



Neurological localization using ictal signs

Simple and complex ictal signs
Differentiation between ictal signs and seizure mimics

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

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

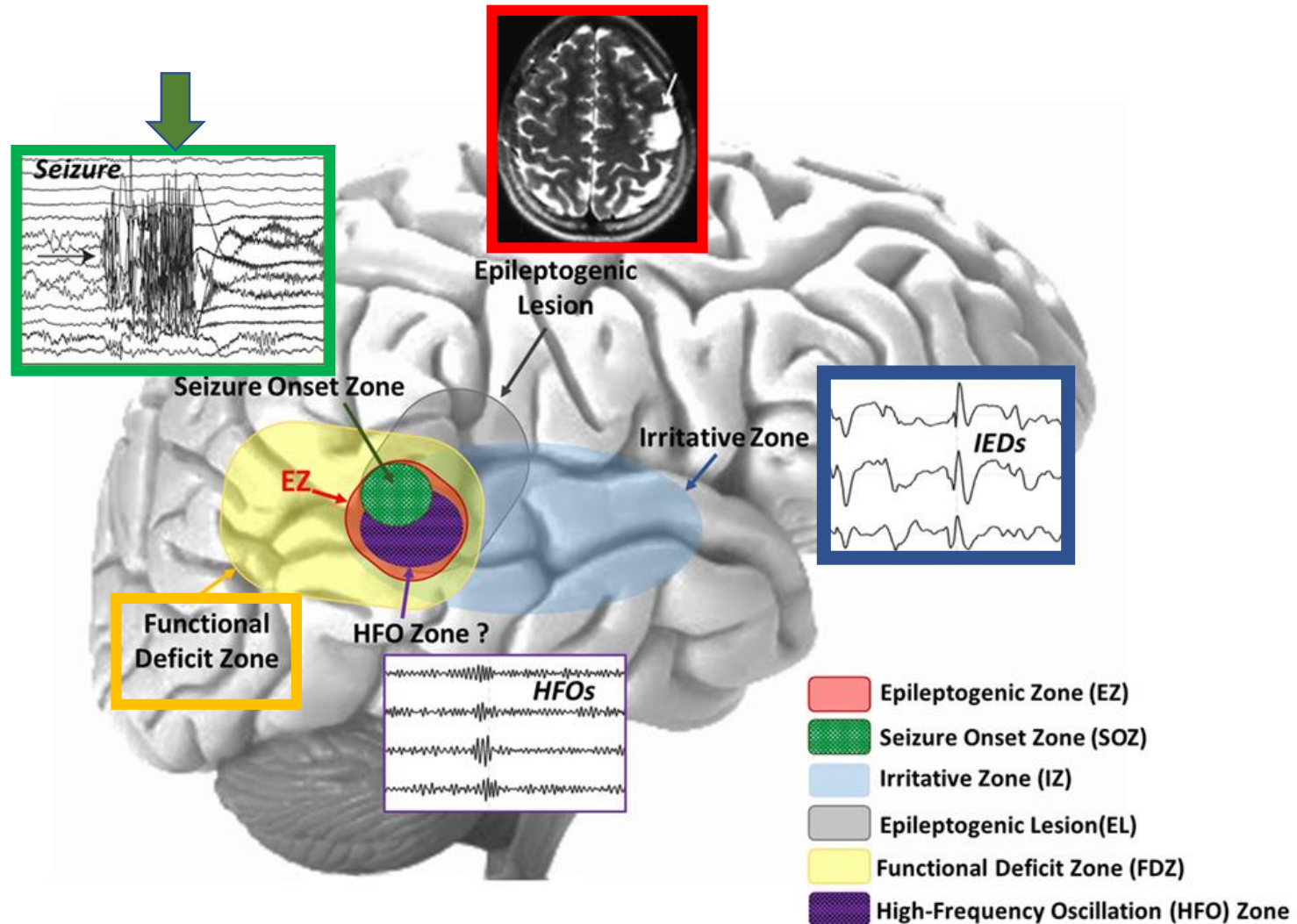
Focal* vs Generalized

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

Localization and/or Lateralization

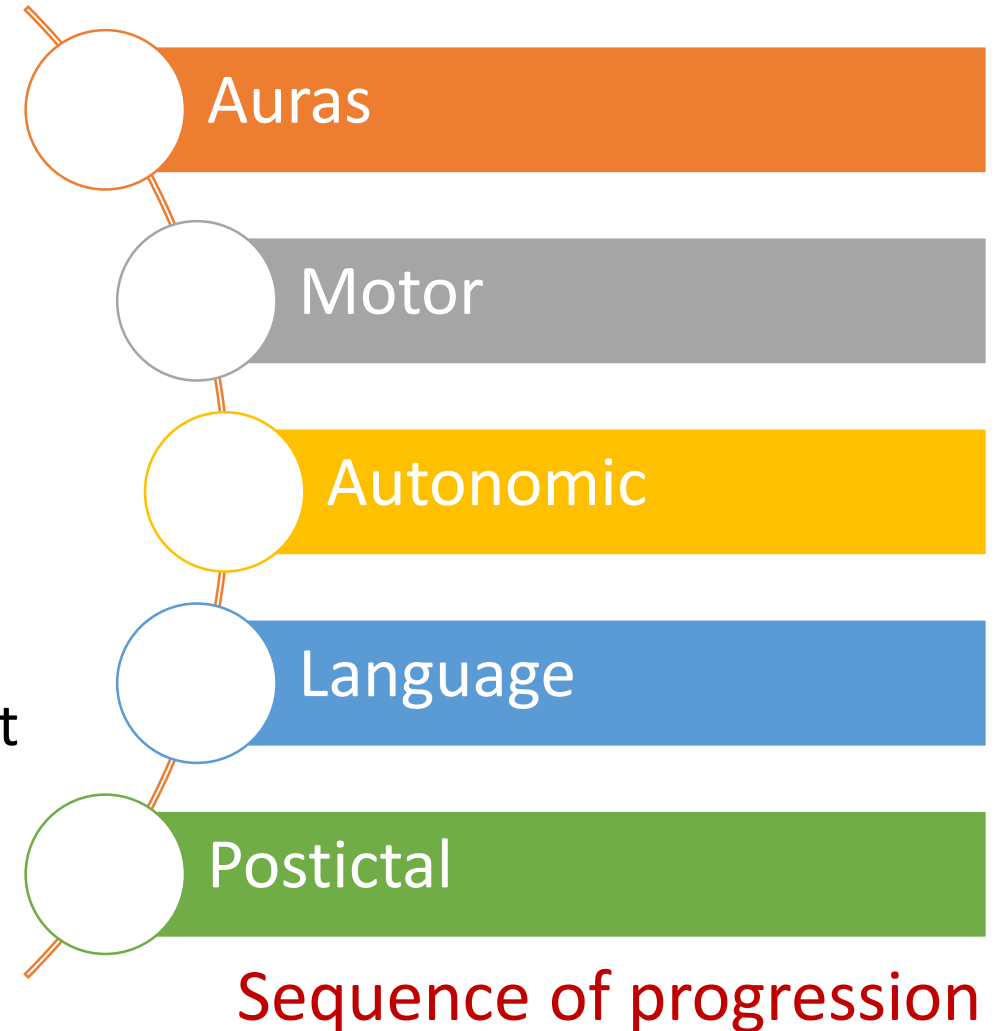
- Surgical treatment
- Lobar localization, hemispheric lateralization

