



How do we evaluate patients before epilepsy surgery?

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How do we evaluate patients before epilepsy surgery?



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Topics

- Who?
- Why?
- **How?**
- Outcome: Benefits & Complications

Intractable Epilepsy

- Recurrent unprovoked seizures occur in 1-2% of children
- 20-40% of children with epilepsy not respond to optimal medical treatment

Epilepsy Surgery; Who?

Epilepsia, 51(6):1069-1077, 2010
doi: 10.1111/j.1528-1167.2009.02397.x

SPECIAL REPORT

Definition of drug resistant epilepsy: Consensus proposal by the ad hoc Task Force of the ILAE Commission on Therapeutic Strategies

^{*,†}Patrick Kwan, [†]Alexis Arzimanoglou, [‡]Anne T. Berg, [§]Martin J. Brodie, [¶]W. Allen Hauser, [#]Gary Mathern, ^{**}Solomon L. Moshé, ^{††}Emilio Perucca, ^{‡‡}Samuel Wiebe, and ^{§§}†††Jacqueline French

Drug resistant epilepsy is defined as

“Failure of adequate trials of two tolerated, appropriately chosen and used antiepileptic drug schedules (whether as monotherapies or in combination) to achieve sustained seizure freedom”

When Patients with Epilepsy should be Referred to Neurologist/Epileptologist

- Doubt in diagnosis
- Inability to control seizures with appropriate 1-2 anticonvulsants
- Epileptic encephalopathy: West syndrome, Landau-Kleffner syndrome
- Hemimegalencephaly, hemispheric cortical dysplasia, Sturge-Weber syndrome (SWS), mesial temporal sclerosis, TSC

ทำไมจึงต้องผ่าตัด?



Epilepsy Surgery; Why?

- Adverse effect of recurrent seizures on brain development, learning, and memory
- Psychosocial issue: depression, aggressive behavior, stigma, social isolation, increased utilization of medical services
- Side effects of anticonvulsants
- Premature death: SUDEP
-

Epilepsy Surgery; Why?

- Increased plasticity of developing brain in children
- Shorter duration of intractable epilepsy determined better post-operative outcome
- In large series, there is a delay between onset of epilepsy and presurgical evaluation of ~ 20 years, even when the refractoriness of the epilepsy became clear at an average time of 9 years

Berg AT, Neurology. 2003;60:186–190

Long-term Outcomes

	N	Years of FU	Seizure-free outcome (%)
Hamiwka L. et al 2005	38	10	Tumors (72) Cortical dysplasia (32)
Kloss S. et al 2002	68	3-10	Cortical dysplasia (50)
Mittal S. et al 2005	109	5-20	Temporal lobe epilepsy (82)

Increasing Utilization of Pediatric Epilepsy Surgery

Table 2. The number of surgeries by procedures over time

Type of procedures, n (%) ^a	1997	2000	2003	2006	2009
Number of cases (weighted)	375	410	589	683	706
Lobectomies, n (%)	145 (39)	135 (33)	197 (33)	194 (28)	205 (29)
Partial lobectomies, n (%)	177 (47)	223 (54)	287 (49)	376 (55)	404 (57)
Hemispherectomy, n (%)	53 (14)	57 (14)	117 (20)	130 (19)	120 (17)

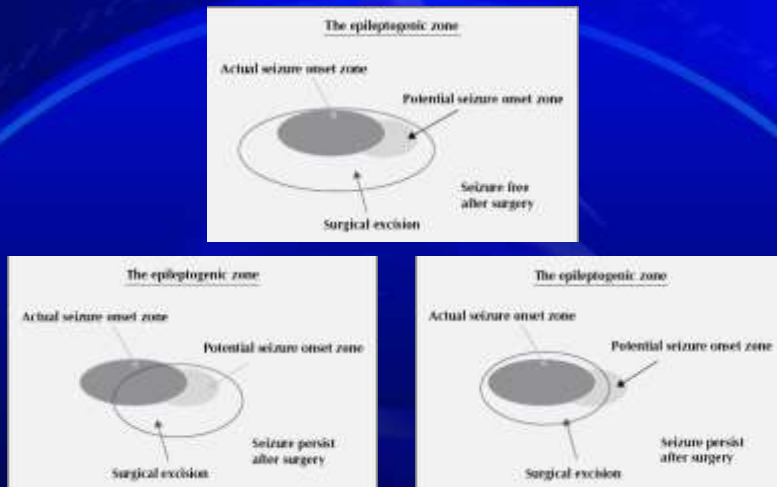
^aProcedures may not add up to 100% due to multiple procedures in one stay.

