Epilepsy surgery in children ……How early is too early?

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Outline

- Introduction
- Selection of Epilepsy surgery candidates
- Presurgical evaluation
- Epilepsy surgery techniques
- How early is too early....

Introduction

- 30% of patients will not achieve seizure freedom with ASMS
- Unlikely to respond to sequential addition of ASMs
- Sometimes predictable FCD, DNET, MTLS

- Seizures in early life cause permanent impairments in learning, memory, and cognition and increased seizure susceptibility due to seizure-induced functional changes
- Eliminating seizures and treatment adverse effects of treatment is the ideal goal of therapy to preserve cognitive development

All patients with DRE should be considered as potential candidates for epilepsy surgery interventions…

- Epilepsy surgery is an established treatment for MRI-positive drug-resistant epilepsy
- Epilepsy surgery can be done safely with good outcomes for non-drug-resistant focal epilepsy with structural etiology
- Ealy intervention is necessary to protect the developing brain and correlate well long-term good outcome
- Children diagnosed < 16 years with DRE were likely to have long-life adverse outcomes (education etc)

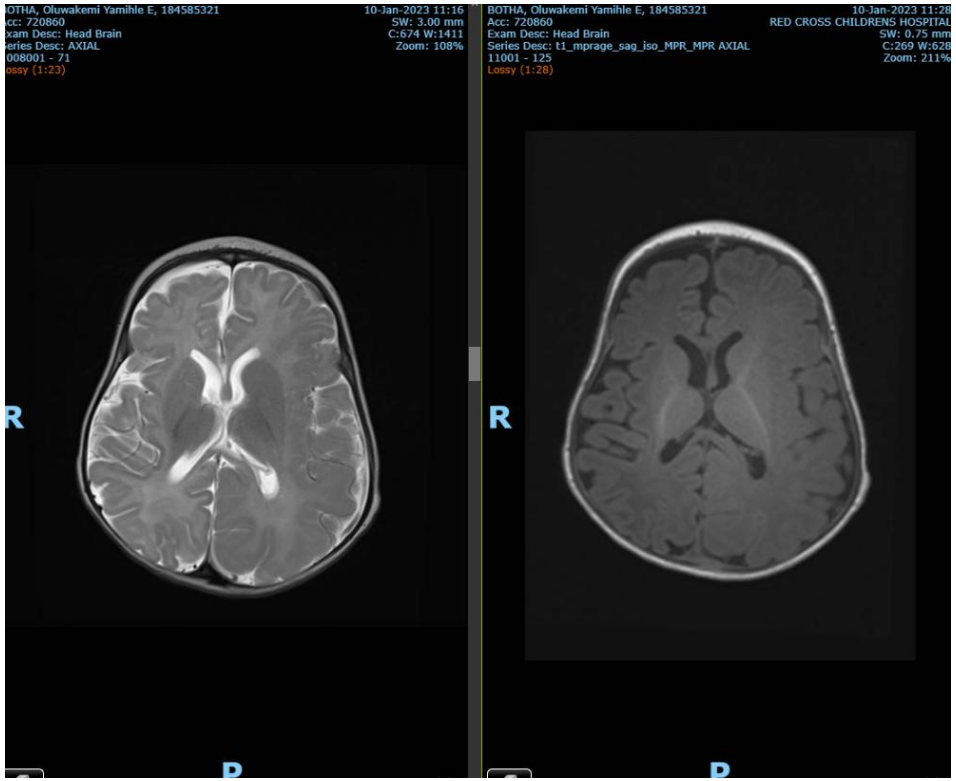
However, both families and physicians are reluctant to consider surgery early in the course

Veronica Pelliccia, Francesco Deleo, Francesca Gozzo, Ginevra Giovannelli, Roberto Mai, Massimo Cossu, Laura Tassi,Early epilepsy surgery for non drug-resistant patients,Epilepsy & Behavior Reports,Volume 19,

