

NEUROLOGICAL LOCALIZATIONS USING “ICTAL SIGNS” (VIDEO ILLUSTRATION)

- SIMPLE & COMPLEX ICTAL SIGNS
- DIFFERENTIATION BETWEEN ICTAL SIGNS AND SEIZURE MIMICS



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PAROXYSMAL NEUROLOGICAL DISORDERS

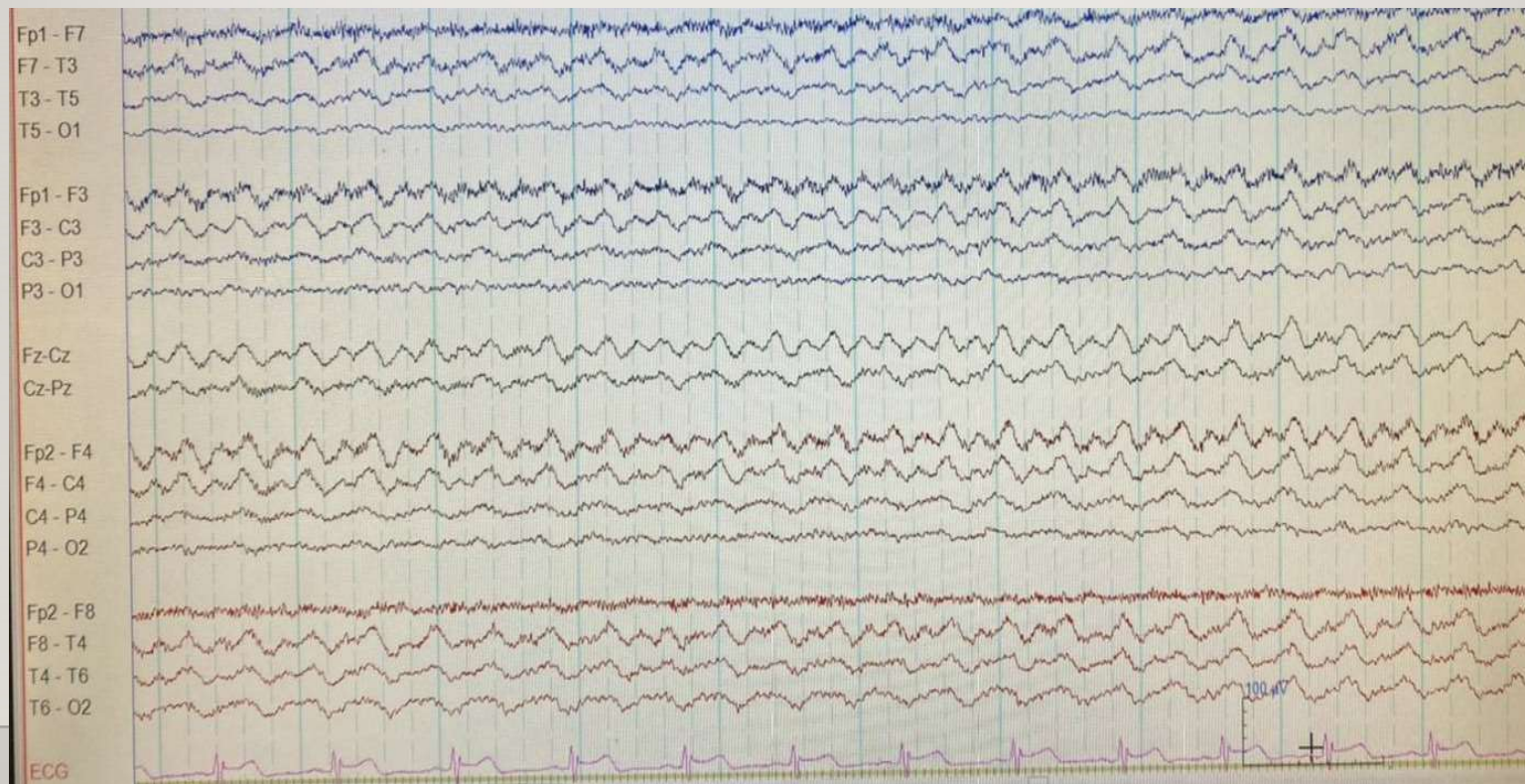
- Epilepsy ***
- Movement disorders **
- Psychological conditions *
- Neuro-vascular disorders *
- Miscellaneous
 - Sleep related disorders
 - Paroxysmal headaches
 - Paroxysms in multiple sclerosis

WHAT IS THIS?

For Education only

- Video 1
- Video 2
- Video 3

EXTREME DELTA BRUSH IN ANTI-NMDA RECEPTOR ENCEPHALITIS



WHAT IS THIS?

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- Video 4
- Video 5
- Video 6

SOME CLINICAL SEMIOLOGICAL FEATURES OF EPILEPTIC AND CONVERSION

	Conversion	ES
Duration>2 min	Common **	Rare
Stereotyped attacks	Common	Common
Major features		
Gradual onset	Common **	Rare
Fluctuating course	Common **	Very rare
Thrashing, violent movements	Common **	Rare
Side to side head movement	Common **	Rare
Asynchronous movements	Common **	Very rare
Eyes closed	Common **	rare

SOME CLINICAL SEMIOLOGICAL FEATURES OF EPILEPTIC AND CONVERSION

Major features	Conversion	ES
Pelvic thrashing	Occasional	Rare
Opisthotonus	Occasional	Very rare
Automatism	Rare	Common
Weeping	Occasional	Very rare
Incontinence	Occasional	Common **
Injury		
Biting inside of mouth	Occasional	Common **
Severe tongue biting	Very rare	Common **
Recall for period of unresponsiveness	Common **	Very rare

Mellers JDC, Postgrad Med J 2005.

EXAMINATION PROCEDURES

	Finding in conversion
Drop patient's hand over their face	Hand falls to the side
If eyes closed, attempt to open them	Resistance to eye opening
If eyes open	
Place mirror in front of patient	Evidence of visual fixation
Roll patient from side to the other	Henry and Woodruff sign
Corneal reflex	Intact
Plantar reflex	Intact

Mellers JDC, Postgrad Med J 2005.

	Syncope	Seizures
Triggers	Frequent	Rare
Preceding symptoms	Nausea, visual blurring, epigastric sensation, heat, headache, tinnitus	Sensorial, psychic, somatosensory 'auras' or motor phenomena
Position	Usually while standing or sitting; supine very rare	Any
Blanks	'Fading away' in young patients or abrupt loss in elderly persons	Abrupt loss
Fall	Slow, flaccid	Fast, tonic
Skin color	Pale	Sometimes acrocyanosis
Eye deviation	Transient upward or lateral deviation	Sustained lateral deviation
Incontinence	Common	Common
Tongue bite	Uncommon; localization: on the tip of the tongue	Common; localization: on the side of the tongue
Convulsions	Lasts few seconds, arrhythmic, multifocal or generalized	May last few minutes, rhythmic, generalized
Duration	3–30 s	Depends on the type of seizures: up to 5 min for GTCS and shorter for others
Postictal period	Somnolence, headache (no longer than 2 h in most cases)	Confusion, somnolence, headache

GTCS — generalized tonic-clonic seizure

CONCLUSION FOR SEIZURE MIMICS

Aware some patterns of recognition

What is this?

- Video 7
- Video 8
- Video 9
- Video 10
- Video 11
- Video 12



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Gratification disorder

Infantile masturbation

- Age onset: 3 mo-3 yr (upto 5 yr), mean 10.5 mo
- Stereotype episodes of variable duration
- Vocalization with quiet grunting
- Facial flushing with diaphoresis
- Pressure on the perineum with the characteristic posturing of lower extremities (e.g. rocking with crossed legs)
- No LOC, cessation with distraction

Shuddering

- Shivering episode mainly involve head, neck, shoulder and occasionally trunk

“ice cube was dropped down their back”

- No impairment of consciousness; staring but alert
- Abrupt onset, 5-15 seconds
- Infancy to early childhood
- Precipitated by fear, anger

Catatonia

- Psychogenic motor immobility
- Unresponsiveness to external stimuli in a person who is apparently awake
- Associated with psychological condition, autoimmune disorder, alcohol & benzodiazepine withdrawal, neuroleptic malignant syndrome
- S&S; mutism, negativism, echopraxia, echolalia, waxy flexibility, withdrawal
- Rx benzodiazepine, underlying disease

Narcolepsy with cataplexy

- Excessive daytime sleepiness
- Cataplexy: sudden loss of tone precipitated by emotion
- Sleep paralysis
- Sleep onset/offset hallucination
- Inv: Overnight polysomnography + multiple sleep latency test, MRI brain

What is this?

- Video 13



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Courtesy of Dr. Chaiyos Khongkhatithum

Gelastic seizures

- "laughing or giggling"
- Hypothalamic hamartomas (50%), anterior cingulate, frontal, parietal and temporal lobes.