Pestana Knight E., Epilepsia. 2015;56:375–381

การประเมินก่อนการผ่าตัด



Principles of the Epileptogenic Region (ER)

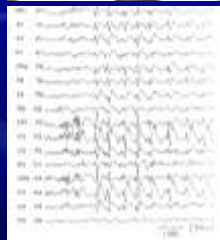


Lüders HO, *Epileptic Disord* 2006;8 (Suppl. 2):S1-9

Presurgical Evaluation

- Video EEG monitoring
 - MRI brain
 - Interictal/ictal SPECT
 - Positron emission topography(PET)
 - Magnetic electroencephalography(MEG)
 - Dense array EEG
 - EEG-fMRI
 - Functional MRI (fMRI)
 - Wada test (intracarotid sodium amobarbital)
 - Neuropsychological tests
- ER
- Functional mapping test

Epilepsy Monitoring Unit (EMU)



Interictal EEG

- low cost and global accessibility
- A single discrete focus
- High reliability of localization: convexity foci
- False localization: basal, mesial temporal, or interhemispheric foci
- False lateralization: hemispheric syndromes
- Localized lesions may demonstrate interictal discharges multifocally at remote/contralateral sites or bilaterally
- Focal attenuation or bursts of fast activity

Jayakar P, Epilepsia 2014;55(4):507–518

Ictal EEG with Video

- Same limitations as the interictal discharges
- Low amplitude fast activity at seizure onset or deep foci may not be evident on the scalp
- Confirm seizure semiology
- Identification of multiple seizure types or nonepileptic events

Jayakar P, Epilepsia 2014;55(4):507–518

จำนวนรวมผู้ป่วยที่ **Admit** ห้อง **EMU** รามาธิบดี แต่ละปี (เริ่ม 13 ก.ค.52)

ปี พ.ศ.	จำนวน (ราย)
2552	6
2553	35
2554	33
2555	52
2556	51
2557	44

Safety Issue



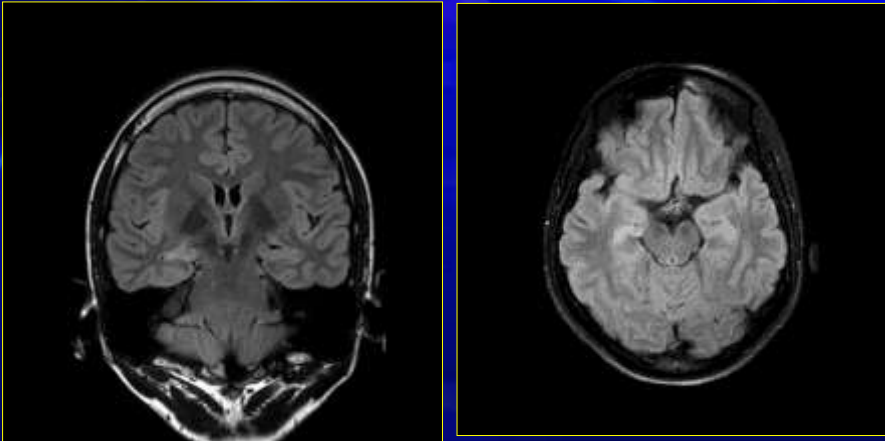
Medical complications	In pediatric EMU (454 admissions)	
Falls		1
Symptomatic subdural fluid collection		1
Hip pain		1
Postictal psychosis		1
Epileptic complications		
Status epilepticus	13 patients	17 events
Rescue medications given	35 patients	