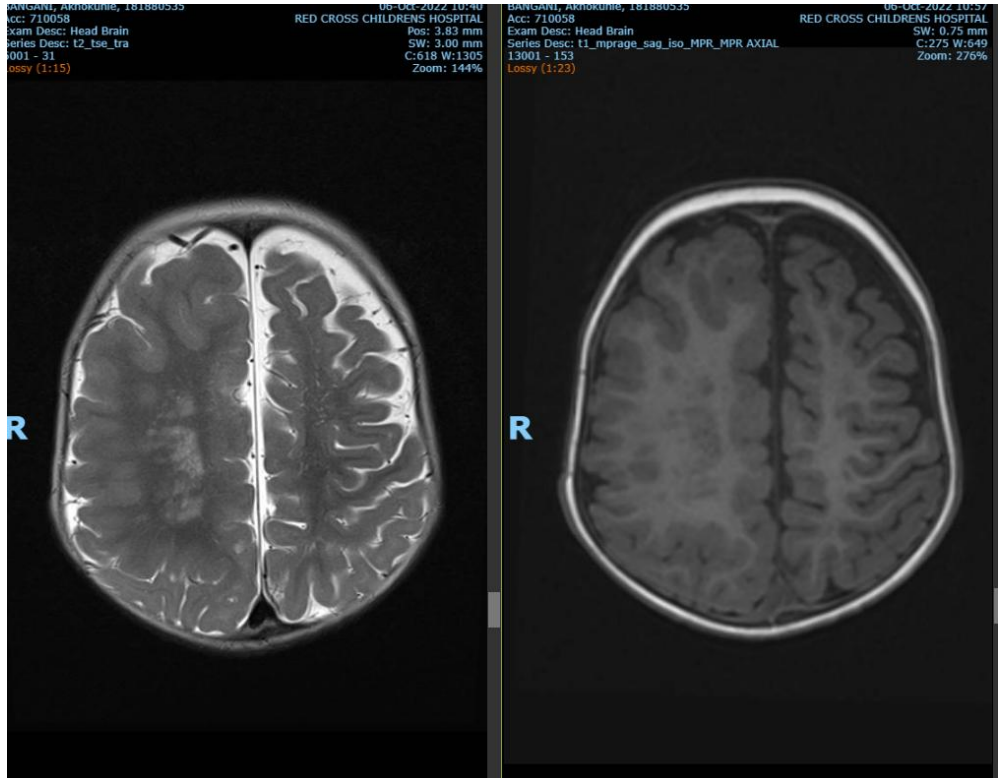
Sillanpää M, Jalava M, Kaleva O, Shinnar S. Long-term prognosis of seizures with onset in childhood. N Engl J Med. 1998 Jun 11;338(24):1715-22. doi: 10.1056/NEJM199806113382402. PMID: 9624191.

Clinical conundrums.....

BO- Life threatening Szs @ 10wks



BK -DRE on 3ASM <8Months



Selection of Epilepsy Surgery Candidates and Pre-surgical evaluation

Halima Naiwumbwe

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DRE is characterized by;

- Persistent seizures.
- An excessive load of ASMs.
- Cognitive decline due to neurobiochemical changes.
- Associations with psychosocial dysfunction.
- Dependent behaviors.
- A limited lifestyle.
- Diminished quality of life (QOL).
- An elevated risk of mortality from accidents or SUDEP.

Epilepsy surgery

- **The objectives of epilepsy surgery encompass**;
  - Achieving a lifelong seizure-free status
  - Avoiding surgical complications
  - Enhancing the QOL.

- **The criteria for considering epilepsy surgery have evolved!**
- **In the past;**
  - Experience of ≥ 4 focal seizures with LOA was a guideline for considering surgical intervention.
- **Currently;**
  - **The extent to which a seizure impedes daily activities has become a pivotal factor in deciding on surgical intervention**.
  - Experience of ≤ 1 monthly seizure that disrupts everyday life can be evaluated for epilepsy surgery.
  - Recognition of critical periods that allow full advantage of neuroplasticity.

Investigatory pathway and principles of patient selection for epilepsy surgery candidates: a systematic review. By Arash Ghaffari-Rafi1,2* and Jose Leon-Rojas2,3

Epilepsy surgery

Demonstrate that surgery is superior to medical treatment in:

- Achieving seizure freedom and
- Enhancing QOL.

Confirming the intractability of a child's epilepsy is not a must.

Suitable candidates should receive epilepsy surgery without unnecessary delay.

For optimal surgical outcomes, guidelines for identifying the most promising surgical candidates are needed.

Recognition of Surgically Remediable Epilepsy Syndromes.

Early identification of surgical candidates prevents lifelong dependence on family and society.