Evaluation of a seizure-like event

Seizure vs mimickers

- History, video

Seizure classification

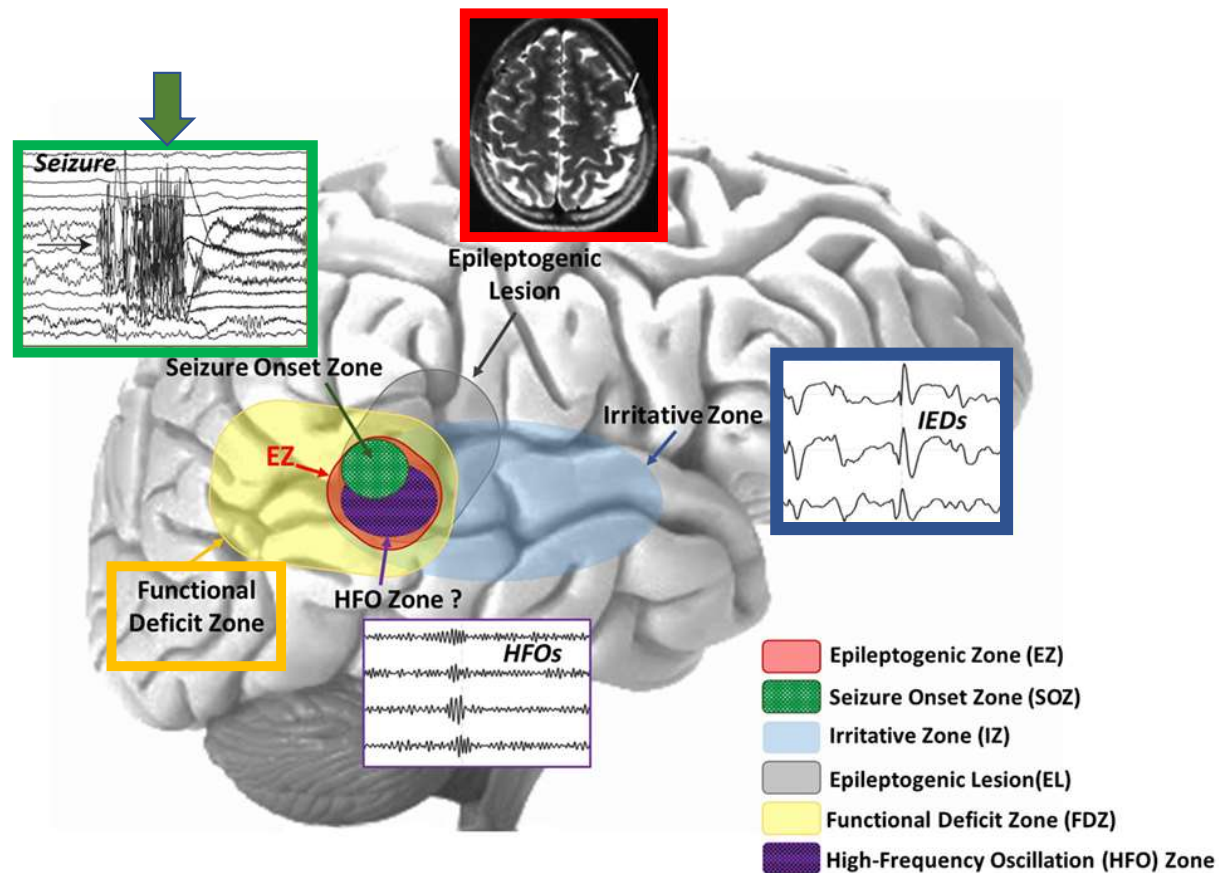
Focal* vs Generalized

- History, video
- EEG (ictal and interictal), MRI

Localization and/or Lateralization

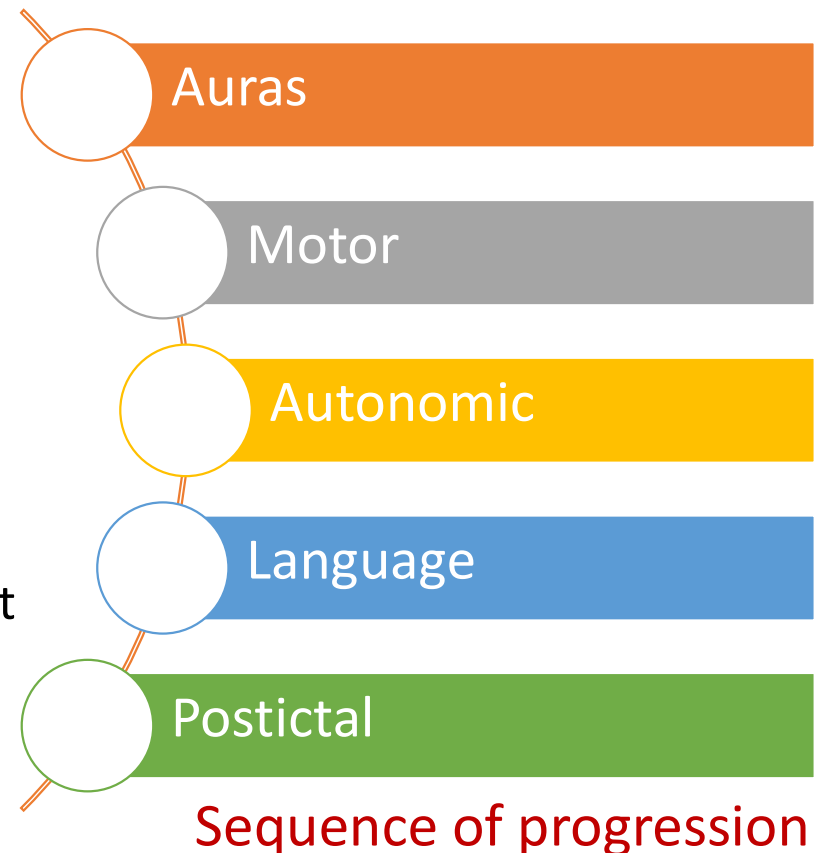
- Surgical treatment
- Lobar localization, hemispheric lateralization

Symptomatogenic Zone in Focal Epilepsy



Seizure semiology

- Semiology can give
 - localization (frontal, temporal, occipital, etc)
 - lateralization
- Simple and cost effective particularly important in cases of MRI negative focal epilepsy.
- Symptomatogenic zone, overlaps or is in close proximity of the epileptogenic zone
 - Epileptic activity may spread from a “silent” cortical area into a different cortical area that actually produces symptoms.
- May be misleading in patients with large intracranial lesions due to atypical functional cortical representation