Arrington DK, Epilep & Behav. 2013;27:346–350

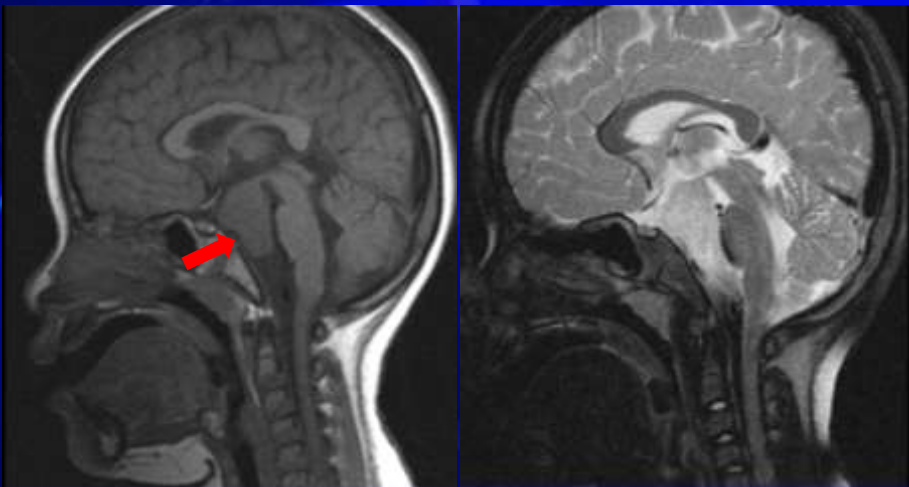
Magnetic Resonance Imaging

- **Focal cortical lesion** is a reliable marker of the location of the epileptogenic region(ER)
- Smaller or rarely larger than the ER
- May help restrict the extent of resection
- Multiple lesions (e.g., tuberous sclerosis or nodular heterotopias) does not necessarily mean that seizures are multifocal onset
- Standardized high resolution MRI protocol
- 3T MRI is superior to 1.5T
- “unfavorable time window” (6 mo – 2 y)

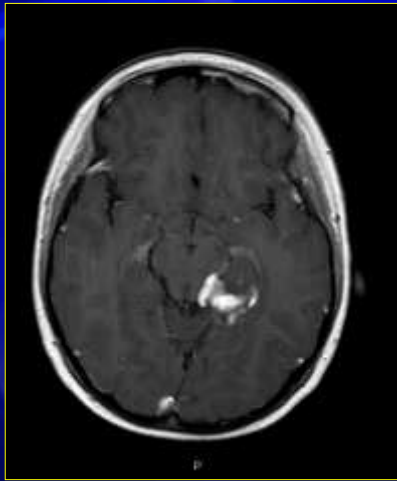
MRI Brain: MTS



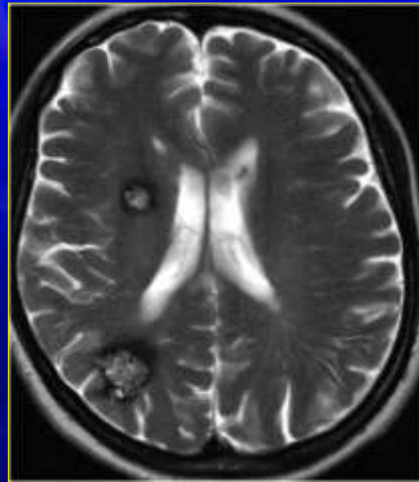
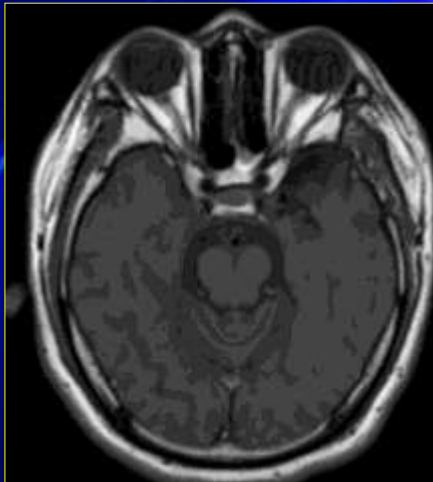
MRI Brain: HT Hematoma



