

Pediatric seizures



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Speaker: Jennifer A. Vickers, MD



1. I do not have any potential conflicts of interest to disclose, **OR**
2. I wish to disclose the following potential conflicts of interest:

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|----------------------------|-------------------------------|
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| Speakers' Bureaus | |
| Financial support | |
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3. The material presented in this lecture has no relationship with any of these potential conflicts, **OR**
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- 1.
- 2.
- 3.

outline



- ❧ Definitions
- ❧ Types of seizures
- ❧ New onset seizures
- ❧ Breakthrough seizures
- ❧ Seizure mimics
- ❧ Who needs to be referred?

Definitions:



- ⌘ Seizure: A transient occurrence of signs and/or symptoms due to abnormal excessive or synchronous neuronal activity in the brain.
- ⌘ Epilepsy: A disorder of the brain characterized by an enduring predisposition to generate epileptic seizures, and by the neurobiologic, cognitive, psychological, and social consequences of this condition.
- ⌘ Epilepsy versus Seizure disorder.

What's the difference?

Nothing, they are the same.

Case 1



- ❧ 26 yo man with mild developmental disability found down on his bed with convulsive activity.
 - ❧ Onset was not witnessed.
 - ❧ All 4 limbs equally involved.
 - ❧ Neither head or eye deviation was noted.
 - ❧ Urinary incontinence, and tongue laceration associated.
 - ❧ Duration: 1 - 2 minutes.
- ❧ At baseline on arrival to ED.

Further information



- ❧ Family history, non-contributory.
- ❧ Birth history, non-contributory.
- ❧ Review of systems:
 - ❧ Seasonal allergies
 - ❧ Not sleeping well recently
 - ❧ Otherwise unremarkable.
- ❧ Exam:
 - ❧ Mentally, consistent with mild intellectual impairment.
 - ❧ Otherwise normal exam.

Evaluation (general)



- ❧ Blood testing
 - ❧ Chemistries - yes.
 - ❧ Assess for metabolic disturbances.
 - ❧ CBC - yes.
 - ❧ Assess for infection.
 - ❧ UDS - always
 - ❧ People can get into anything.
 - ❧ UA - yes for girls, only if complaints in boys.
 - ❧ Pregnancy test
 - ❧ In post pubertal females - yes.
- ❧ Lumbar Puncture
 - ❧ Infection or bleeding.



Further work up

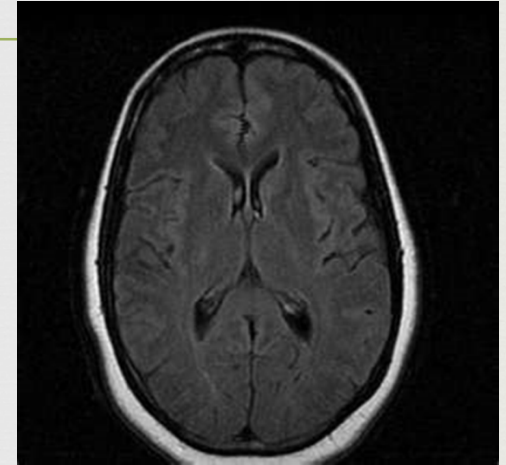


Imaging studies

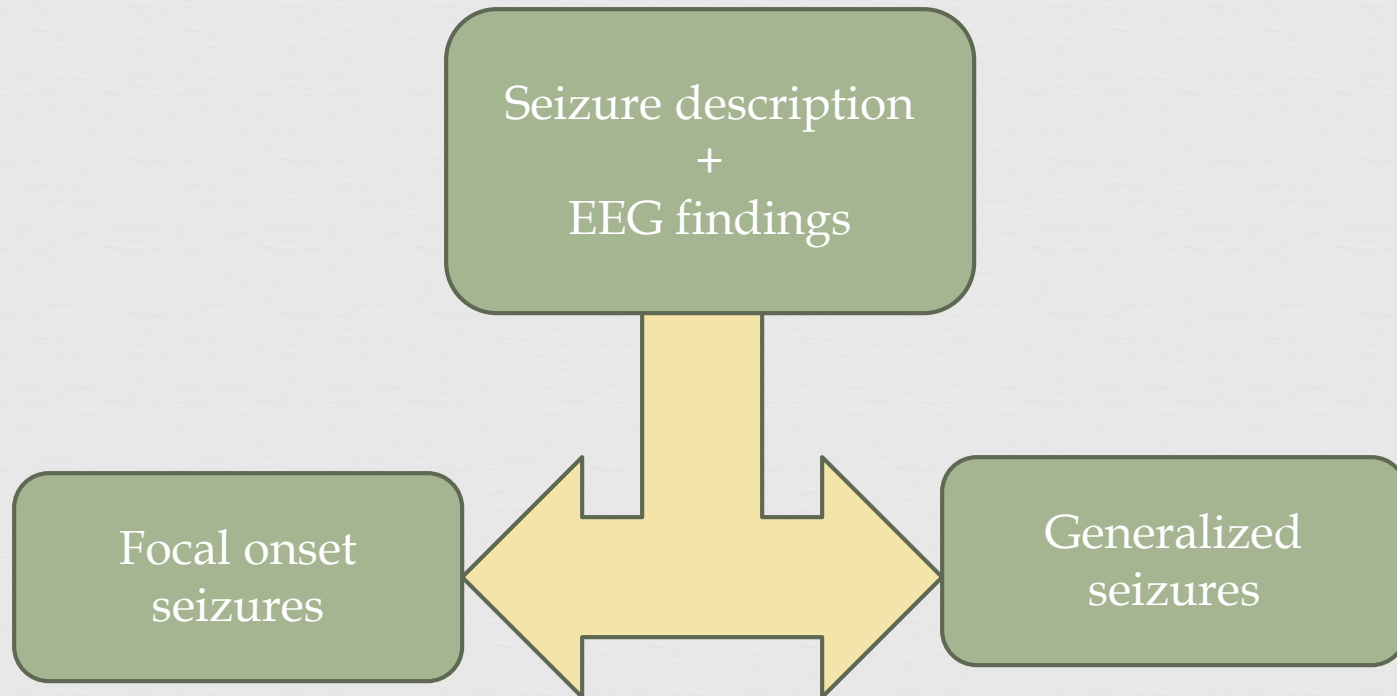
- not necessarily emergent.
- MRI preferred over CT.