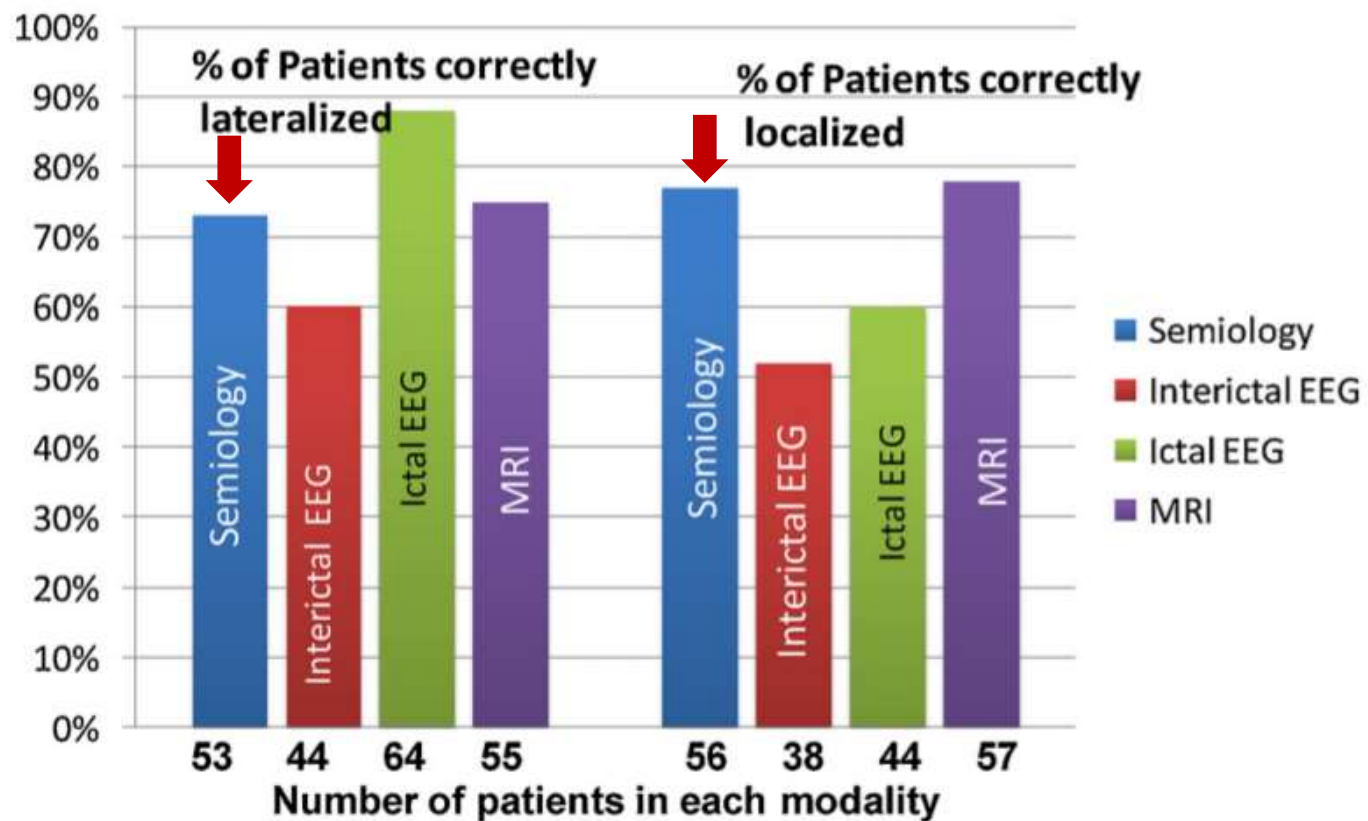


Signs for Localization

Ideally the signs used for localization should fulfill these criteria;

- 1. Easy to identify and have a high inter-rater reliability**
- 2. It has to be the first or one of the earlier components of the seizure in order to have localizing value**
 - Later symptoms or signs are more likely to be due to ictal spread and may have only a lateralizing value.
- 3. The symptomatogenic zone corresponding to the recorded ictal symptom has to be clearly defined and well documented.**
 - Reproducibility of the initial ictal symptoms with cortical stimulation identifies the corresponding symptomatogenic zone.

Lateralizing and Localizing value of presurgical evaluation



Age-dependent seizure semiology: TLE

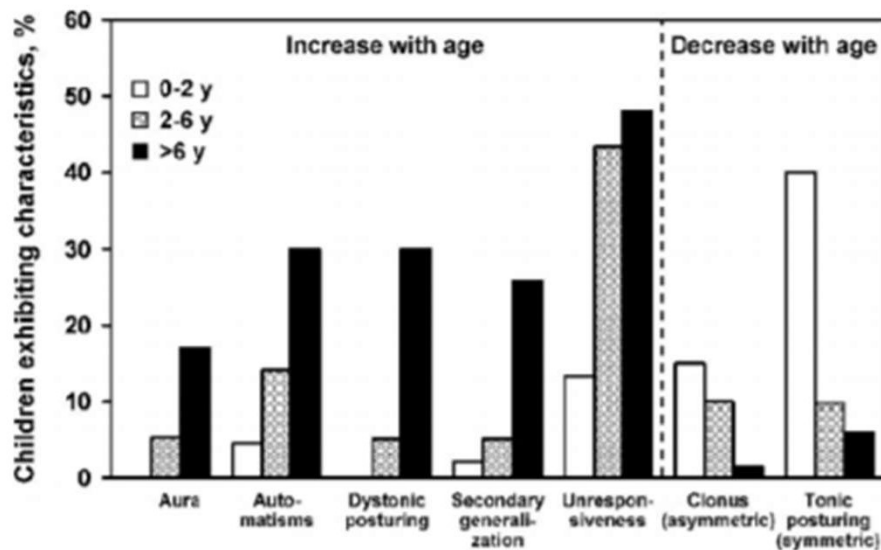
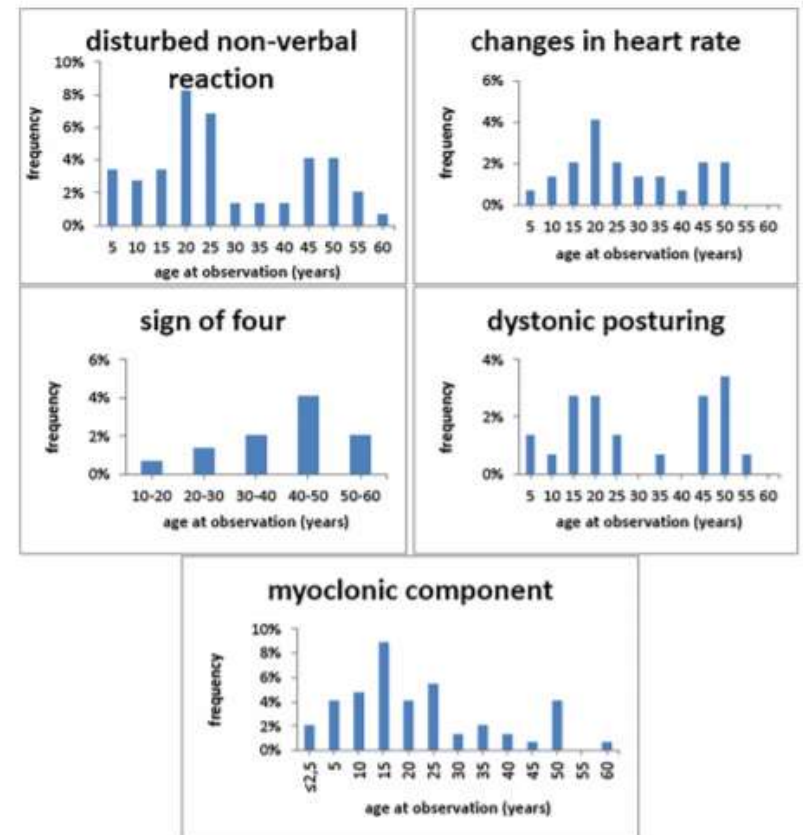


FIGURE 2. Seizure characteristics that change with age. (Modified from Nordli et al., 2001. Used with permission.)

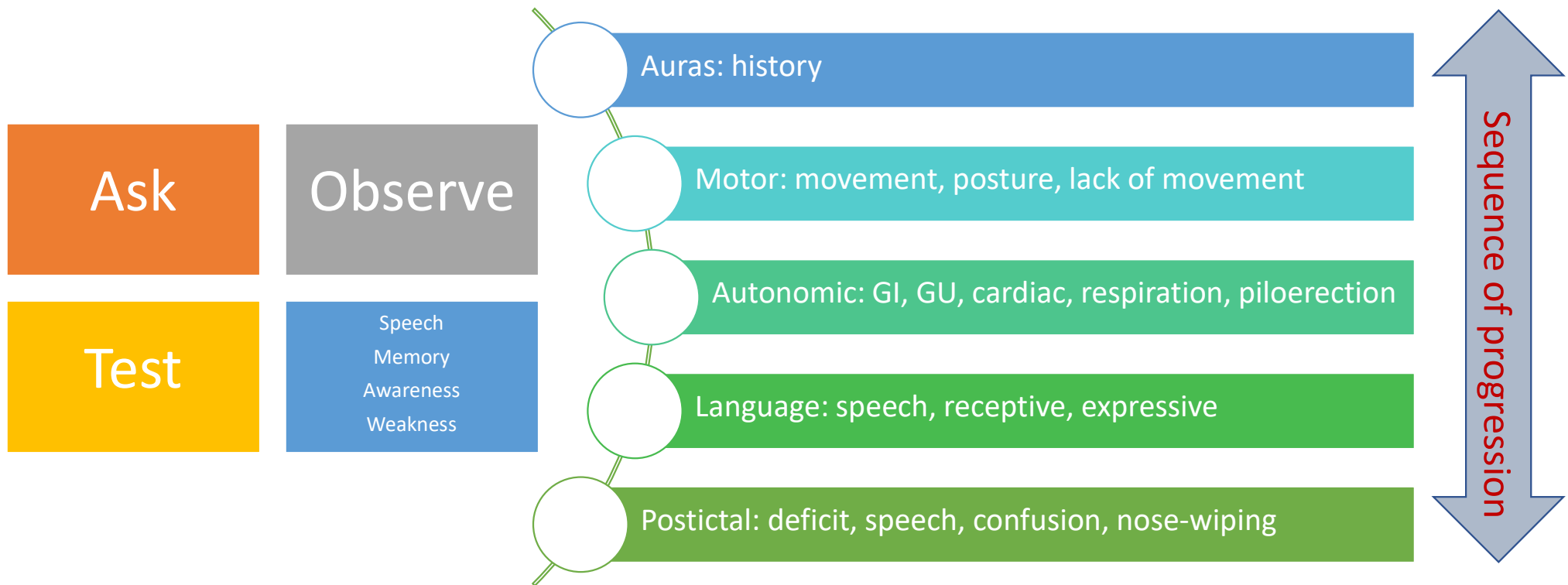
- Children under 3 to 4 y tend to have prominent tonic, clonic, or myoclonic movements that may be bilateral and symmetric, resembling generalized epilepsy.
- Automatism less elaborate and restricted to the orobuccal region.
- After age 6, the manifestations of TLE are similar to those of adults.