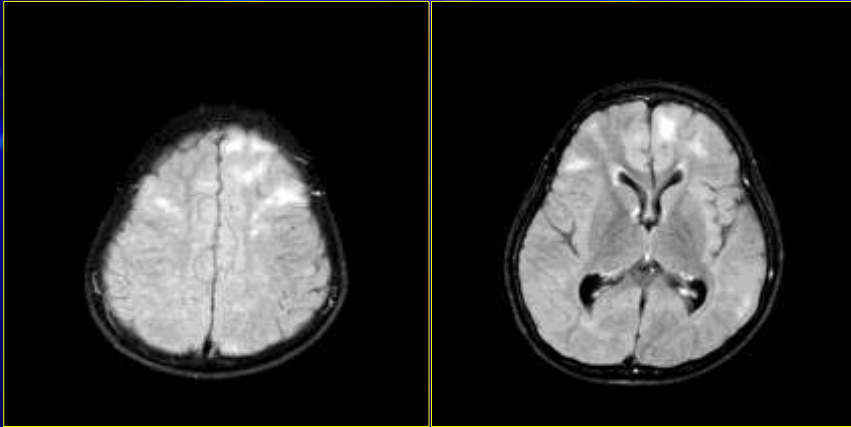
MRI Brain: Ganglioglioma



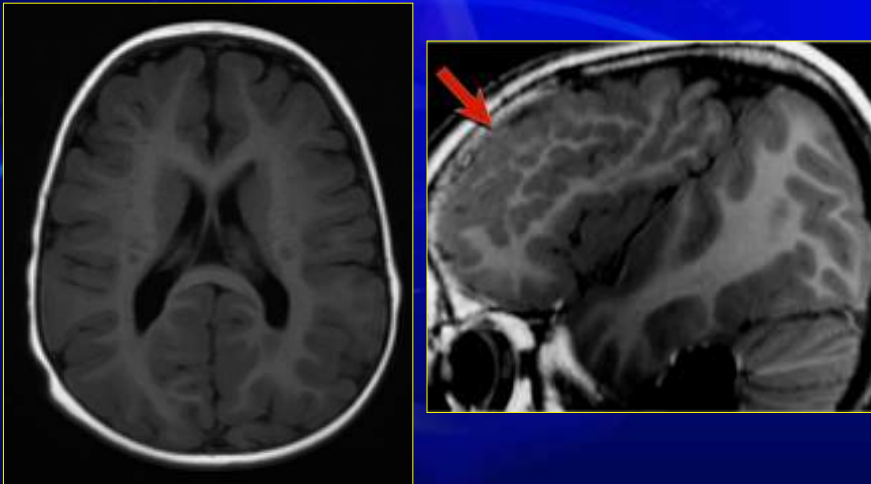
หลอดเลือดผิดปกติในสมอง: AVM & Cavernoma



MRI Brain ในผู้ป่วย TSC

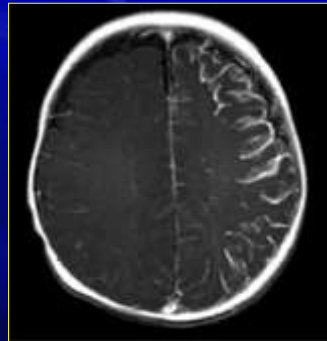
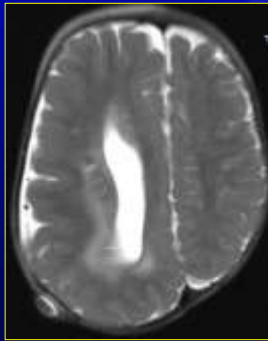


MRI Brain: Heterotopia & Polymicrogyria

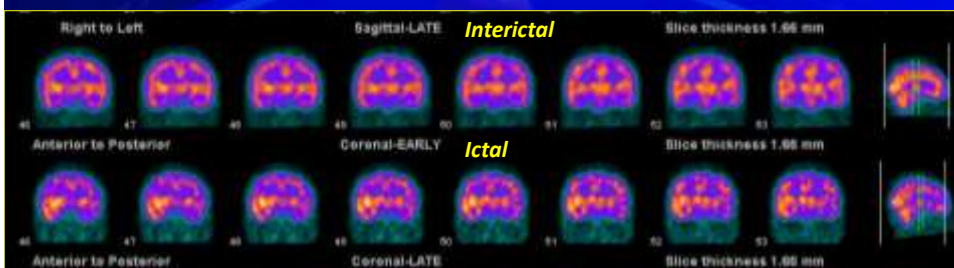


Hemimegalencephaly & Sturge-Weber Syndrome

- Medically refractory, catastrophic epilepsy
- Focal deficit: hemiparesis
- Hemispherectomy: plasticity of developing brain

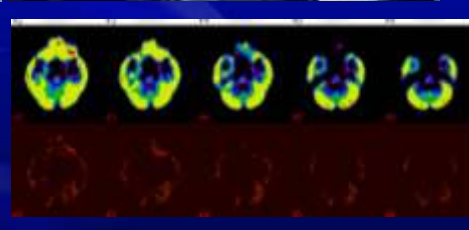
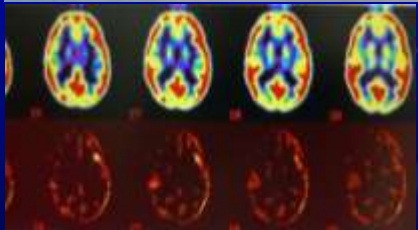


