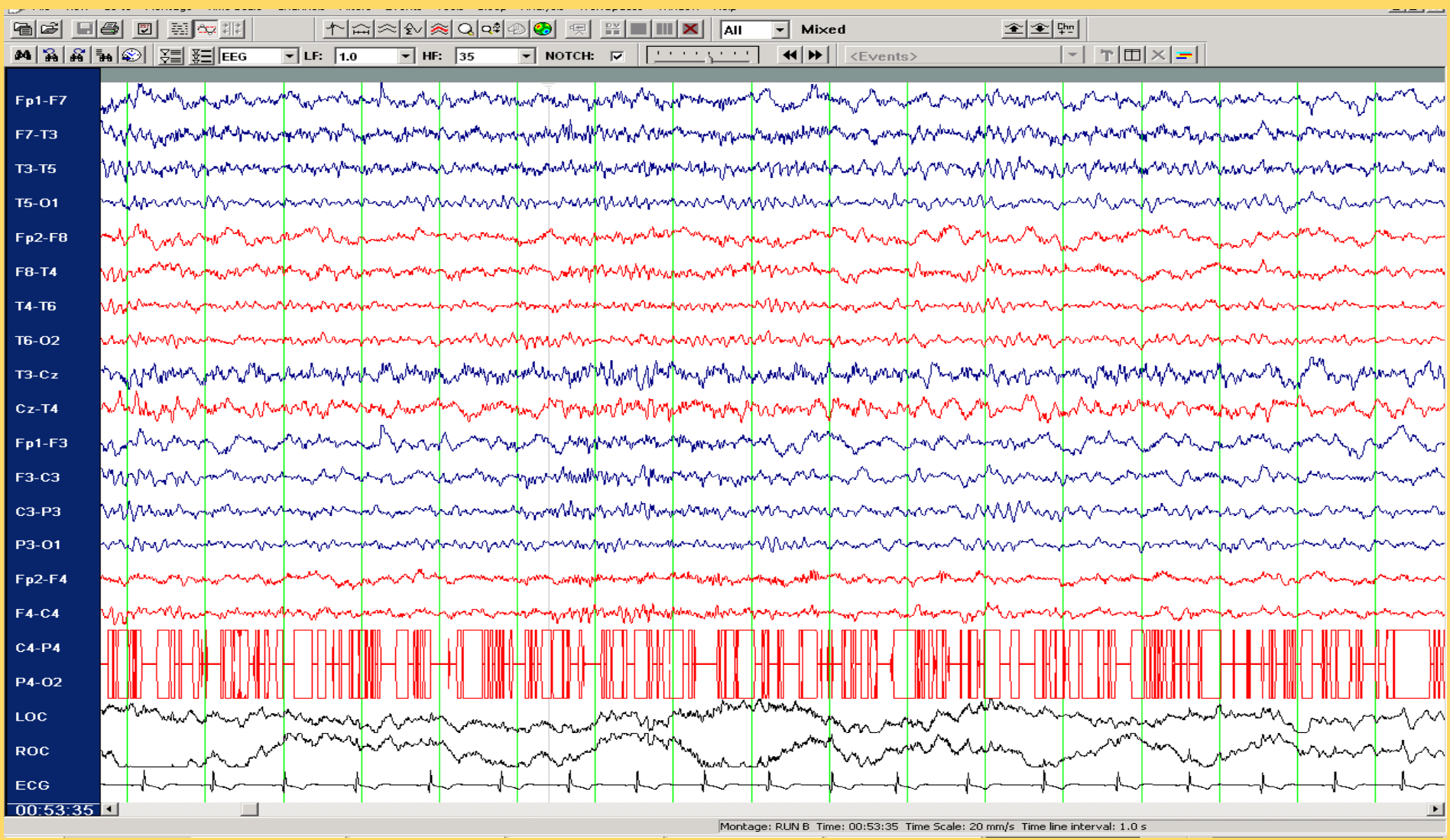
Medial frontal, cingulate gyrus, orbitofrontal, or frontopolar regions