Age-dependent semiology: FLE

- Changes in the frequency of both, motor and non-motor semiological elements.
- Lateralized motor signs like dystonic posturing, sign of four and version were more common with increasing age.
- Age-dependent alterations in phenomenology may reflect maturation in connectivity and seizure propagation within and beyond the frontal lobe, and affect the localizing and lateralizing value of ictal phenomena.



Seizure semiology



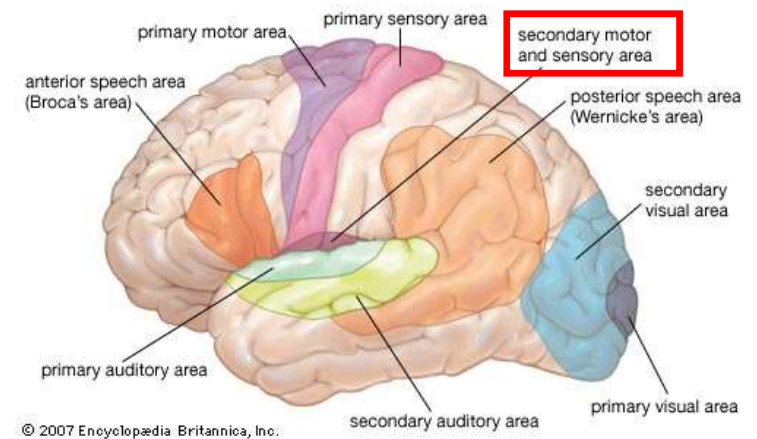
Somatosensory auras

Primary sensory cortex

- Abnormal sensations: tingling, numbness
- Limited to clearly defined somatosensory region
- **Unilateral, distal distribution, sensory march****

Secondary sensory motor area

- Superior bank of the Sylvian fissure
- Posterior insula
- Bilateral and widespread sensations
- Stimulation → unpleasant sensations of heat or pain.
- ❖ "all body sensations": no localizing



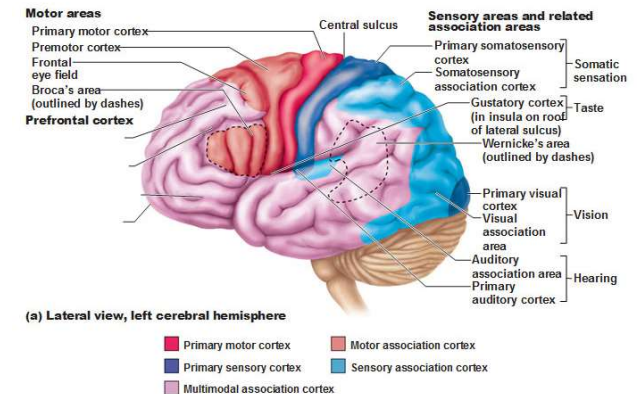
Visual auras

Visual hallucinations: Broadmann's area 17 and 18

- Flashing lights of different colors, blink and move in the visual field.
- In front of both eyes >> lateralized to one visual field
- Amaurosis

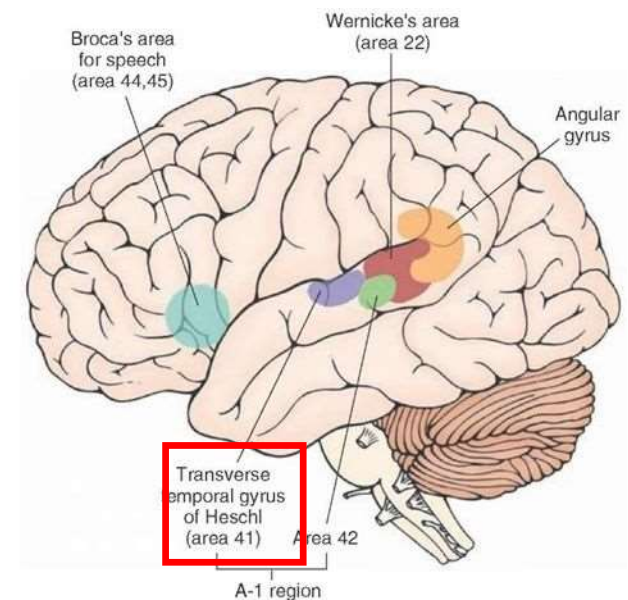
Complex visual hallucinations and visual illusions:

- Association cortex (parieto- temporal) or the adjacent lobes
- Frequently are part of psychic auras.



Auditory auras

- Simple auditory hallucinations, like hearing a "buzz" or a "noise"
- Heschl's gyrus the superior temporal gyrus.
- Not lateralizing



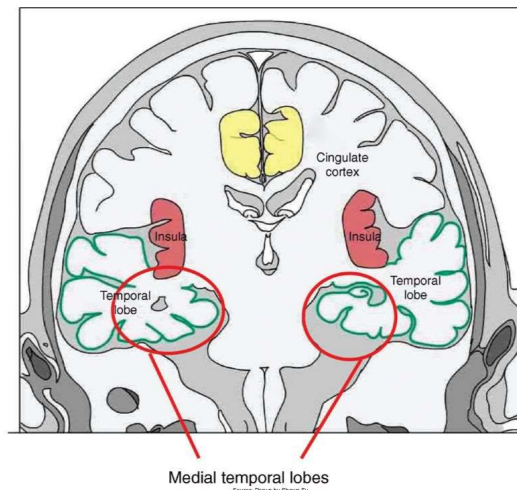
Olfactory and Gustatory auras

Olfactory auras

- Unpleasant smells.
- Most frequently seen in mesial temporal lobe epilepsy
- Not lateralizing

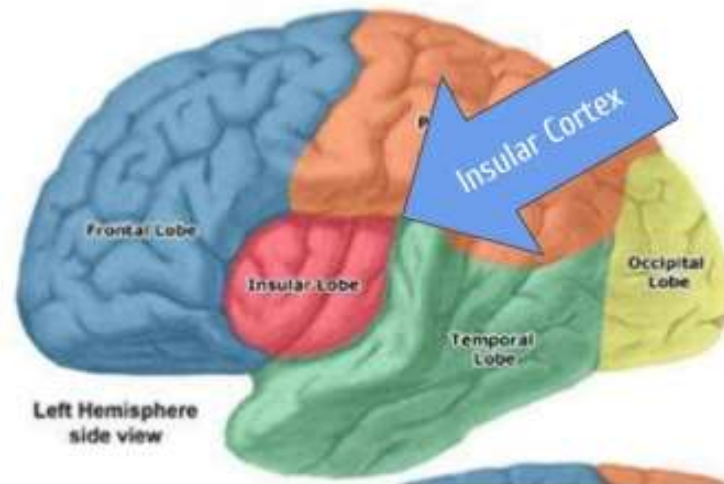
Gustatory auras

- Unpleasant taste.
- Insula
- Not lateralizing.



Autonomic auras

- Subjective sensations suggesting possible autonomic alterations such as palpitations, sweating, "goose bumps", etc.
- Insular cortex



Peri-ictal headache

- The headache was more likely to be ipsilateral to the seizure onset focus in temporal lobe epilepsy (90% of cases)
- Headache in non-temporal lobe epilepsy was not lateralizing.
- Mechanism: unclear, suggested vasodilation and postictal hyperemia with subsequent activation of the trigeminal nervous system

Aura: Localization and Lateralization



Auras	Symptomatogenic zone	Localization	Lateralization
Somatosensory	Primary somatosensory area	P	CL
	Secondary somatosensory area SSMA	P, T T, F	IP (if unilateral) CL
Simple visual	Primary visual cortex	O	CL
Complex visual	Temporo-occipital junction, basal temporal	T, O	CL (if unilateral)
Simple auditory	Primary auditory cortex	T	CL (if unilateral)
Complex auditory	Auditory association cortex	T	CL (if unilateral)
Vertiginous	Temporo-occipital junction	T	NL (R>L)
Olfactory	Orbitofrontal, amygdala, insula	MT, F	NL
Gustatory	Parietal operculum, basal temporal	T	NL
Autonomic	Insula, amygdala, ant cingulum, SSMA	T, F	NL
Abdominal	Ant insula, frontal operculum, mesial tempora, SSMA	MT	NL
Fear	Amygdala, hippocampus, mesial frontal	T, F	NL
Déjà vu/jamai vu	Uncus, entorhinal cortex, temporal neocortex	T	NL (nondominant)

CL contralateral, IP ipsilateral, NL nonlateralized, MT mesial temporal

Foldvary-Schaefer N, Unnwongse K. Epilepsy & Behavior 2011.