EEG

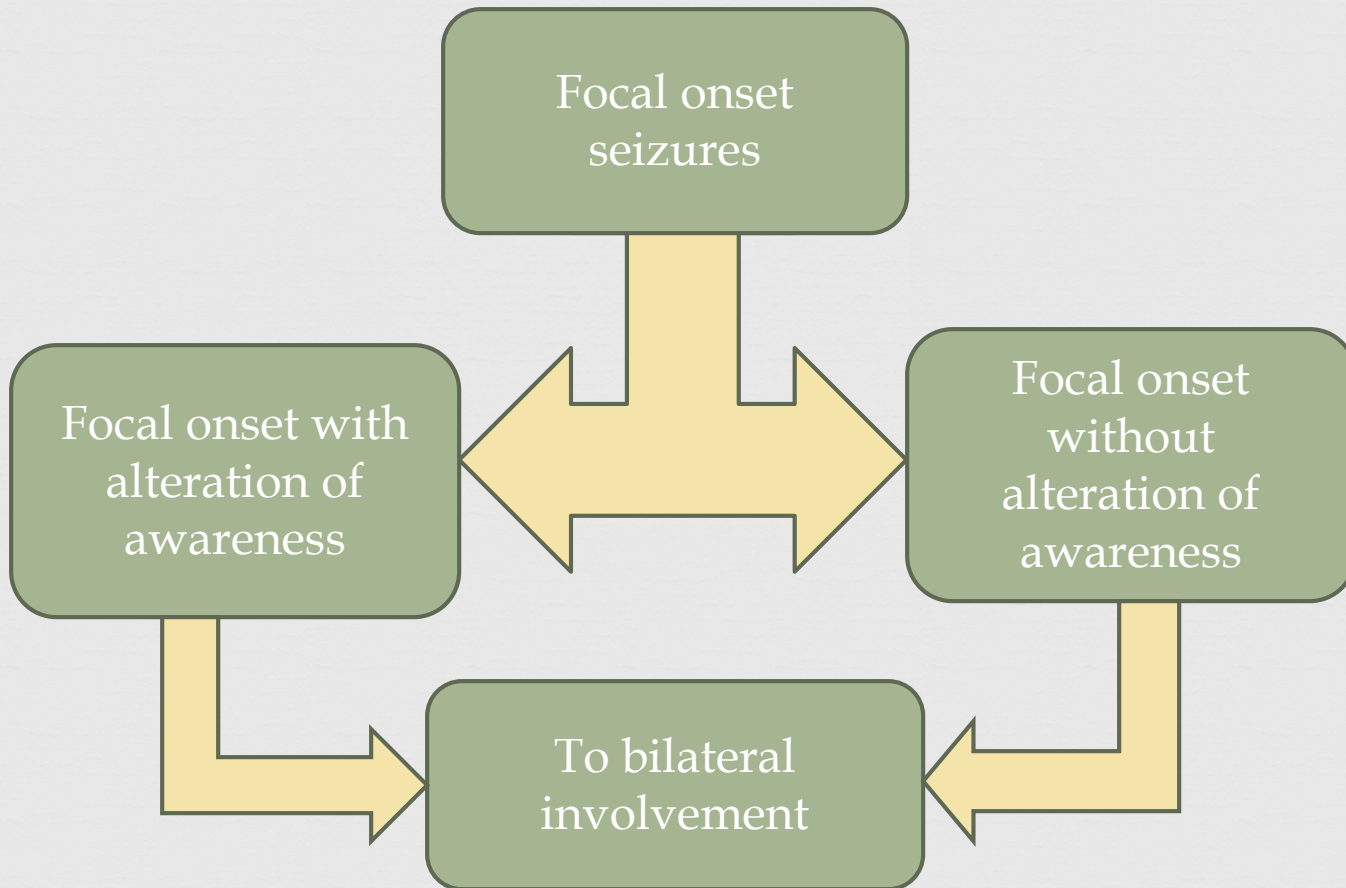
- Maybe.....



Seizure Classification



Focal onset seizures









Generalized Seizure types



- ∞ Tonic clonic
- ∞ Clonic
- ∞ Tonic
- ∞ Myoclonic
- ∞ Atonic
- ∞ Absence or Atypical Absence
- ∞ Behavioral arrest (Not staring spells)













Focal seizure types



- ❧ Unilateral clonic
- ❧ Behavioral arrest (Not staring spells)
- ❧ Unilateral or focal Myoclonic seizures
- ❧ Unilateral or focal tonic seizures
- ❧ Focal atonic

Should we treat?



- ⌘ Risk after first unprovoked seizure?
- ⌘ Risk after repetitive seizures?
 - ⌘ Less than 24 hours.
 - ⌘ Greater than 24 hours.
- ⌘ Risk after status epilepticus?



ILAE consensus statement



Traditional definition:

- At least 2 unprovoked seizures occurring > 24 hours apart.

Added definition:

- One unprovoked seizure with probability of further seizures (making the risk similar to the above).
- Diagnosis of a specific epilepsy syndrome.

Fisher RS et al, *Epilepsia* 2014;55(4):475-482.

Recurrence risk after 1st unprovoked seizure



Immediate treatment –
204 patients

Deferred treatment – 193
patients

7% at 3 months

60% reduction in the rate
of relapse for immediate
versus deferred
treatment

3 months

8% at 6 months

6 months

17% at 12 months

12 months

25% at 24 months

51% at 24 months

First Seizure Trial Group. *Neurology*
1993;43:478-483

Recurrence risk after 1st unprovoked seizure

Immediate treatment
722 patients

Deferred treatment - 721
patients

22% at 6 months

30% reduction in the rate
of relapse for immediate
versus deferred treatment

30% at 6 months

37% at 2 years

47% at 2 years

48% at 5 years

58% at 5 years

52% at 8 years

61% at 8 years

Marson A et al. *Lancet*
2005;365:2007-2013

Problems



- ❧ Does seizure type matter?
- ❧ Does seizure duration matter?
- ❧ Abnormalities on EEG or imaging studies?
- ❧ Other medical co-morbidities?



Increased risk of recurrence



- ⌘ Epileptic activity on EEG.
- ⌘ Symptomatic cause.
- ⌘ Abnormal neurologic exam.
- ⌘ Arose from sleep.



Not related to increased risk of recurrence



- ⌘ Age (child vs adult)
- ⌘ Generalized vs focal onset seizures
 - ⌘ based on EEG findings
- ⌘ Multiple seizures < 24 hours
- ⌘ Status Epilepticus
- ⌘ Family history
- ⌘ Prior febrile seizure

Third article



Concerns

- ❧ Most patients are seen by PCP or ED
- ❧ More than half the patients had a second seizure before being seen.
- ❧ Compliance

Recommendation: WAIT

- ❧ Employment becomes harder.
- ❧ Health insurance premiums increase
- ❧ Epilepsy has a very negative image.
- ❧ Potential for severe adverse reactions to medications.
- ❧ Cost of medications.

Lawn N et al. *Epilepsia*
2016;56(9):1425-1431

Conclusion

Consider AED for following



- ∞ Multiple seizures in 24 hours.
- ∞ History of significant CNS pathology.
- ∞ Family is “freaked out”.
- ∞ Prolonged seizure (5 minutes or longer).
- ∞ Concerns that this is not the first seizure.