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

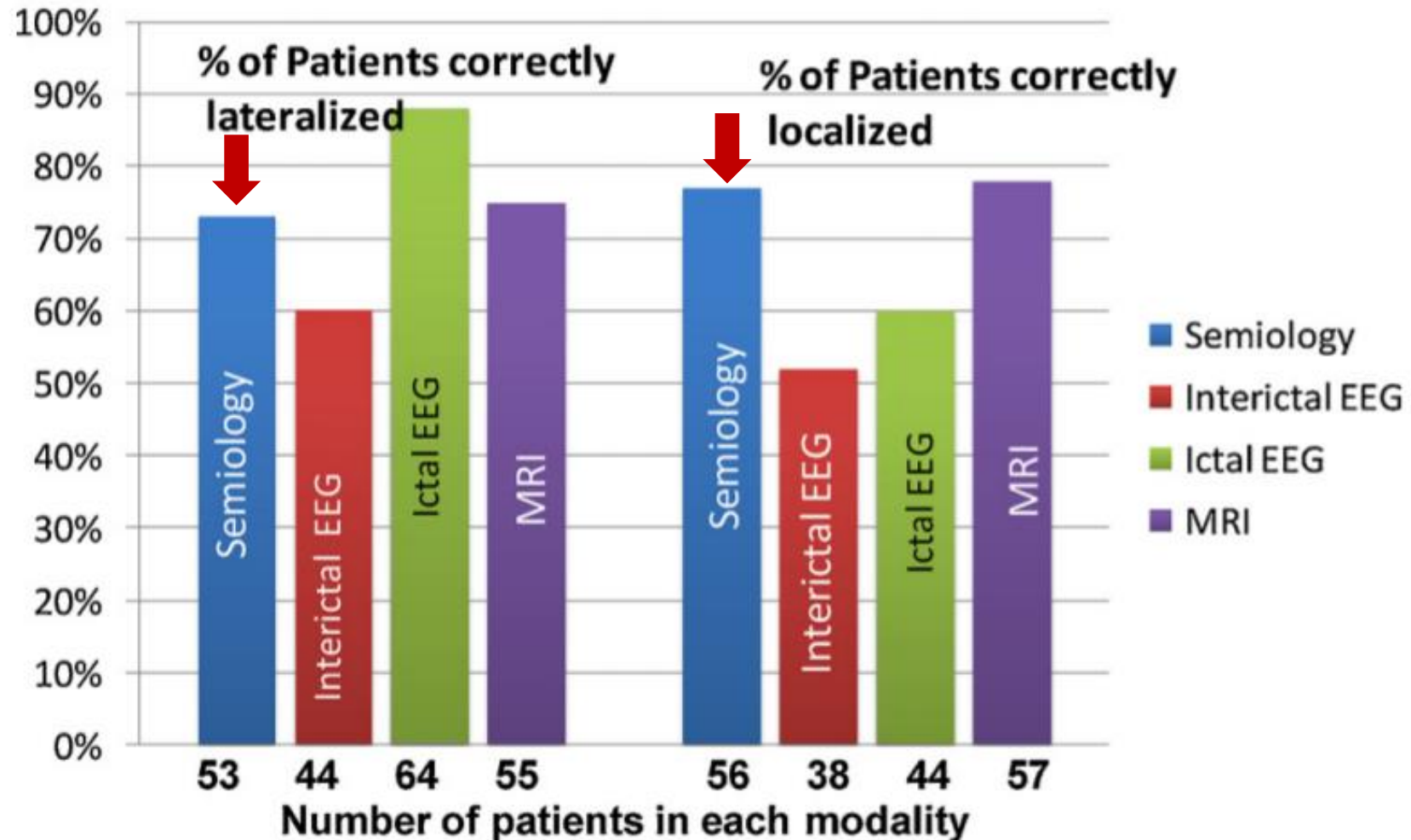


Signs for Localization