Ictal motor manifestations

- Version
- Clonic and tonic activity
- Unilateral epileptic spasms
- Dystonic posturing
- Unilateral automatisms
- Automatisms with preserved responsiveness
- Misc: ictal spitting and vomiting, emotional facial asymmetry, unilateral eyeblinking, ictal nystagmus, and akinesia

Lateralizing language features

Semiology	Localization	Lateralization
Ictal speech	Temporal	Nondominant
Ictal aphasia, dysphasia		Dominant
Ictal speech preservation		Non-dominant
Postictal dysphasia		Dominant
Ictal vocalization	Frontal	NL

Lateralizing postictal features

- Postictal paresis (Todd's palsy)
- Postictal hemianopia
- Postictal aphasia and dysphasia
 - difficult to differentiate between postictal confusion and aphasia.
 - Language and speech testing for expressive, receptive, and global aphasia is crucial
- Postictal nose wiping
 - Within 60 seconds of the end of the seizure
 - TLE (53%), ipsilateral (92%)
 - Ipsilateral in 54.5% of patients with extratemporal lobe epilepsy
 - Activation of the central autonomic network, in particular, the amygdala, has been suspected of causing nasal secretions

Lateralizing postictal features

- Postictal disorientation
 - Prolonged spatial disorientation was more observed after right temporal seizures
- Postictal flattened affect
 - 40% of right hemispheric seizures and 12.5% of left hemispheric seizures
- Ipsilateral tongue biting
 - Focal > generalized epilepsy
 - contralateral genioglossus muscle activation, causing deviation of the tongue to the opposite side

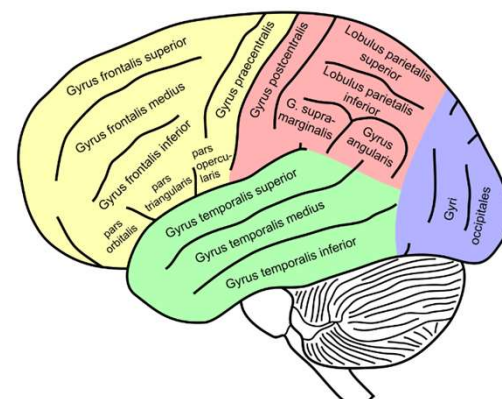
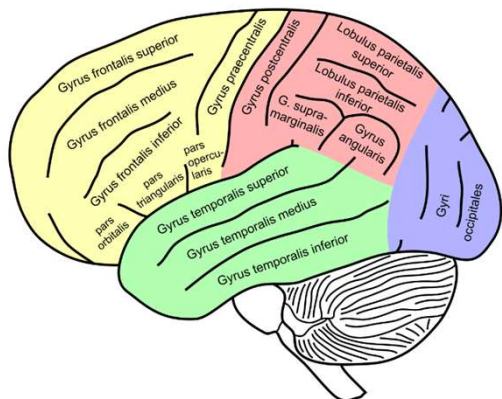
Lateralizing postical features

Peri-ictal water drinking

- during a seizure or up to 2 minutes after a seizure in patients with nondominant temporal lobe epilepsy
- propagation of mesial temporal epileptiform discharges via pathways between the hypothalamus and the mesial temporal structures causes water drinking to quench the thirst caused by an epileptiform discharge

Postictal verbal and visual memory impairment

- TLE
- disturbance of memory consolidation in the mesial temporal region



Semiology – Ictal signs

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Prasat Neurological Institute

What is ictal signs?

- Video 14

For teaching only
Do not duplicate

Ictal hyperventilation

Mesial Frontal

What is ictal signs?

- Video 15

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Ictal Asystole

Mesial temporal

What is ictal signs?

- Video 16

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Ictal Splitting

ND Temporal

What is ictal signs?

- Video 17

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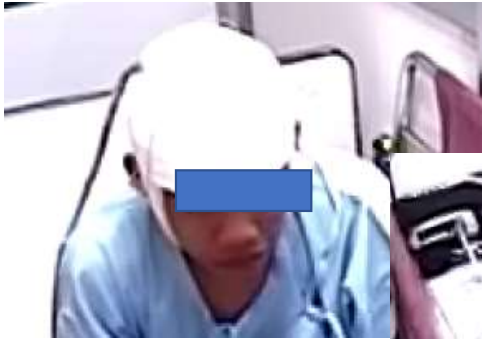
Sleep related Hypermotor Sz
(SHE)

Frontal lobe
(orbitofrontal)

What is ictal signs?

- Video 18



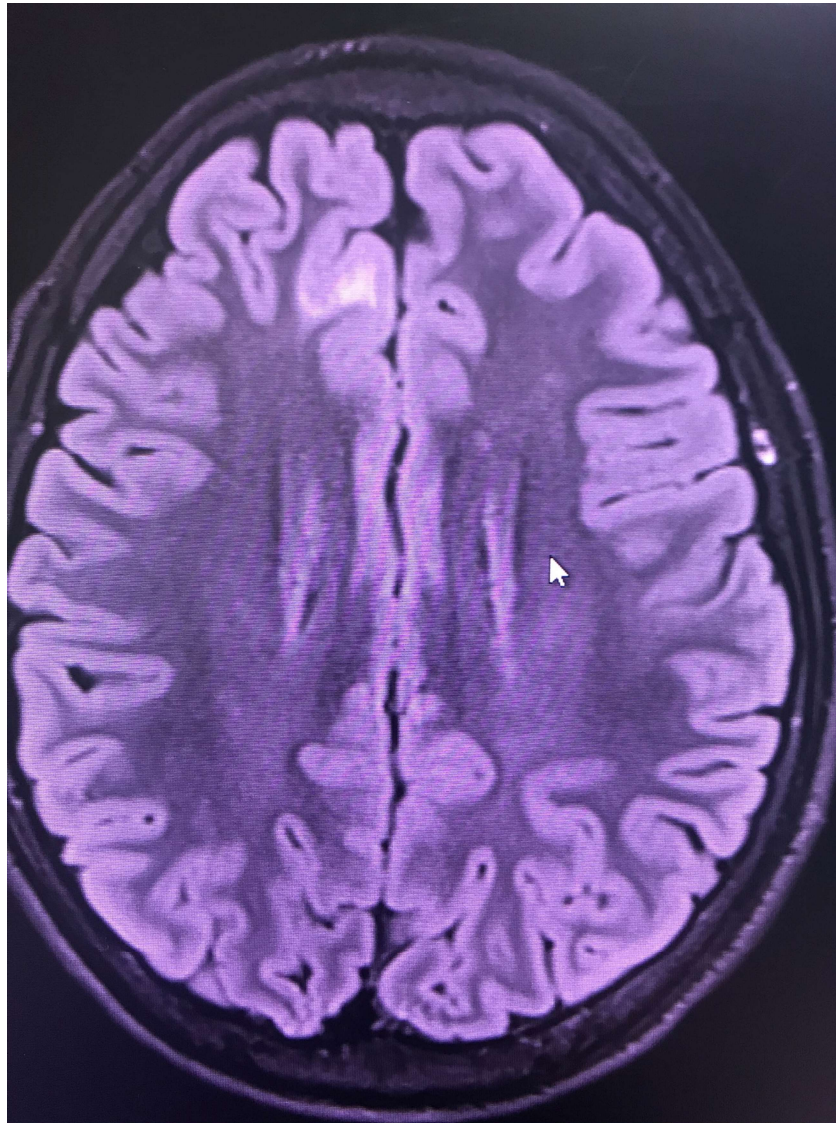


Ictal Signs

- Ictal Pouting
- Axial Tonic
- Versive
- Hypermotor

MRI

- FCD, Right Frontal



What is ictal signs?