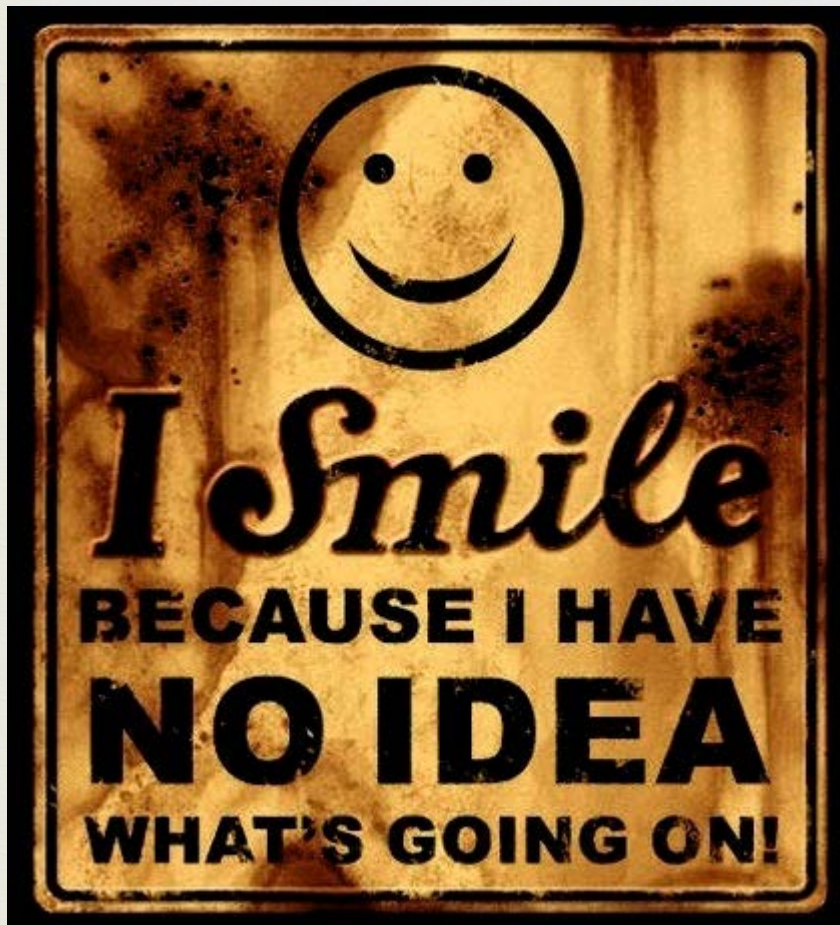


New Classification



- ❧ Complex partial seizures
- ❧ Simple partial seizures
- ❧ Staring spells
- ❧ ...with secondary generalization
- ❧ Focal onset seizures with alteration of awareness
- ❧ Focal onset seizures without alteration of awareness
- ❧ Behavioral arrest
- ❧ ...to bilateral involvement

So what about case # 1!?



- Onset not witnessed
- No lateralizing activity identified.
- Exam, mild intellectual impairment
- State of patient at onset unknown if awake or asleep.



“You caught a virus from your computer and we had to erase your brain. I hope you’ve got a back-up copy!”

Case 2



- ❧ 28 year old woman with medically intractable focal onset seizures to bilateral involvement.
- ❧ History of:
 - ❧ Traumatic brain injury due to NAT at 4 months of age.
 - ❧ Moderate intellectual impairment.
 - ❧ Right hemiplegic CP.
- ❧ Chief complaint:
 - ❧ Prolonged breakthrough seizure.

Case 2 continued

Questions to consider:



- ❧ Sleep?
- ❧ Eating?
 - ❧ Weight gain?
 - ❧ Weight loss?
 - ❧ Sudden increase in carbs?
- ❧ Bowel movements?
 - ❧ Constipation?
 - ❧ Diarrhea?
- ❧ Illness?
 - ❧ Anyone sick at home?
- ❧ Other Stressors?
- ❧ Change in medications?
 - ❧ New AED Rx?
 - ❧ Change in tablets?
 - ❧ New medication affecting AED level?



Does the medication need to be changed?



- ❧ Fix the underlying problem if possible.
- ❧ Consult the prescribing physician.
- ❧ Consider a clonazepam bridge.

Common non-epileptic mimics



Non-epileptic event study



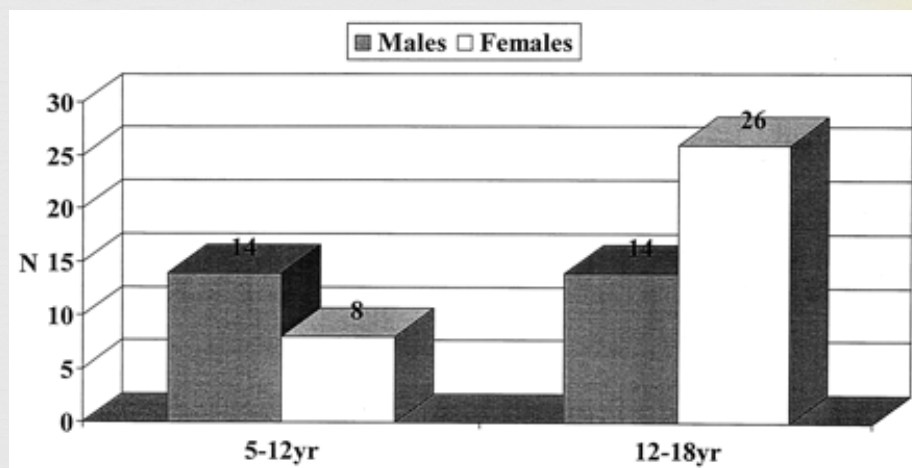
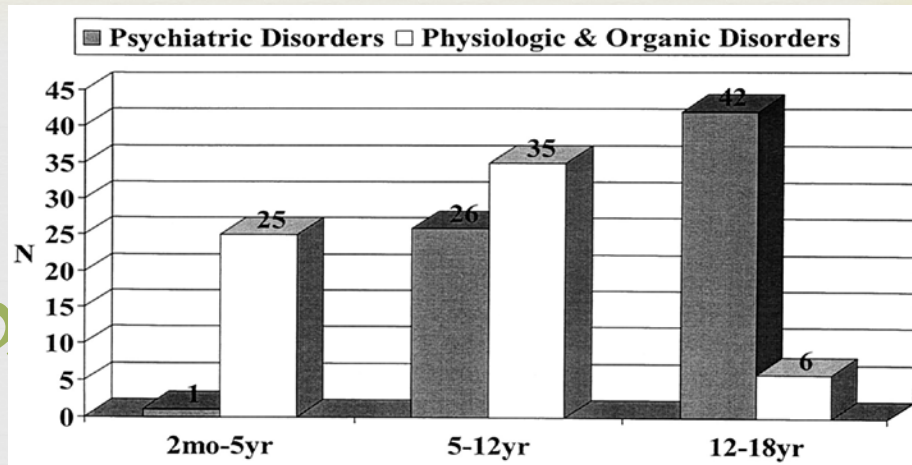
- ∞ 883 patients under 18 years of age admitted to the PEMU at Cleveland Clinic from 1/1989 to 12/1995.
- ∞ 199 (22.5%) diagnosed with Non-Epileptic events.
- ∞ 134 (15.2%) had spells “captured” on EEG.
- ∞ Grouped by age:
 - ∞ 2 months to 5 years
 - ∞ 5-12 years
 - ∞ 12-18 years
- 66 patients had physiologic/organic disturbances
- 69 had psychiatric issues