Delayed recognition can result in developmental setbacks and behavioral disturbances. (EE).

Common surgically remediable epilepsy syndromes include;

- MTLE with hippocampal sclerosis,
- DRE with a discrete focal lesion visible on MRI- FCD, DNETs.
- Diffuse hemispheric pathology.

Many patients might not fit these specific criteria but are still viable candidates for surgery.

Who are the better Epilepsy Surgery Candidates?

Patients displaying a discrete lesion on MRI with concordant VEM results.

Patients diagnosed with unilateral hippocampal sclerosis who have concordant VEM results.

Patients with unilateral hippocampal sclerosis but discordant VEM results *(intracranial EEG is necessary)*.

Patients with FCD and concordant VEM results (*intracranial EEG might be required*).

Patients diagnosed with MR-negative TLE exhibit ≥2 consistent results from pre-surgical evaluations (*intracranial EEG is essential*).

Priyanka Madaan et al 2021

- ***Priyanka Madaan et al 2021;***
- ***Pediatric Epilepsy Surgery: Indications and Evaluation***

Table 1 Selection criteria for candidature for epilepsy surgery

- Established diagnosis of epilepsy
- Drug refractoriness
- Debilitating seizures
- Recurrent status epilepticus
- Localizable epileptogenic region with a brain MRI lesion and/or when without an MRI lesion supported by concordant evidence from VEEG and functional imaging
- Informed and motivated parents
- Any progressive underlying cause/neurodegenerative disease ruled out (except Rasmussen's encephalitis)
- High likelihood of improvement in quality of life with seizure control

MRI Magnetic resonance imaging; *VEEG* Video electroencephalography

How to Select Epilepsy Surgery Candidates

A multidisciplinary methodological approach involving:

- Clinical history and physical exam
- Scalp video EEG telemetry
- Structural MRI (epilepsy protocol)
- Neuro-psychological assessment
- Neuropsychiatric assessment
- Social work and nursing assessment of patient support network.
- Discuss realistic expectations of surgical outcomes with parents.

Selecting patients for epilepsy surgery: Synthesis of data, by John S. Duncan et al, 2011

Pre-Surgical Evaluation

Presurgical evaluation is complex and resource-intensive.

Involves establishing surgical candidacy by;

- Confirming focal-onset epilepsy,
- Defining the EZ by **anatomo-clinical-electrographic-concordance**.
- Checking relationship to eloquent function mapping when necessary

Should be at a comprehensive epilepsy center by an MDT of

- Paediatric neurologists/ neurologists/epileptologists, neuroradiologists, neurosurgeons, and neuropsychologists.

Pre-surgical evaluation

- Combinations of non-invasive pre-surgical investigations may give one of the three answers:
  - A high level of concordance pointing to a specific localization without requiring further investigation before considering surgery.
  - Evidence of diffuse or multifocal epilepsy or an onset in an eloquent area, probably precluding surgery.
  - Discordant data requiring intracranial EEG recording to identify a surgically remediable target.

Non-invasive localization of the Epileptic Zone

1. Clinical localization based on seizure semiology:

- Seizure semiology corresponds to the symptomatogenic zone
- However, semiology in young children is elementary compared to adolescents and adults.
- **Children often have non-localizing, non-lateralizing, and bland Seizures like epileptic spasms and myoclonic & hypo motor seizures.**

2. Inter-ictal and ictal EEG:

- Inter-ictal EEG (for irritative zone).
- An ictal video EEG - requires at least three habitual seizures for the ictal-onset zone.
- **However, in infants and young children, focal findings may be masked by generalized epileptiform abnormalities**

3. HR brain MRI;

3 Tesla with epilepsy protocol to identify any focal lesions like FCDs and HS, DNETs.

The ILAE Neuroimaging Task Force recommends the use of the Harmonized Neuroimaging of Epilepsy Structural Sequences (**HARNESS-MRI) protoco**l with

High-resolution 3D T1 gradient echo sequences,

3D FLAIR sequences, and

2D sub-millimetric T2 sequences.

A quantitative analysis **(quantitative MRI [qMRI])** of signal intensity, through computational methods and machine learning, uncovers epileptogenic foci that expert human examiners do not accurately identify.

Between 9 and 18 months of age, lesions may disappear/become less obvious with changing pattern of myelination, & re-emerge later with adult MRI characteristics

Ancillary tests

4. 18F FDG-PET and SPECT

- For further confidence in EZ localization in case of discordance btn vEEG and a non-lesional MRI.