- Video 19
- Video 20



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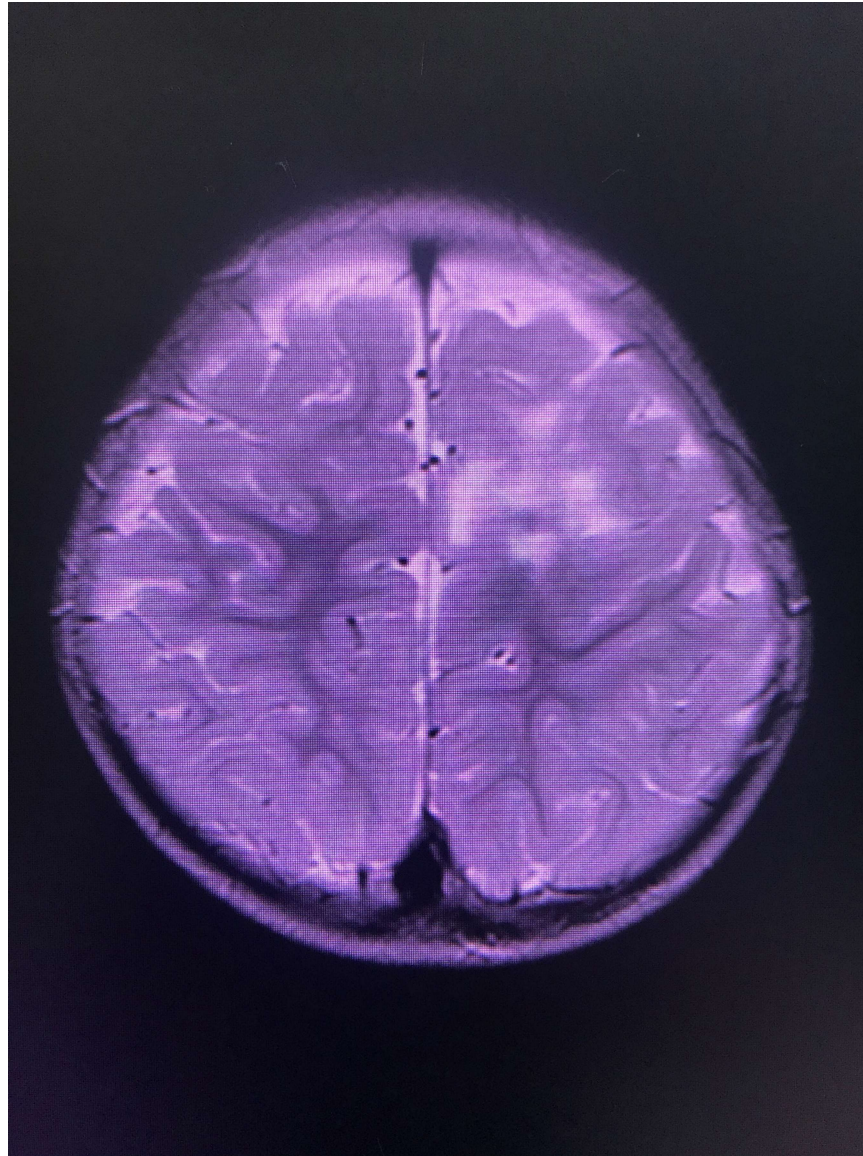
Ictal Signs

- Dystonic
- Akinetic



MRI

- Tumor at precentral gyrus



What is ictal signs?

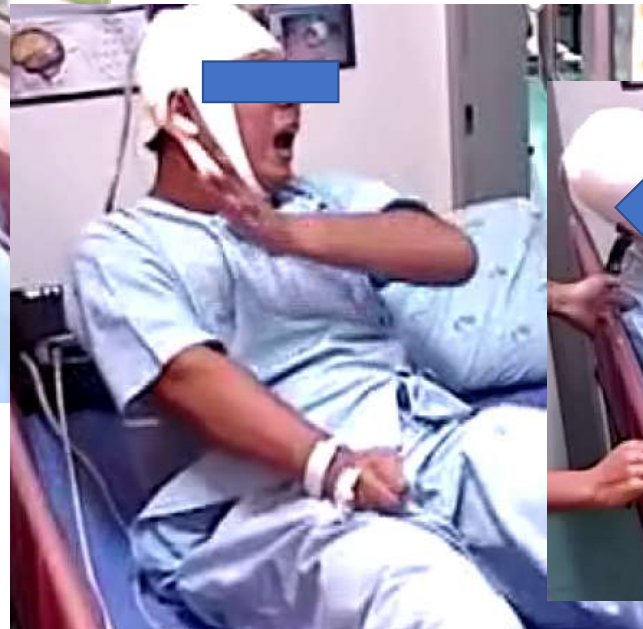
- Video 21



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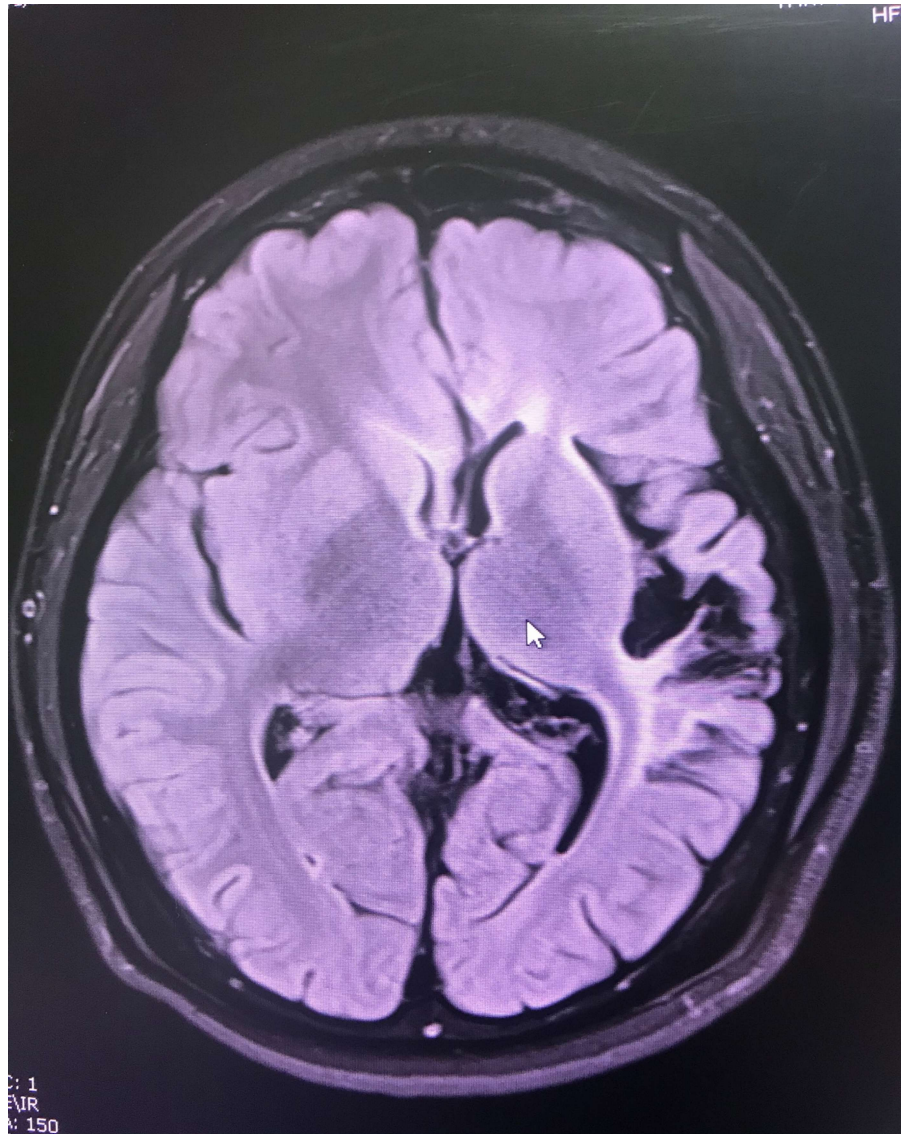
Ictal Signs

- Automotor
- Versive
- Figure of 4
- GT=>GTC



MRI

- Encephalomalacia



What is ictal signs?