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

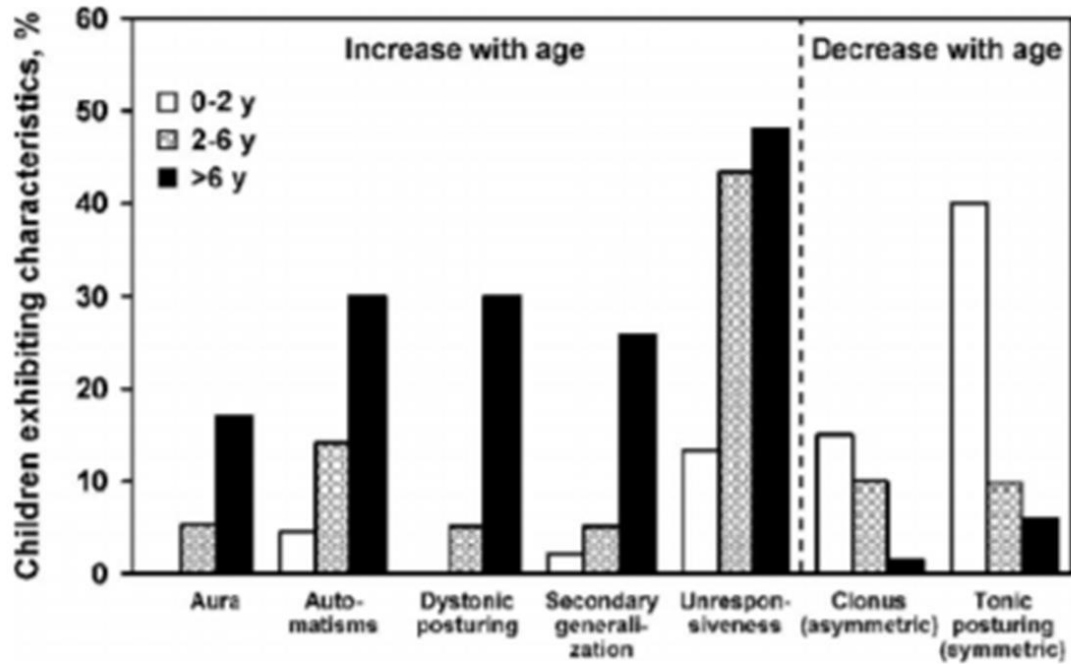
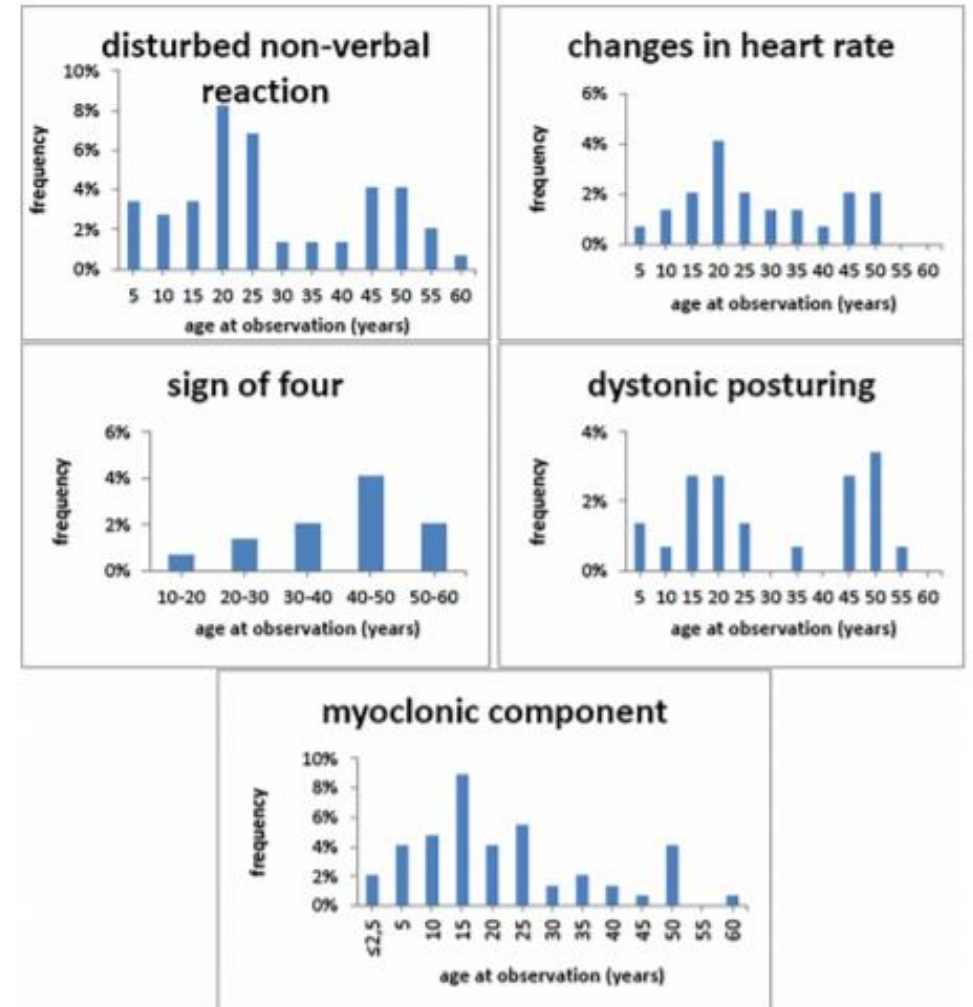