SPECT



ขณะชัก: มีการไหลเวียนของเลือดเพิ่มขึ้นที่สมองด้านขวา

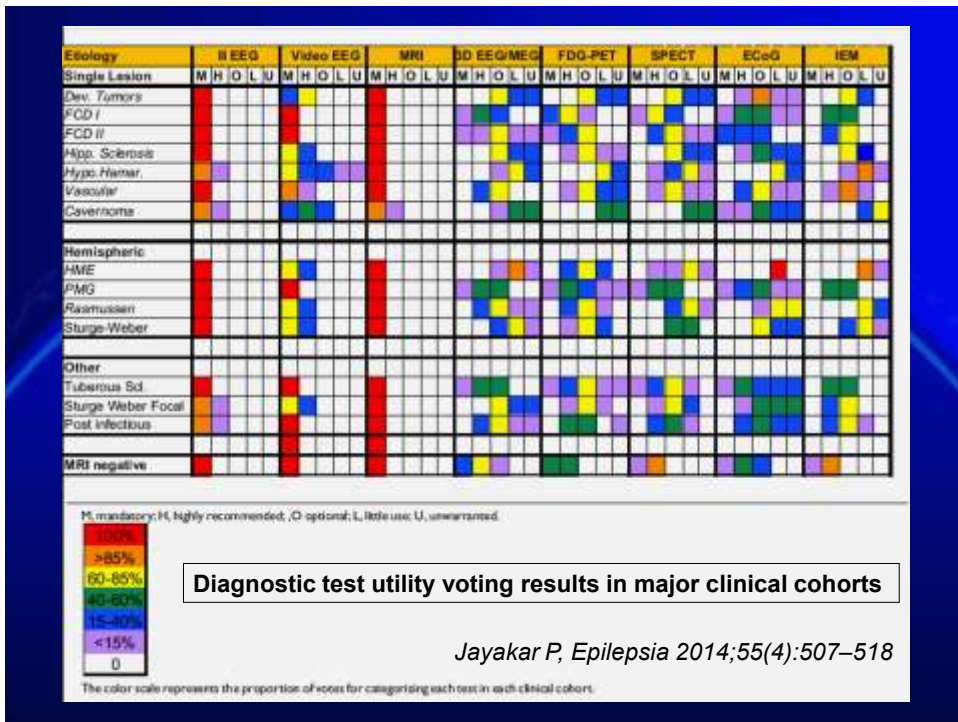
PET Scan



ขณะไม่ชัก: มีการใช้น้ำตาลกลูโคสลดลงที่สมองด้านขวาทางด้านหน้า

Neuropsychology & Neurodevelopmental Testing

- Baseline data for later comparison to quantify surgical impact and outcome
- Characterization of cognitive strengths and deficits sometimes not previously detected
- Informing the risk of postoperative deficits
- Contribution to the localization/lateralization of function
- Delineation of specific aims of surgery
- Information pertinent for educational and rehabilitation planning



Major Indications for the Implantation of Subdural grids

- 1. Determination of extent and distribution of the epileptogenic zone.
 - Normal imaging data (non-lesional)
 - Epileptogenic zone more widespread than the structural lesion
 - Discordance of non-invasive data
 - Epileptogenic zone relationship with structural lesion
 - Dual pathology
- 2. Determination of the relationship of the epileptogenic zone to eloquent cortex
 - Cortical stimulation
 - Somatosensory evoked potentials
 - Cortico-cortical evoked potentials