- Video 22



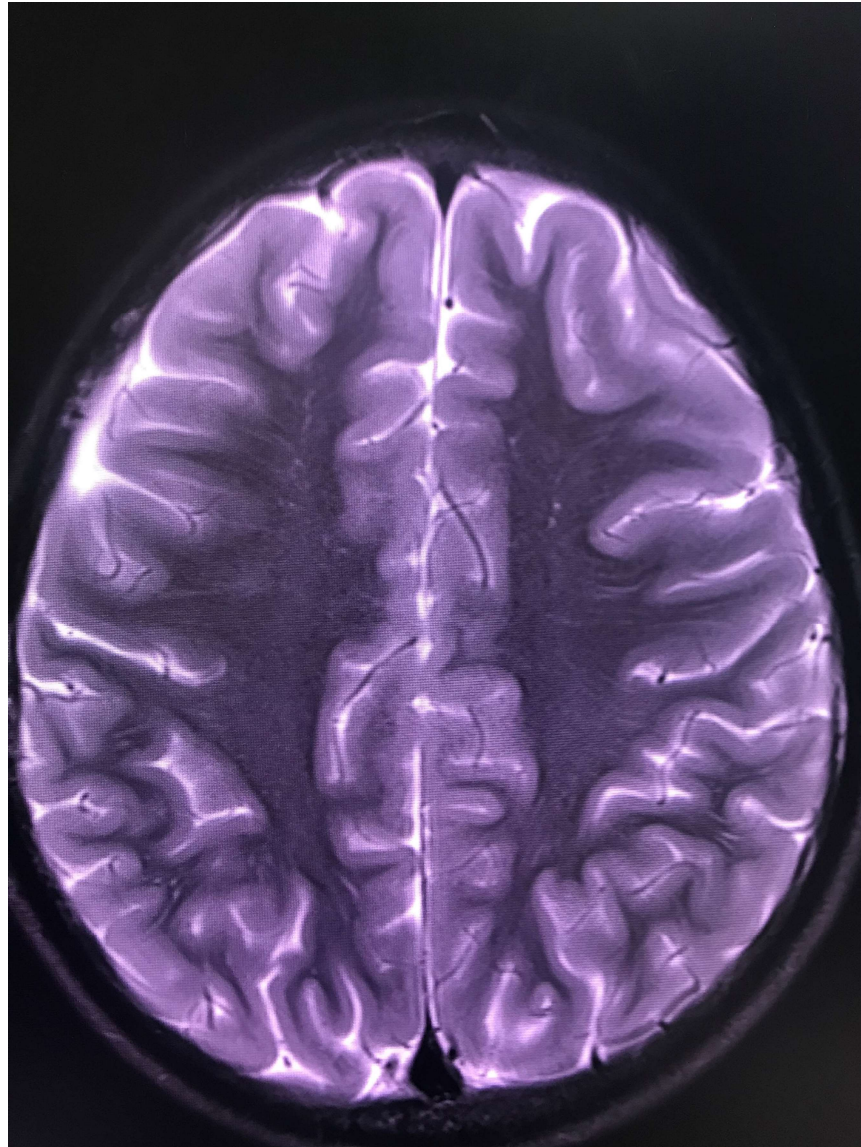
Ictal Signs

- Numbness, LH



MRI

- FCD, Right Parietal



What is ictal signs?

- Video 17

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Somatosensory aura

Primary
somatosensory cortex,
SSMA

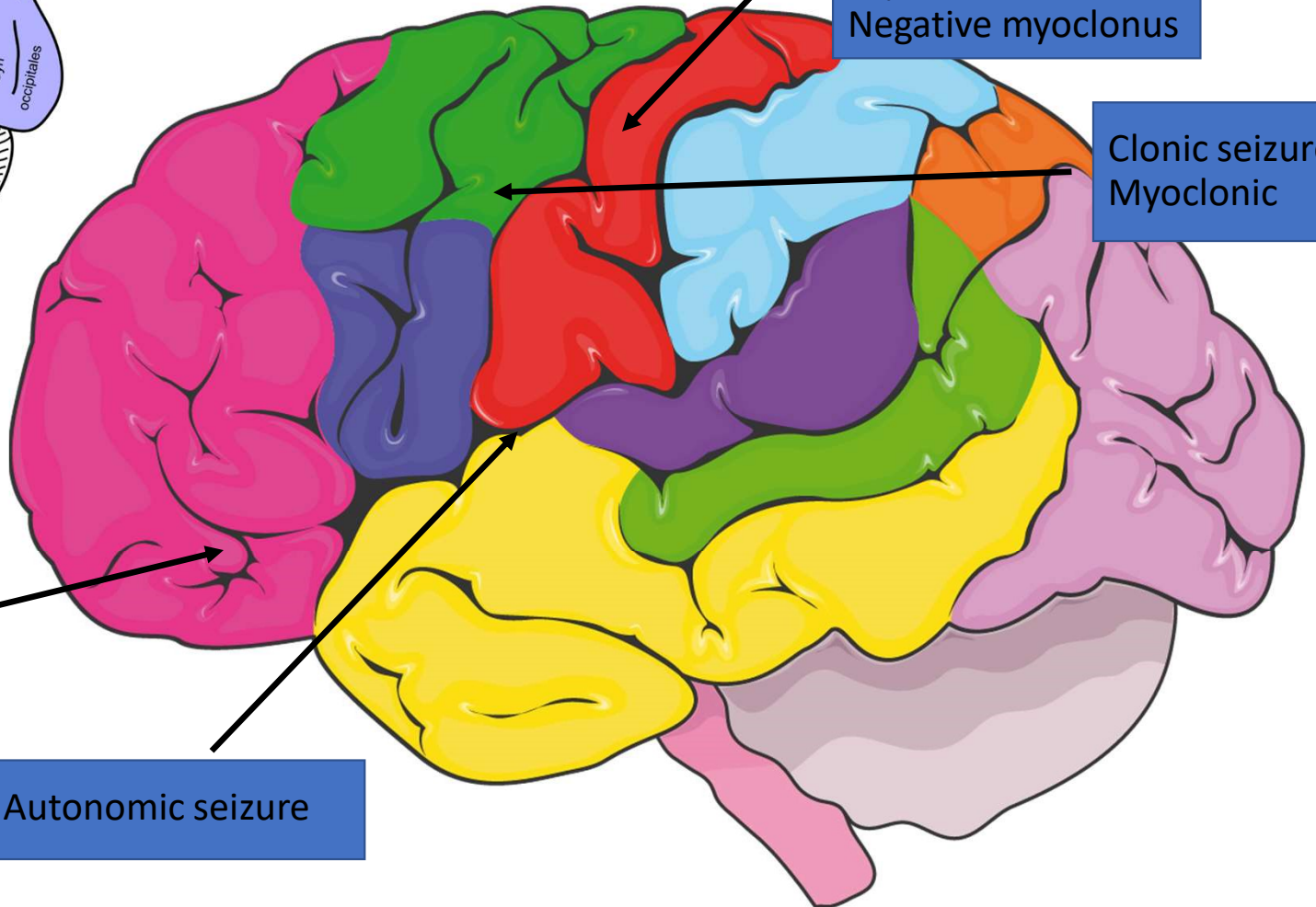
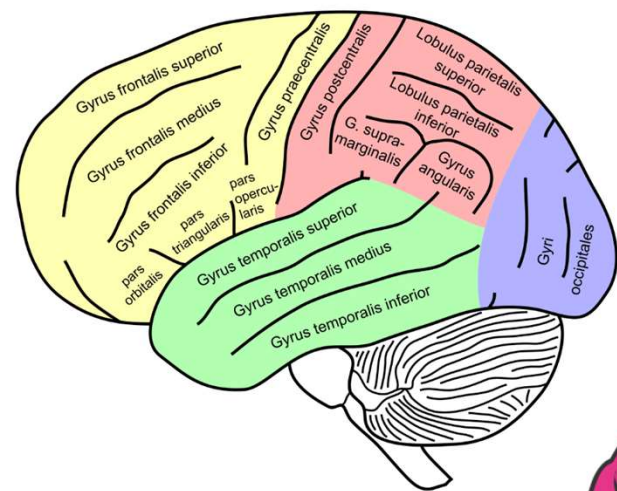
Seizure