- **Concordance between SPECT and PET is useful.**
- **An inter-ictal PET** – a focal region of hypometabolism, which helps in EZ localization.

- **Ictal SPECT –EZ-** an area of hyperperfusion corresponding with the focal ictal onset and early ictal spread.

- Using the subtraction ictal SPECT co-registered to MRI (SISCOM) technique, ictal SPECT image can be subtracted from interictal SPECT image and superimposed onto MRI, resulting in better delineation.

- Ictal SPECT poses challenges in children since extratemporal epilepsy is common (with brief and rapidly propagating seizures).

5. Magnetoencephalography (MEG)

Is an advanced investigation with high spatiotemporal resolution.

Locates the 3D source of inter-ictal discharges.

Detects brain activity produced by recording magnetic fields due to the electrical currents generated by neurons.

EEG source imaging is sensitive to vertical dipoles, but

MEG is sensitive to tangential dipoles.

Inter-ictal MEG may help to localize epileptiform activity corresponding to the irritative zone.

MEG localization is especially useful in patients with previous neurosurgery, other skull defects, or failed surgery.

Invasive Localization of EZ

Long-term invasive EEG evaluation:

For better delineation of EZ and ictal-onset zone and/or mapping of eloquent brain function in selected children.

Intracranial electrode insertion through craniotomies (**strip and grid subdural electrodes**)

Robotic-assisted navigation for precise placement of **depth electrodes** without craniotomy.

Lately, **stereotactic EEG (SEEG)** has been preferred as it is minimally invasive and provides a 3-D orientation of the epileptogenic focus.

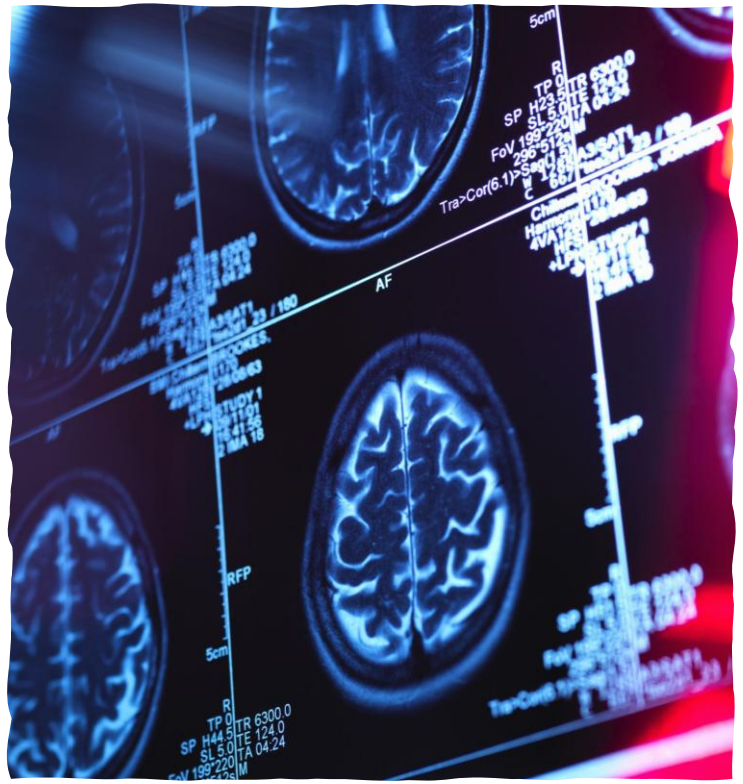
Due to limited electrode coverage, both require a prior hypothesis for possible EZ that should be confirmed or improved with the data acquired during the invasive EEG evaluation.

2. Intra-operative electrocorticography (ECoG)

It involves placing an electrode grid or depth electrode directly on the brain's surface for EEG recordings in the operating room during planned surgery and can be done before and after resection.

May be useful, especially for FCDs in children with repetitive and frequent inter-ictal epileptiform discharges.

Non-invasive Localization of Eloquent Cortex



- Removal of an eloquent cortex results in paralysis or loss of linguistic ability or sensory processing such as vision.
- **Functional MRI (fMRI) or MEG** can be used.
- Lateralization of language function and motor mapping.
- However, there are very few studies on fMRI in pre-surgical evaluation of children.
- Using fMRI in children is difficult, considering movement artifacts and poor cooperation for specified tasks due to their young age and DD.