Bingaman WE, Bulacio J. *Childs Nerv Syst.* 2014;30:1897-904

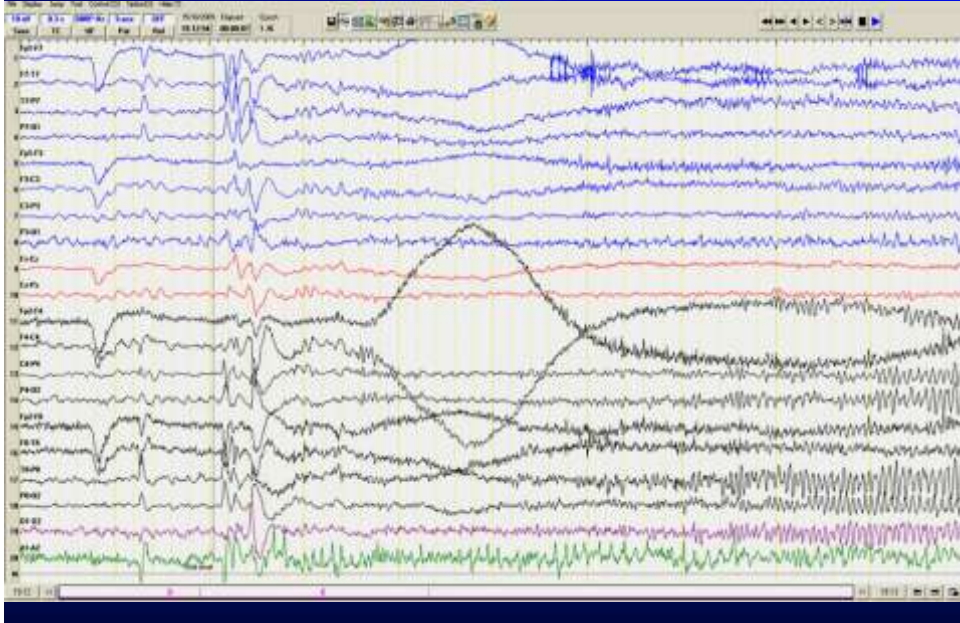
Case Demonstration

- A Thai 13-year-old girl
- Seizure onset 3 years
- Seizure Semiology:
 - Abdominal aura → Hand and/or oral automatisms
 - Complex motor seizure → GTC (rare)
 - Duration~ 2-5 min
 - Frequency: 1-2/week up to daily
- Current AEDs: Valproate, Topiramate
- IQ: Slow learner

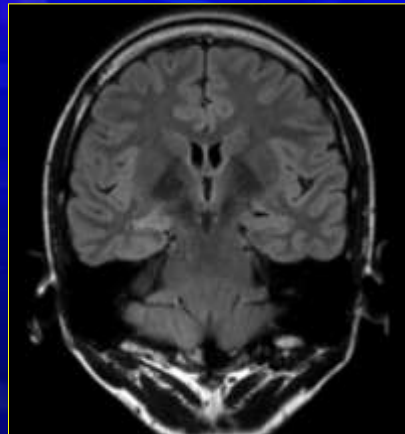
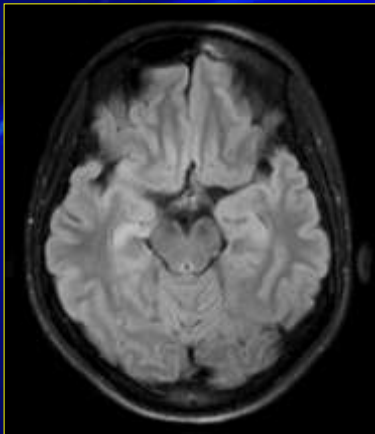
Video EEG monitoring

- Video recording

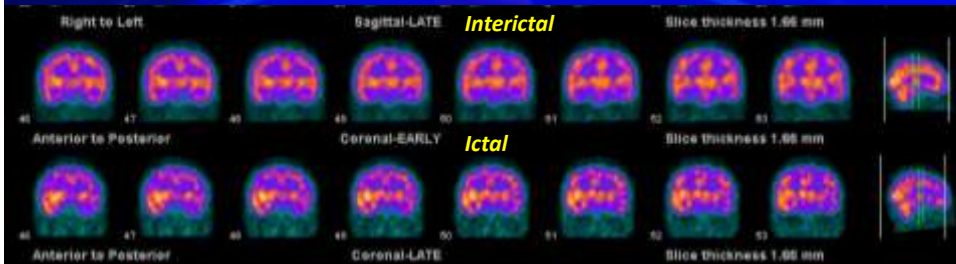
Ictal EEG



MRI brain



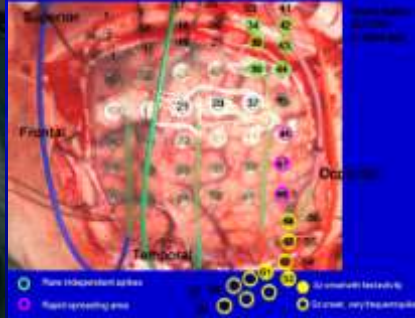
SPECT



ขณะชัก: มีการไหลเวียนของเลือดเพิ่มขึ้นที่สมองด้านขวา



การผ่าตัดสองขั้นตอน (Invasive Monitoring)



ค่าใช้จ่ายสูงและใช้เวลามาก



ผู้ป่วยภายหลังได้รับการผ่าตัด



Ramathibodi Excellent & Comprehensive Epilepsy Center- “RECEC”

- Medicine & Pediatrics
- Neurosurgery
- Neuroradiology & Nuclear medicine
- Psychiatry
- Neuropathologist
- Nurses & EEG technicians

Ramathibodi Excellent & Comprehensive Epilepsy Center



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