Kotagal P et al. *Pediatrics*
2002;110(4):e46

Results

Age

| | 2 Months-5 Years | 5-12 Years | 12-18 Years |
|--------------------------|------------------|------------|-------------|
| Inattention/daydreaming | 1 | 12 | 1 |
| Hypnic jerks | 4 | 5 | 2 |
| Stereotyped movements | 5 | 7 | 0 |
| Parasomnias | 5 | 3 | 2 |
| Movement disorders | 0 | 5 | 0 |
| Gastroesophageal reflux | 4 | 0 | 0 |
| Nonepileptic myoclonus | 2 | 1 | 0 |
| Apneas | 2 | 0 | 0 |
| Shuddering attacks | 1 | 0 | 0 |
| Alternating hemiplegia | 1 | 0 | 0 |
| Migraine | 0 | 1 | 0 |
| Hyperventilation attacks | 0 | 1 | 0 |
| Syncope | 0 | 0 | 1 |
| Total | 25 | 35 | 6 |



19 of the 135 children (14 %) with non-epileptic spells also had a diagnosis of epilepsy

Non-epileptic spells



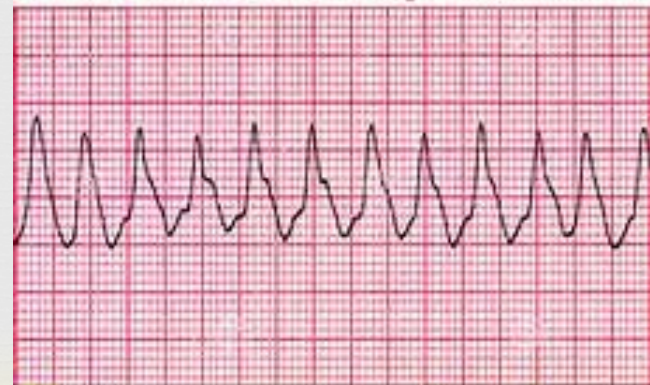
- ❧ Syncope *
- ❧ Cardiac arrhythmia *
- ❧ Breath holding spell *
- ❧ Panic attacks
- ❧ Hypoglycemia *
- ❧ Esophageal reflux
- ❧ Movement disorder
- ❧ Cataplexy
- ❧ Sleep disorder
- ❧ Psychogenic episodes
- ❧ Trauma *
- ❧ Staring spells
- ❧ Infantile self-stimulation (aka masturbation)

Syncope or Cardiac Arrhythmia

- ❧ Onset is rapid
- ❧ Loss of consciousness (transient in syncope)
- ❧ Loss of postural tone
- ❧ Recovery in syncope,
 - ❧ Spontaneous
 - ❧ Complete
 - ❧ Prompt.
- ❧ Convulsive activity may be seen with either



Ventricular Tachycardia



Breath holding spells



Pallid spells

Provoked by fright or pain.
Minimal crying.
Overstimulation of vagus nerve.
Decreased CNS perfusion.

- ❧ 6 – 24 months
- ❧ Loss of consciousness.
- ❧ Loss of postural tone.
- ❧ Convulsive activity can occur. (pallid > cyanotic)

Cyanotic spells

Provoked by anger and frustration.
Vigorous crying is heard.
Pathophysiology unclear.



Anxiety or panic attacks



- ❧ 18 – 45 years (mean 24 years)
- ❧ Women 2 – 3 times more often
- ❧ Co-morbidities
 - ❧ Asthma (4.5 fold increase)
 - ❧ Mitral valve prolapse
 - ❧ Tension or migraine headaches
 - ❧ Hypertension
 - ❧ Epilepsy (6.5 %)
- ❧ Pathophysiology – uncertain.



Hypoglycemia



☞ Symptoms:

- ☞ Tremulousness
- ☞ Tachycardia
- ☞ Anxiety
- ☞ Sensation of hunger
- ☞ Weakness
- ☞ Fatigue
- ☞ Dizziness
- ☞ Inappropriate behavior
- ☞ Difficulty concentrating
- ☞ Confusion
- ☞ Blurred vision
- ☞ Loss of consciousness

Esophageal reflux



- ⌘ Age < 24 months
- ⌘ Related to feeding
- ⌘ Sudden tonic posturing
- ⌘ Opisthotonus
- ⌘ Duration - up to 3 minutes.

Aka Sandifer's syndrome



Movement disorders



- ❧ Onset at any age
- ❧ Without loss of awareness
- ❧ Atypical posturing
- ❧ Asymmetric
- ❧ Asynchronous
- ❧ Resolves with sleep
 - ❧ Except tics



Sleep disorders / cataplexy



- ❧ Sleepwalking
- ❧ Night terrors
 - ❧ First 30 – 90 minutes of sleep
 - ❧ Resume sleep immediately after
 - ❧ 5 years of age or less.
- ❧ Dream-enacting behavior
- ❧ Head banging
- ❧ Hypnic jerks
- ❧ Cataplexy
 - ❧ Sudden loss of muscle tone in response to significant emotional stimulus.
 - ❧ Narcolepsy is always associated.
- ❧ Nocturnal frontal lobe epilepsy
 - ❧ Stereotypic events
 - ❧ Can be seen any age.

Psychogenic spells



Any age, but usually adolescents and older

Form of conversion disorder

Spells are:

Asynchronous movements

Eyes closed

Placid face

Trajectory change from

Rotational movements.

Pelvic thrusting.

“faking”

sexual abuse is

is affected.

psychiatric

The activity observed, that tells us these spells are non-epileptic, is never discussed in front of the patient.

Treat as anxiety disorder acutely.

Nocturnal Frontal Lobe Epilepsy

- ⌘ Hypermotor seizures
- ⌘ Arise from sleep
- ⌘ Very short duration
- ⌘ Very violent movements
- ⌘ REFER



Post-traumatic seizures



- ⌘ Occur within one week of the head injury:
- ⌘ Not an indication of new onset seizure disorder.
- ⌘ Long term treatment is not necessary.
- ⌘ Use of an antiepileptic medication following head injury will not prevent the development of Post-traumatic epilepsy.



Staring spells



- ⌘ Sleep disorder
 - ⌘ Microsleep.
- ⌘ Attention deficit disorder – inattentive type
- ⌘ Slow processing of information.