FIGURE 2. Seizure characteristics that change with age. (Modified from Nordli et al., 2001. Used with permission.)

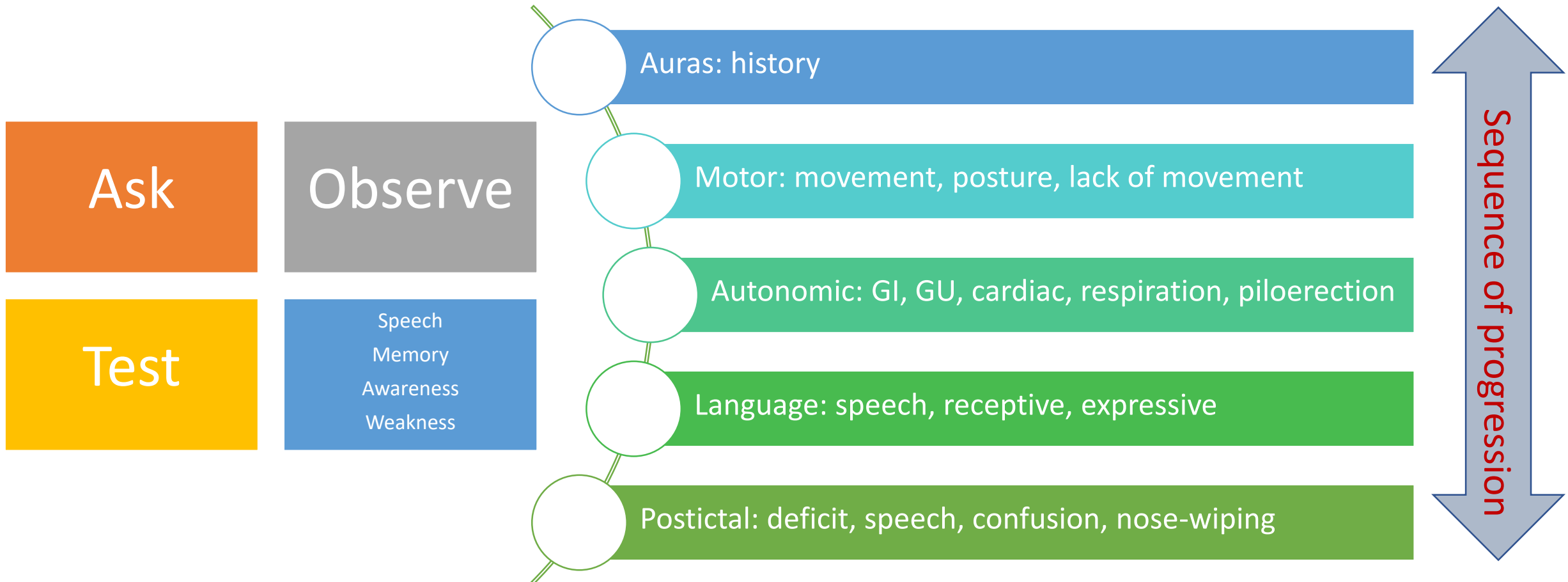
- Children under 3 to 4 y tend to have prominent tonic, clonic, or myoclonic movements that may be bilateral and symmetric, resembling generalized epilepsy.
- Automatism less elaborate and restricted to the orobuccal region.
- After age 6, the manifestations of TLE are similar to those of adults.