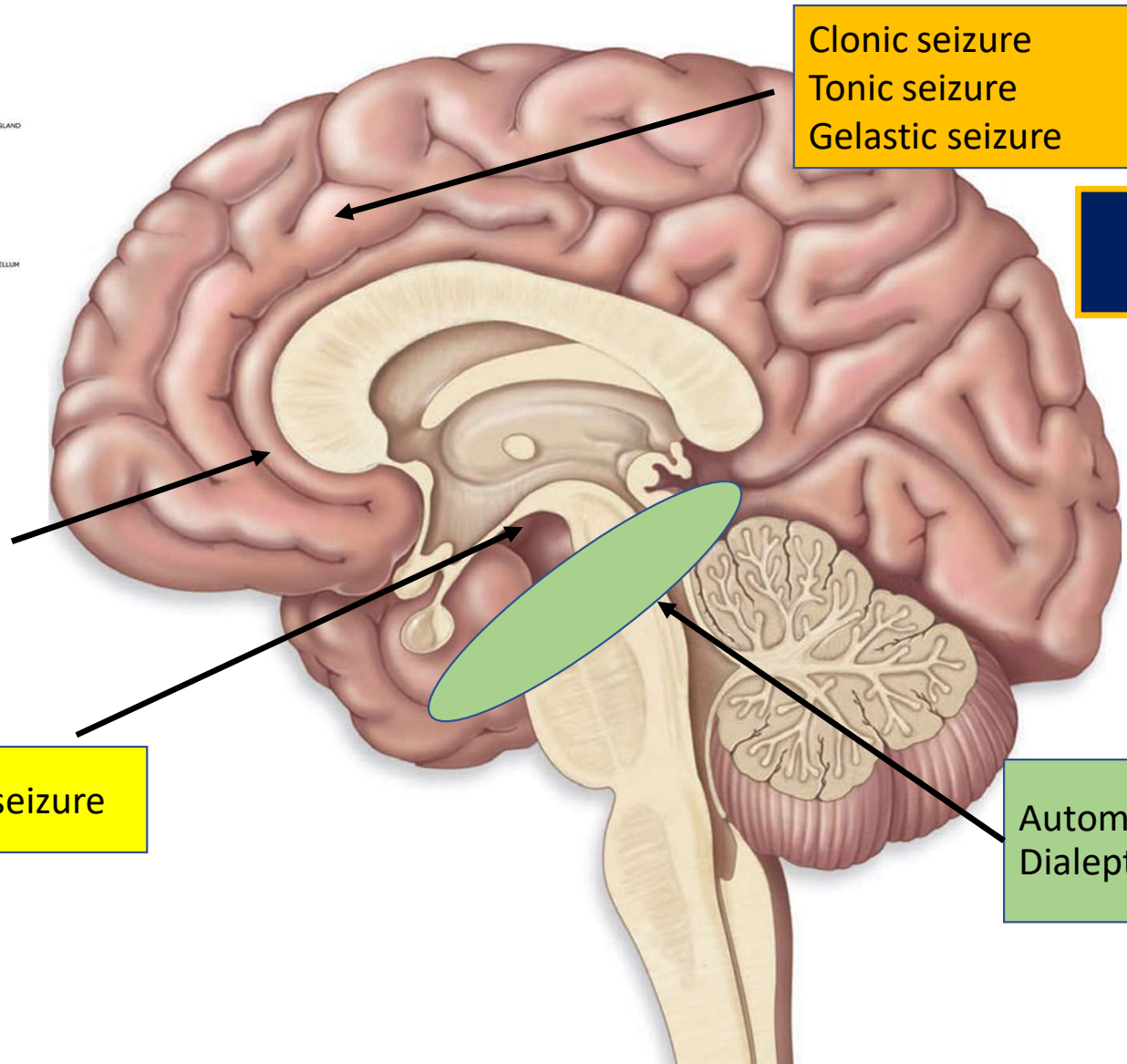
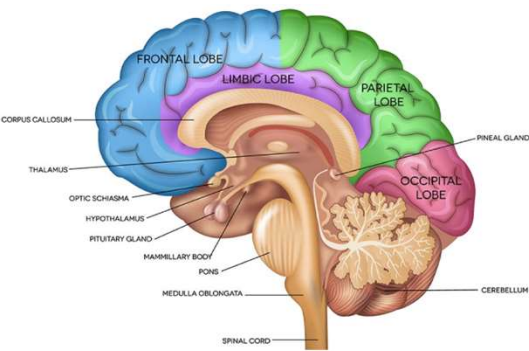
Clonic seizure
Tonic seizure
Myoclonic seizure
Negative myoclonus

Clonic seizure
Myoclonic

Hypermotor seizure
Dialeptic seizure

Autonomic seizure





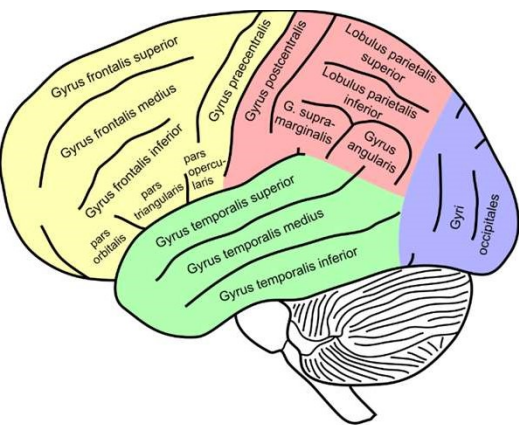
Clonic seizure
Tonic seizure
Gelastic seizure

Seizure

Autonomic seizure
Automotor seizure
Hypermotor seizure
Dialeptic seizure

Insula
Autonomic seizure

Automotor seizure
Dialeptic seizure



BSG

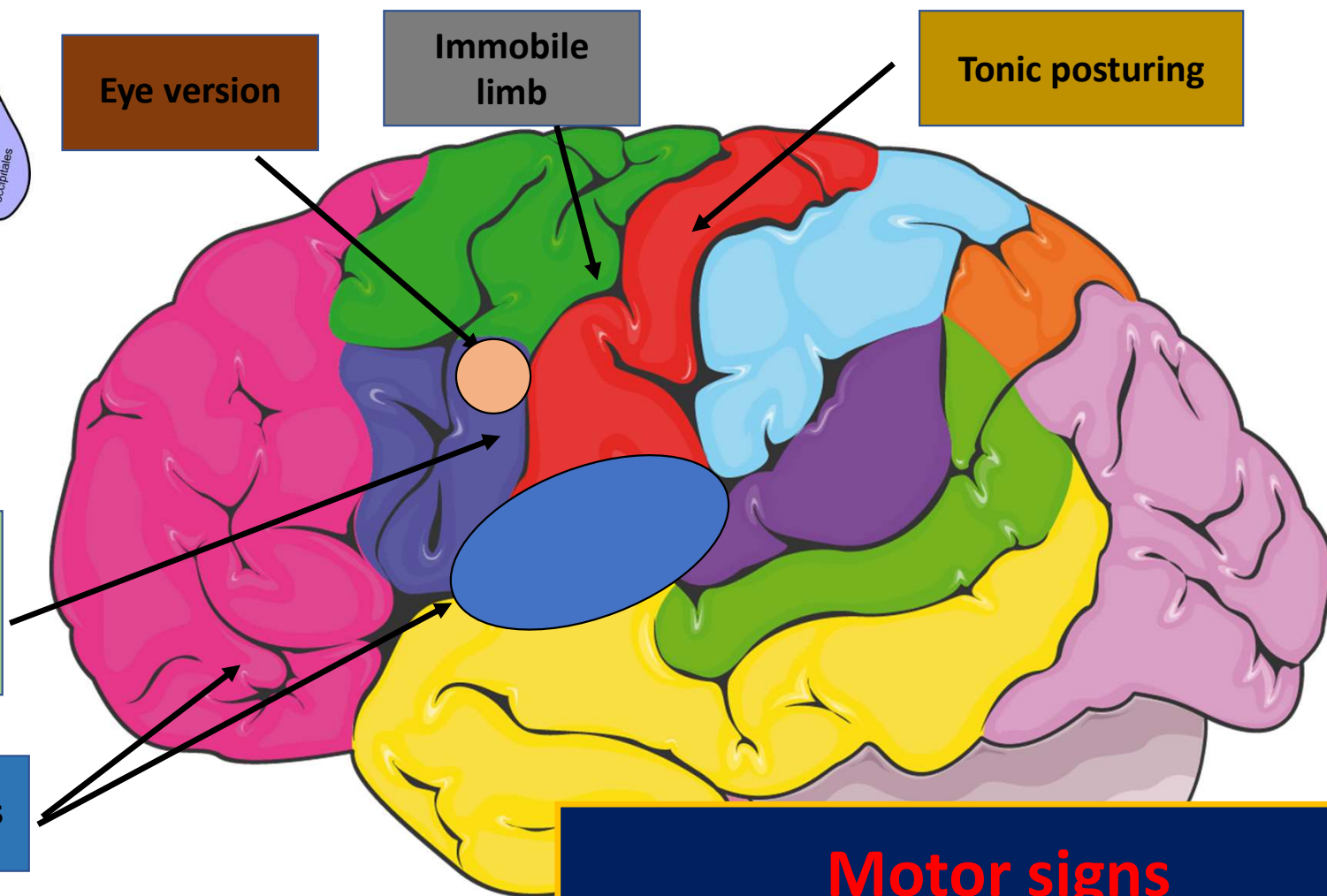
Dystonic limb
Tonic posturing
Head turning

Facial alterations

Eye version

Immobile limb

Tonic posturing



Motor signs
In Complex motor Seizure

Common lateralising seizure manifestations

Symptom	Localisation	Specificity	Frequency*
Forced head turn ("version")	Contralateral	>90%	35-40%
Unilateral dystonic posturing	Contralateral	>90%	20-35%
"Figure of Four"	Contralateral	90%	65% (sGTCS)
Postictal nosewiping	Ipsilateral	>70%	10-50%
Ictal speech**	Nondominant	>80%	10-20%
Ictal automatisms with preserved awareness	Nondominant	100%	5%
(Post)ictal dysphasia	Dominant	>80%	20%

***In patients referred for presurgical video telemetry**

Less common lateralising or localising seizure manifestations

Symptom	Localisation	Specificity	Frequency
Elementary visual aura	Contralateral occipital	>90%	?
Acoustic aura	Temporal, if unilateral then contralateral	>90%	?
Olfactory aura	Mesiotemporal	>70%	?
Abdominal aura	Temporal	90%	Common
→ Automotor sz	Temporal	98%	
Ictal aphasia	Dominant	>80%	?
Ictal nystagmus	contralateral	>95%	?
Hyperkinetic movements	Frontal/frontomesial	>80%	>10%

Thank you