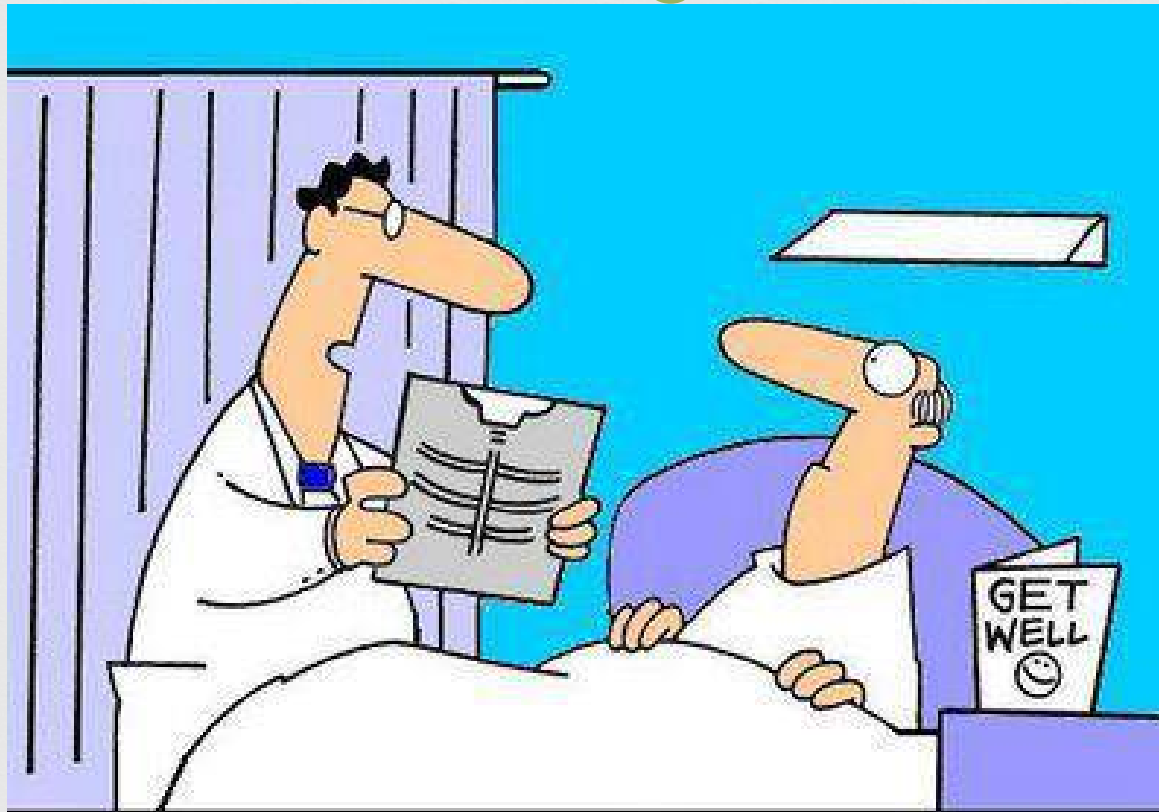
Infant self-stimulation.



- ❧ Associated with onset of sleep.
- ❧ Crosses and stiffens legs.
- ❧ Vibratory movements of the legs often seen
- ❧ Minimal response to parents during spell.
- ❧ Once movement stops, child is asleep.