- Complex behavioral events of motor agitation and gestural automatisms; viscerosensory symptoms and strong emotional feelings; motor activity repetitive and may involve pelvic thrusting, pedaling, or thrashing (hypermotor), often accompanied by vocalizations or laughter/crying; seizures often bizarre and may be diagnosed incorrectly as psychogenic
- Watch Test video # 1

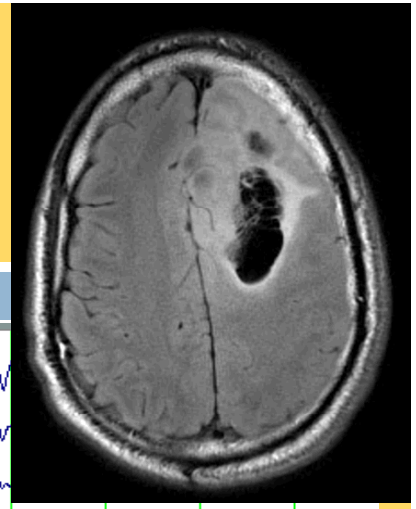
EEG in FLE

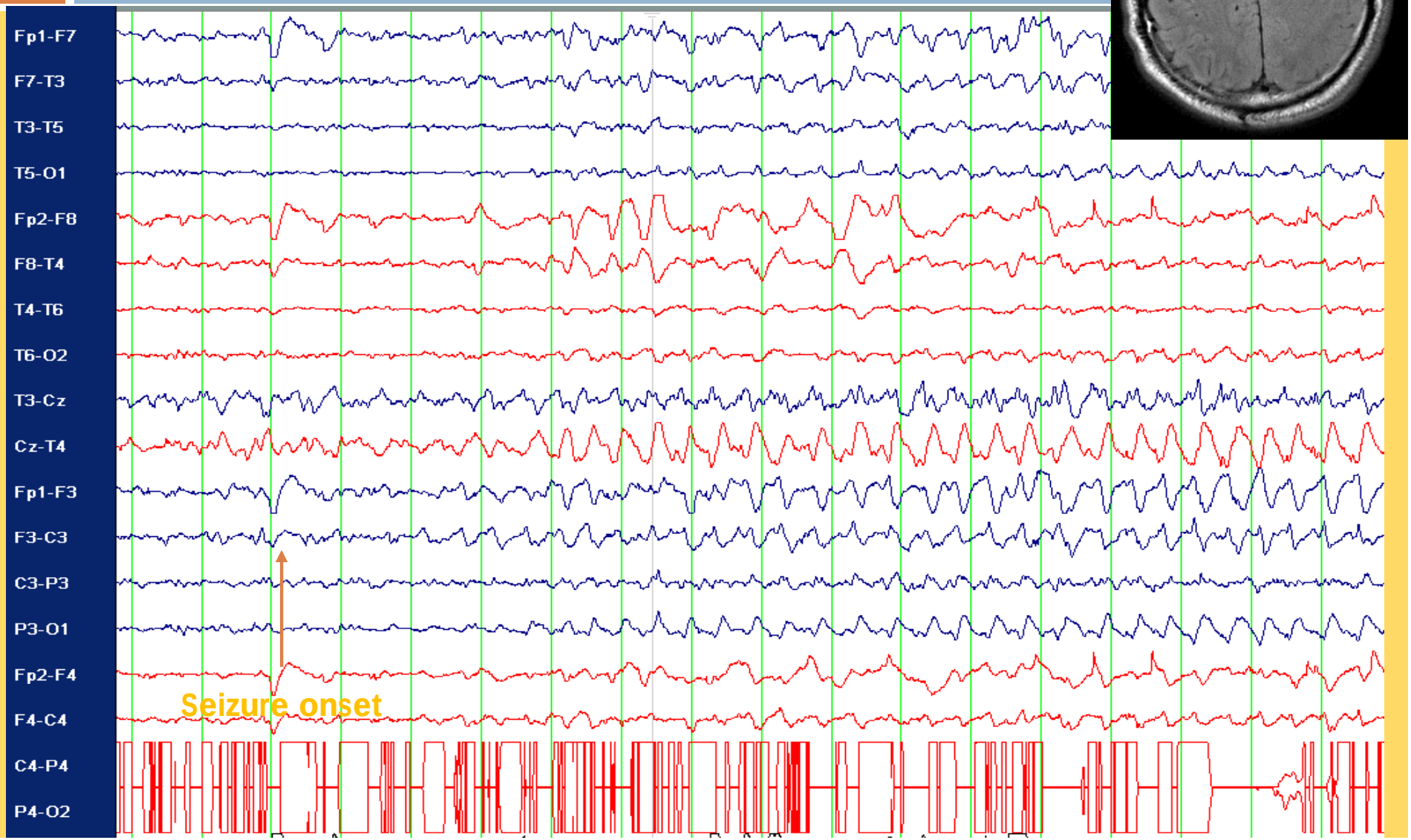
- The scalp EEG in FLE is frequently not localizing
- When epileptiform activity is detected, the spatial resolution and discharge localization is very poor
- As motor manifestations are prominent and sudden, ictal scalp EEG recording is often swamped by muscle artifact and thus uninterpretable. Post-ictal EEG suppression or slowing may be very short and non-localizing
- Intracranial EEG is sometimes attempted, but intracerebral studies suffer from sampling error, only detecting discharges that are very near the electrodes
- Without accurate information to guide electrode placement, this too is often unsuccessful