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



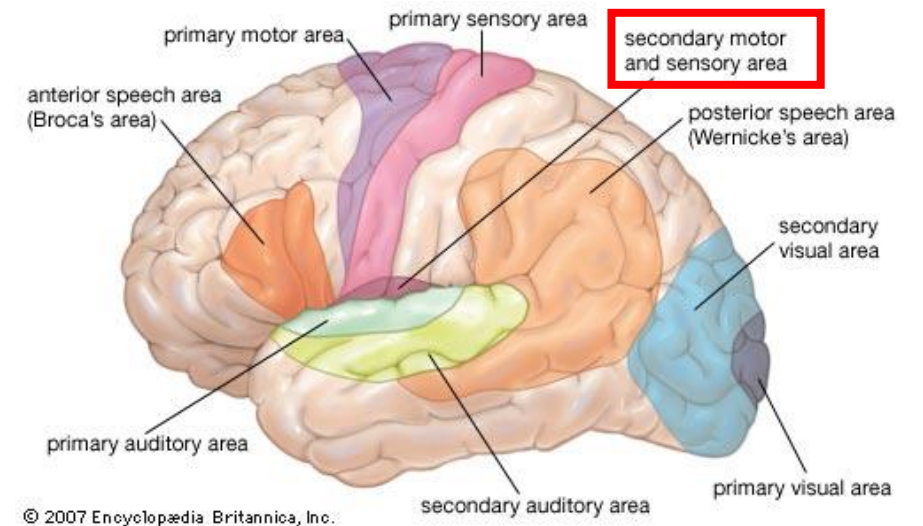
Somatosensory auras

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



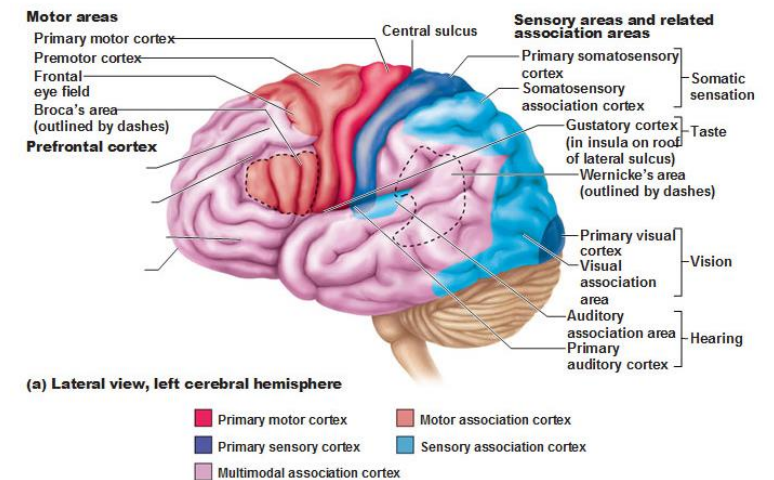
Visual auras

Visual hallucinations: Brodmann'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

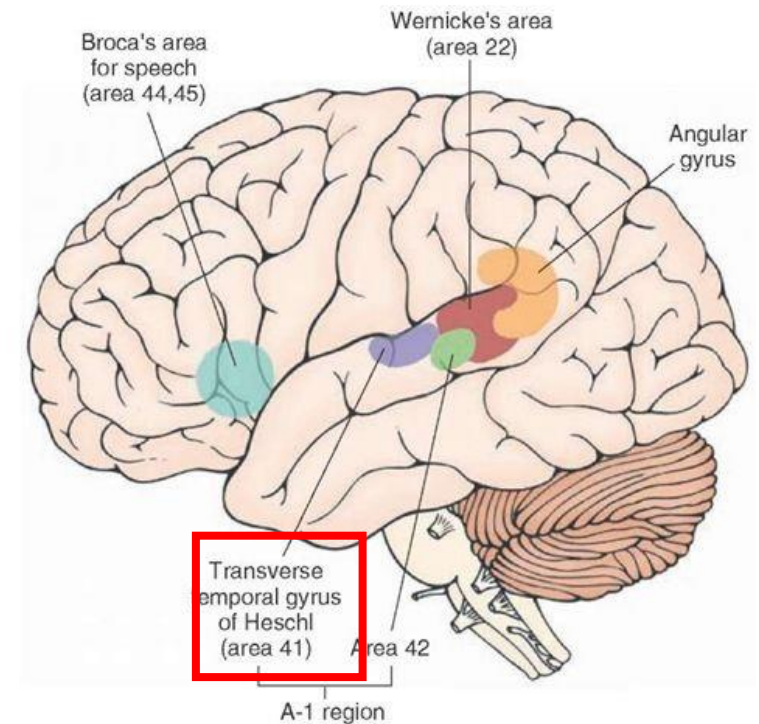
Complex visual hallucinations and visual illusions:

- 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"
- Heschel's gyrus the superior temporal gyrus.
- Not lateralizing



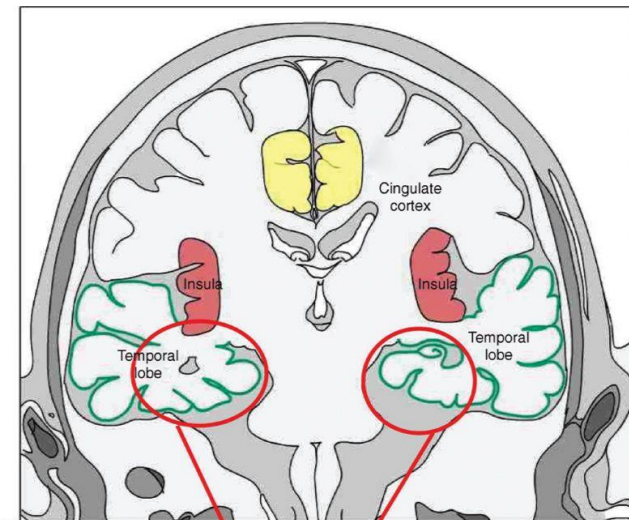
Olfactory and Gustatory auras

Olfactory auras

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

Gustatory auras

- Unpleasant taste.
- Insula
- Not lateralizing.

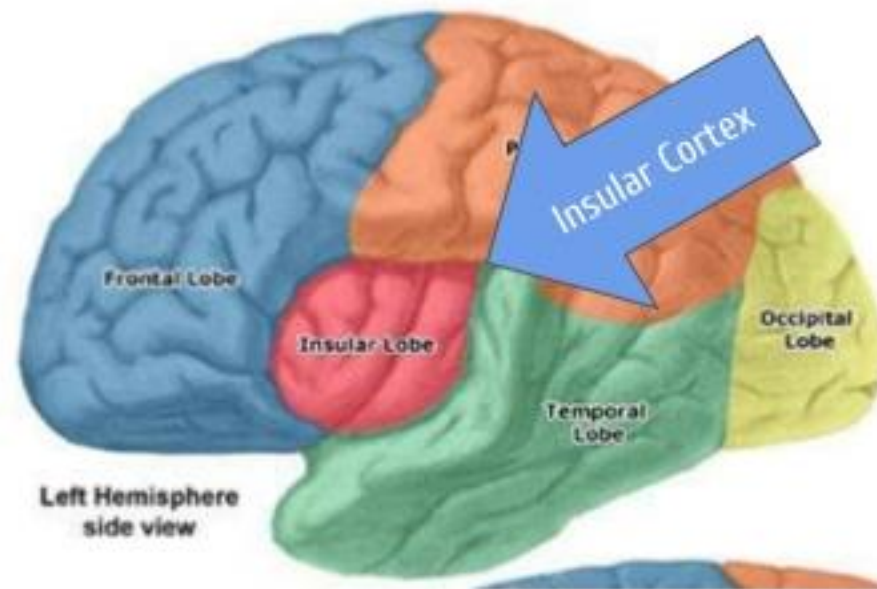


Medial temporal lobes

Source: Drawn by Shaan Fu

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

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