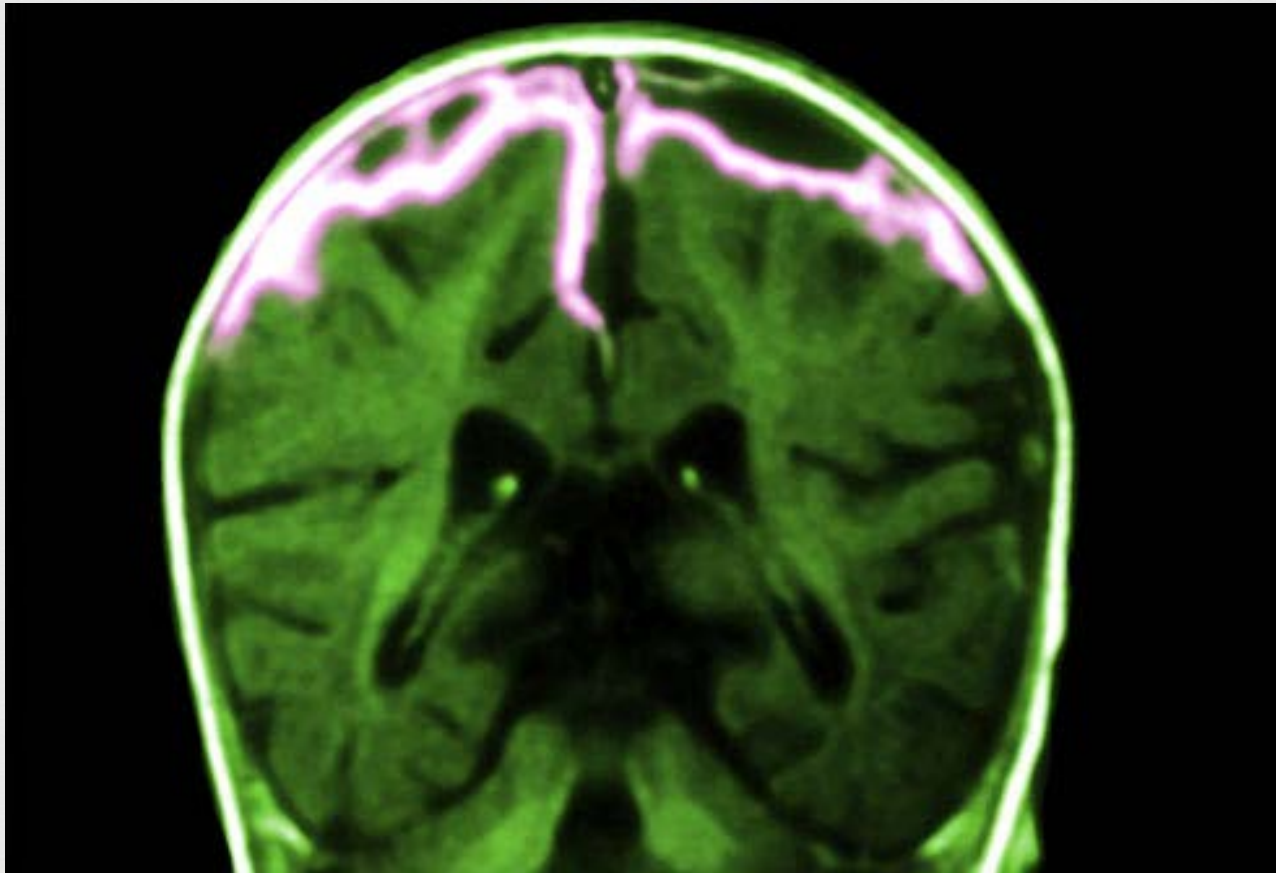


Etiologies



**“Your x-ray showed a broken rib,
but we fixed it with Photoshop.”**

Bacterial infections



Encephalitis

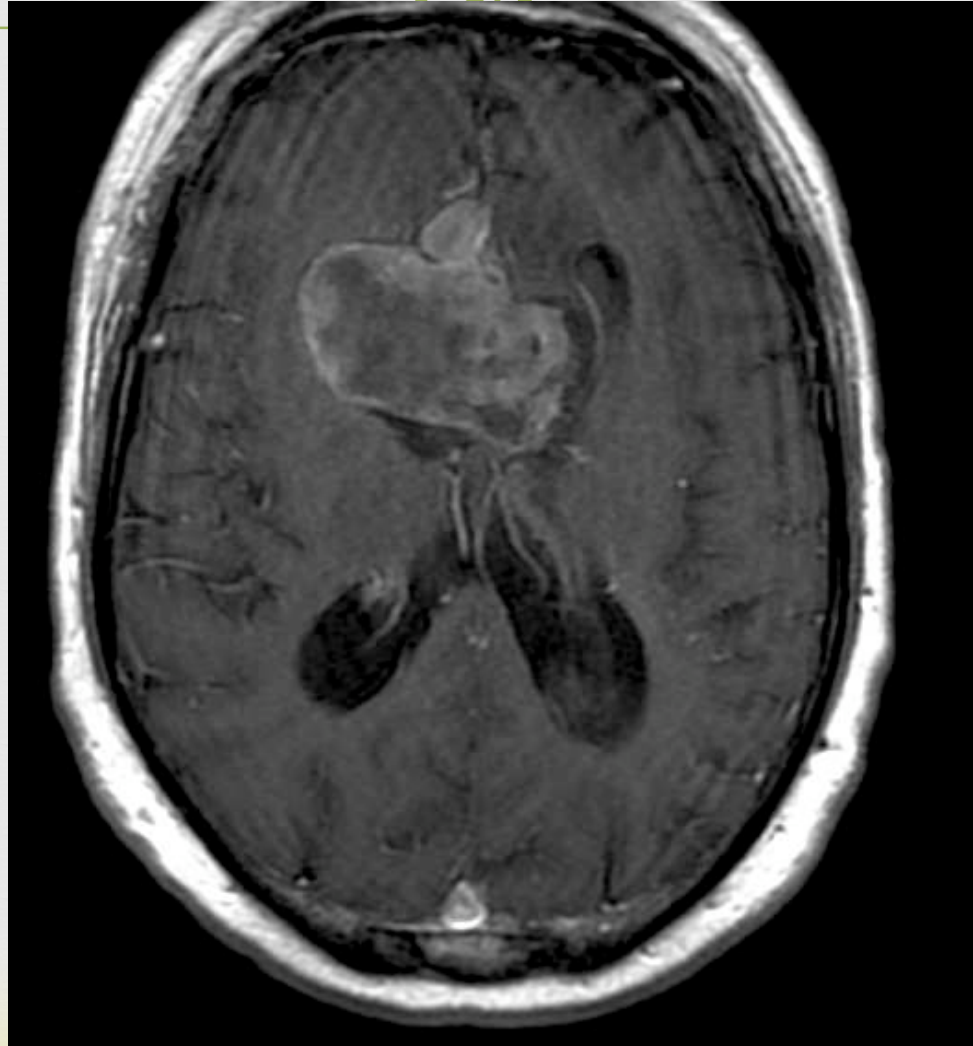


Figure 1

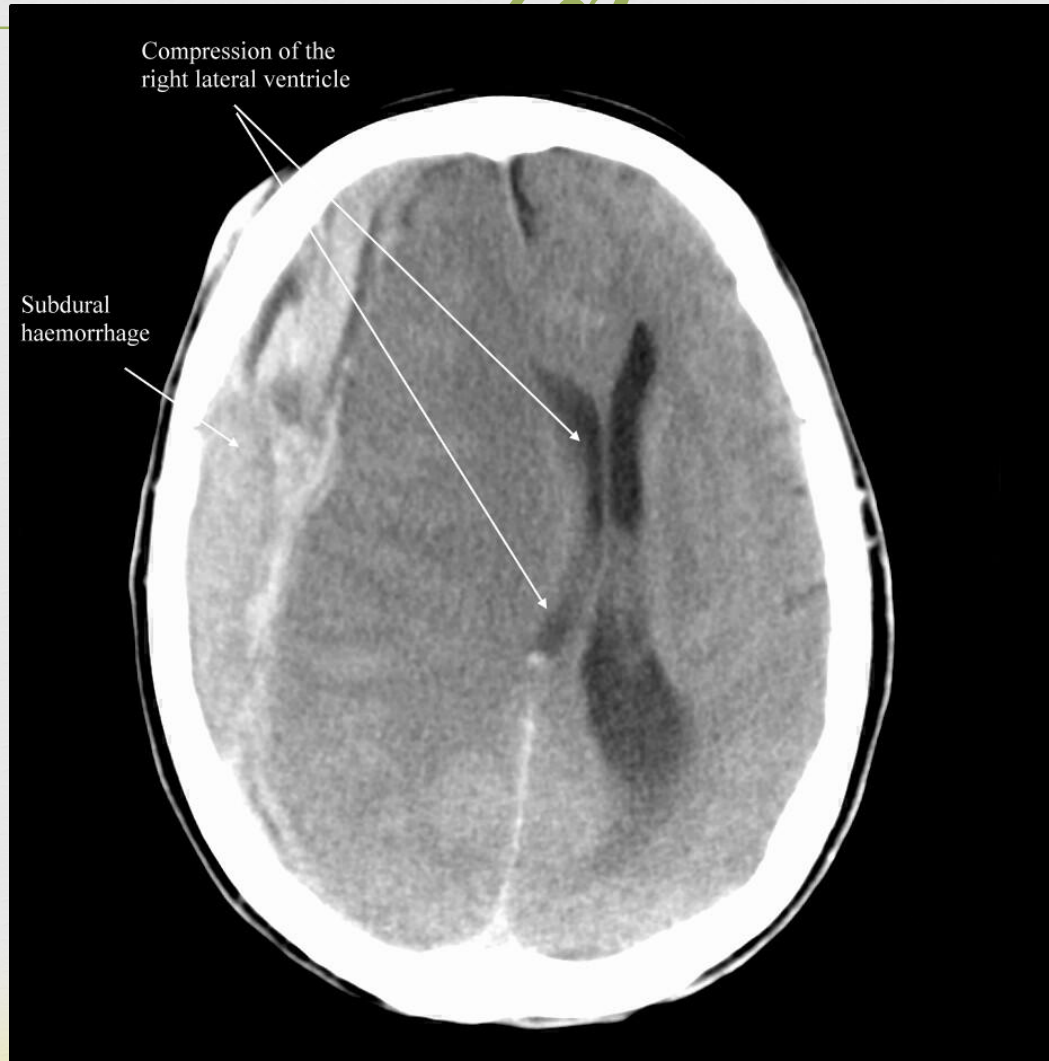


Figure 2

Brain Tumors