Invasive Localization of Eloquent Cortex

The Wada test

- Cannot be used in young children due to a lack of cooperation
- Used to lateralize language, but it is currently used sparingly due to the availability of fMRI.

Electrocortical stimulation mapping-

- Is the standard investigation for functional localization.
- Done by cortical stimulation with gradually increasing stimulus intensity and duration.
- Can be used intraoperatively or in an extra-operative setting (*via stereotactic depth or subdural electrodes*).

Invasive methods are difficult in children because of the associated patient discomfort and the need for patient cooperation.

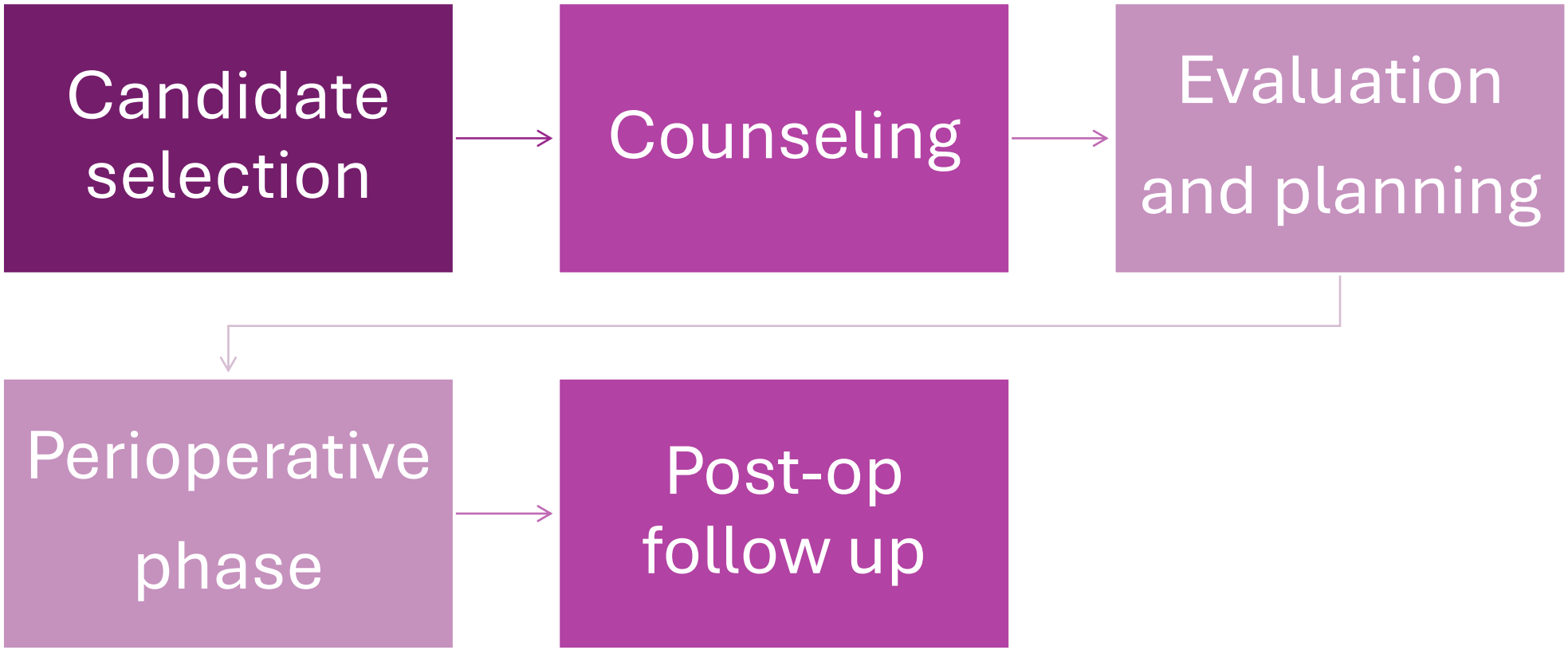
The 3D MMI

The different qualitative and quantitative MRI acquisitions, fMRI, EEG, and the above ancillary tests can be combined to create **a three-dimensional multimodality image (3D-MMI)** custom-tailored to each specific patient.