Inetrictal background 1-4 Hz left frontal slowing



Ictal EEG




Fp1-F7
F7-T3
T3-T5
T5-O1
Fp2-F8
F8-T4
T4-T6
T6-O2
T3-Cz
Cz-T4
Fp1-F3
F3-C3
C3-P3
P3-O1
Fp2-F4
F4-C4
C4-P4
P4-O2
Seizure onset

Post-test

1. A simple partial seizure (SPS) or “aura” involving the lateral temporal lobe (superior temporal gyrus, transverse temporal gyri) might be manifested by which of the following symptoms:
    a. a disagreeable smell (olfactory hallucination)
    b. a feeling of intense familiarity (déjà vu)
    c. an unprovoked sudden feeling of fear
    d. hearing noises or sounds (auditory hallucination)
    e. all of the above are correct
    f. only a, b, and c are correct
2. A simple partial seizure (SPS) or “aura” involving the left (dominant) frontal lobe might be manifested by which of the following symptoms:
    a. a speech arrest (expressive or nonfluent aphasia)
    b. a feeling of intense familiarity (déjà vu)
    c. rhythmic jerking of the right face and hand
    d. numbness and tingling on the left side of the face and body
    e. all of the above are correct
    f. only a and c are correct
3. Video-EEG monitoring shows a 32-year-old right handed man who has epigastric rising sensation that is followed by unresponsiveness and orobuccal automatisms. The patient then has a versive head turn to the left and secondary generalization. What is the most appropriate localization of the seizure onset in this patient?
    a. Right temporal lobe
    b. Right frontal lobe
    c. Left temporal lobe
    d. Left frontal lobe
    e. Left medial frontal lobe

Post-test Question # 4

Watch the Test Video #3 and select the most likely diagnosis for the patient

a. Right temporal lobe
b. Right frontal lobe
c. Left temporal lobe
d. Left frontal lobe
e. Left medial frontal lobe

Post-test Question # 5

Watch the Test Video # 4 and select the most likely diagnosis for the patient

a. Pseudoseizure
b. Temporal lobe seizure
c. Frontal lobe seizure
d. REM behavior disorder
e. None of the above