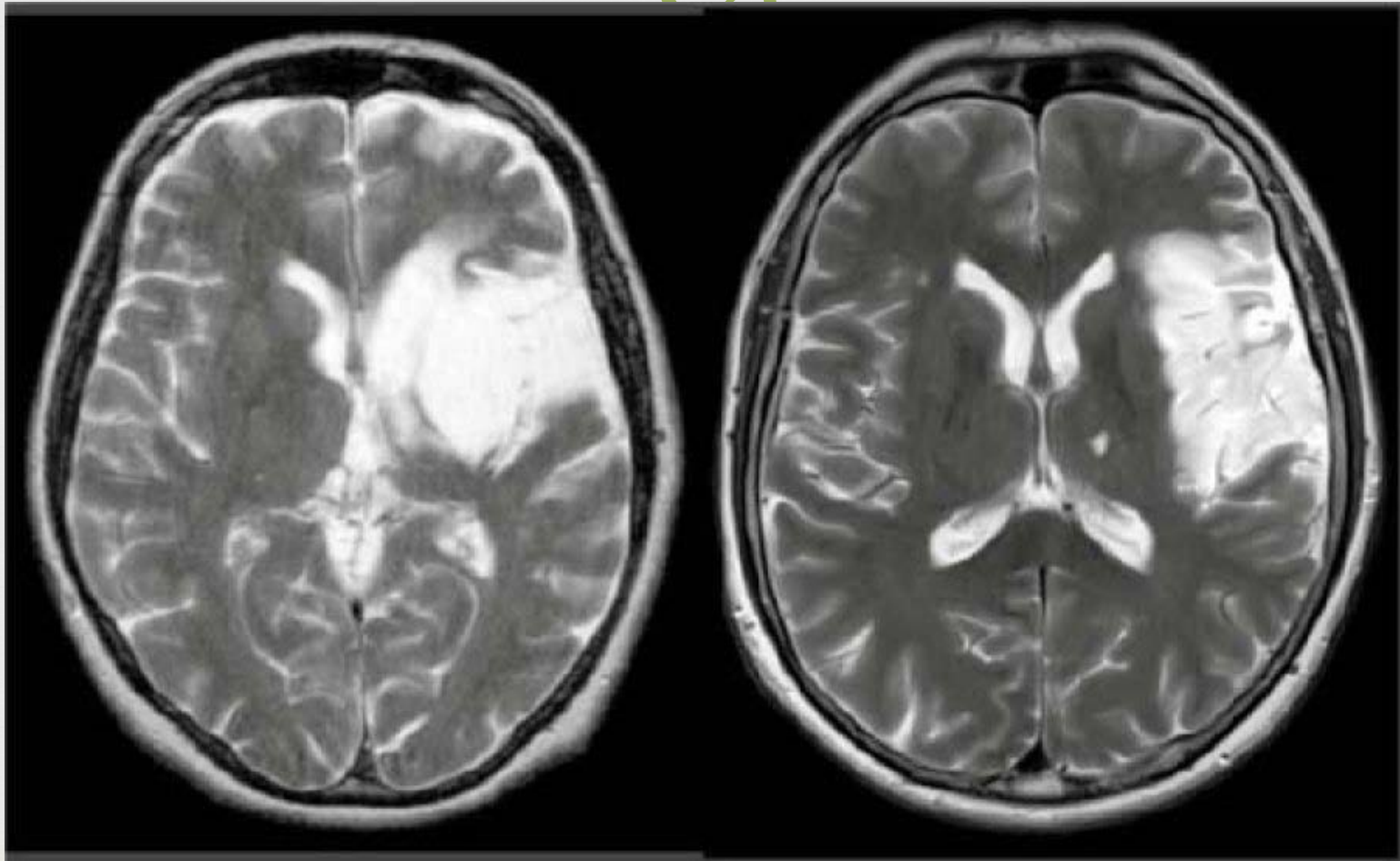


Traumatic Brain Injury

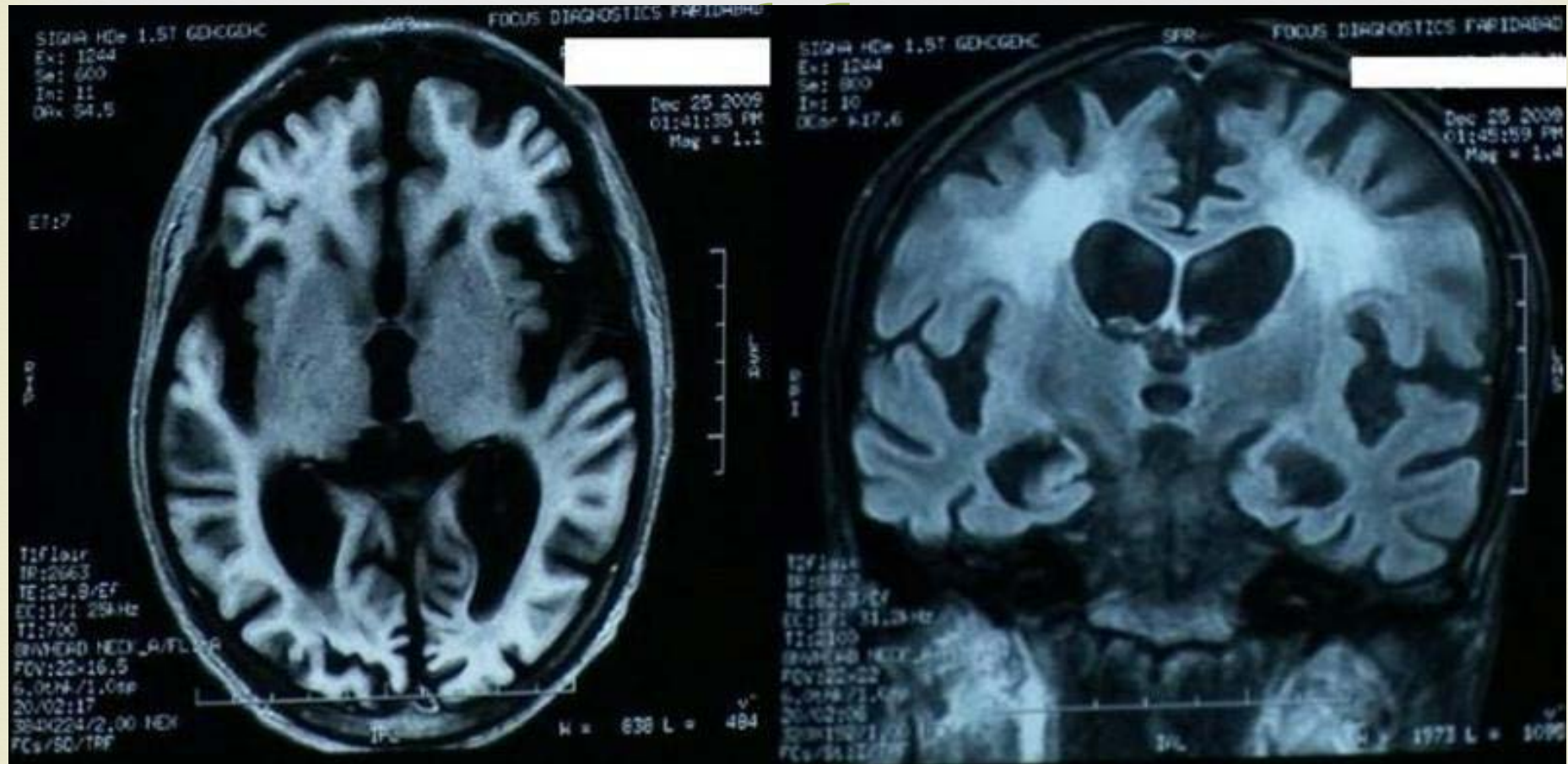


Cerebrovascular disease

CB



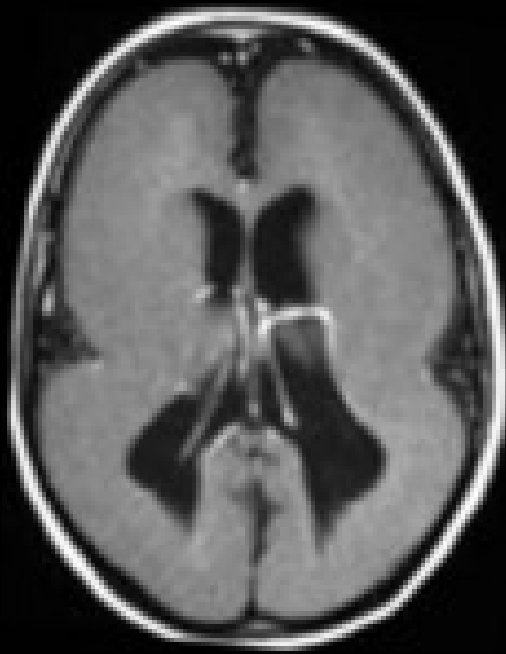
Hypoxic Ischemic Injury



Congenital malformations

CB

Lissencephaly

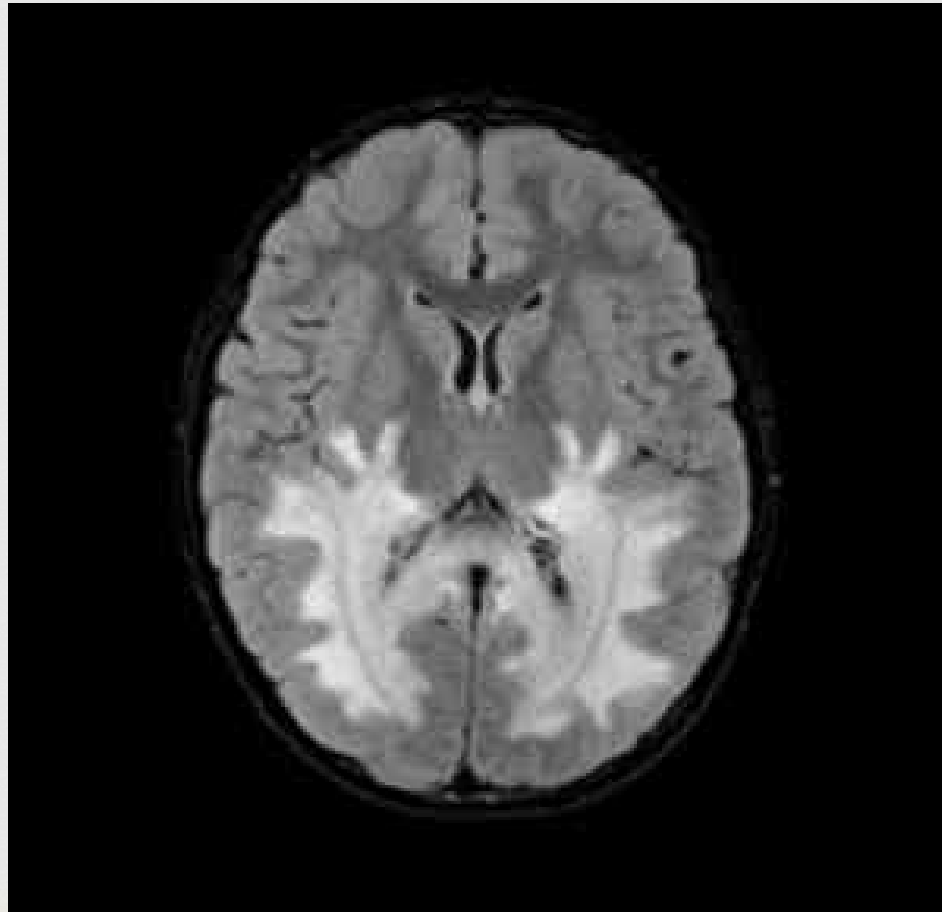


MRI: Axial view

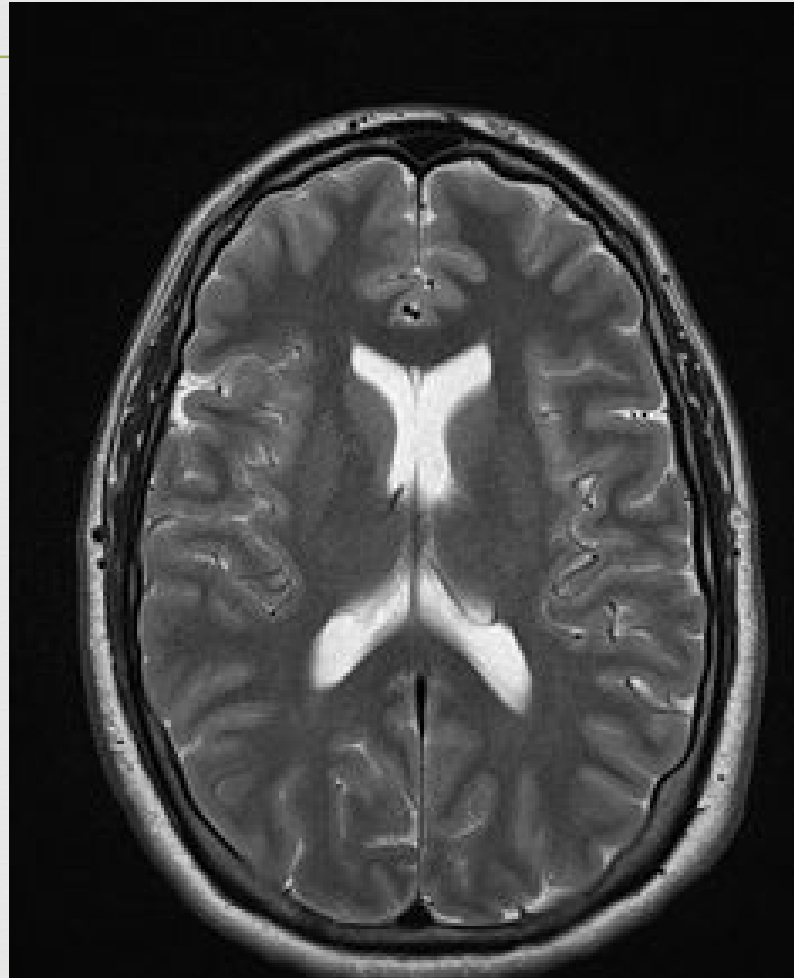


Normal brain

Degenerative diseases



unknown



summary



- ⌘ Many different seizure types.
- ⌘ Many causes of seizures still a large group of unknown.
- ⌘ Many different seizure mimics.
- ⌘ Uncertain?
 - ⌘ Please call!



Questions?