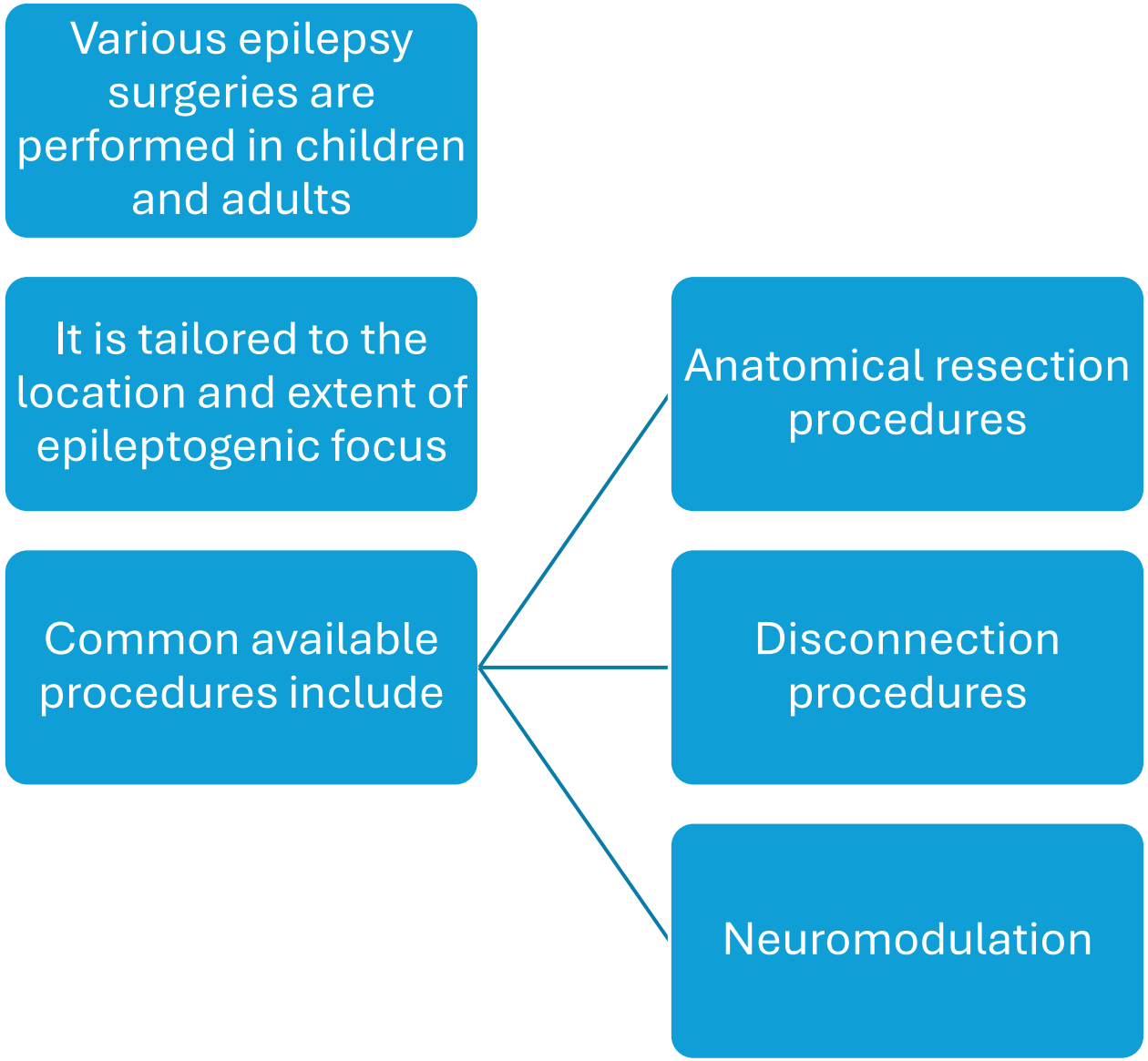
This **3D-MMI** can provide important information on the patient's particular anatomy and the location **of functional white matter tracts** to be avoided during surgery; this reduces surgical morbidity by increasing precision during surgery and resulting in improved post-operative seizure status.

Surgical interventions

Cyprian Birmeh


Candidate selection
Counseling
Evaluation and planning
Perioperative phase
Post-op follow up

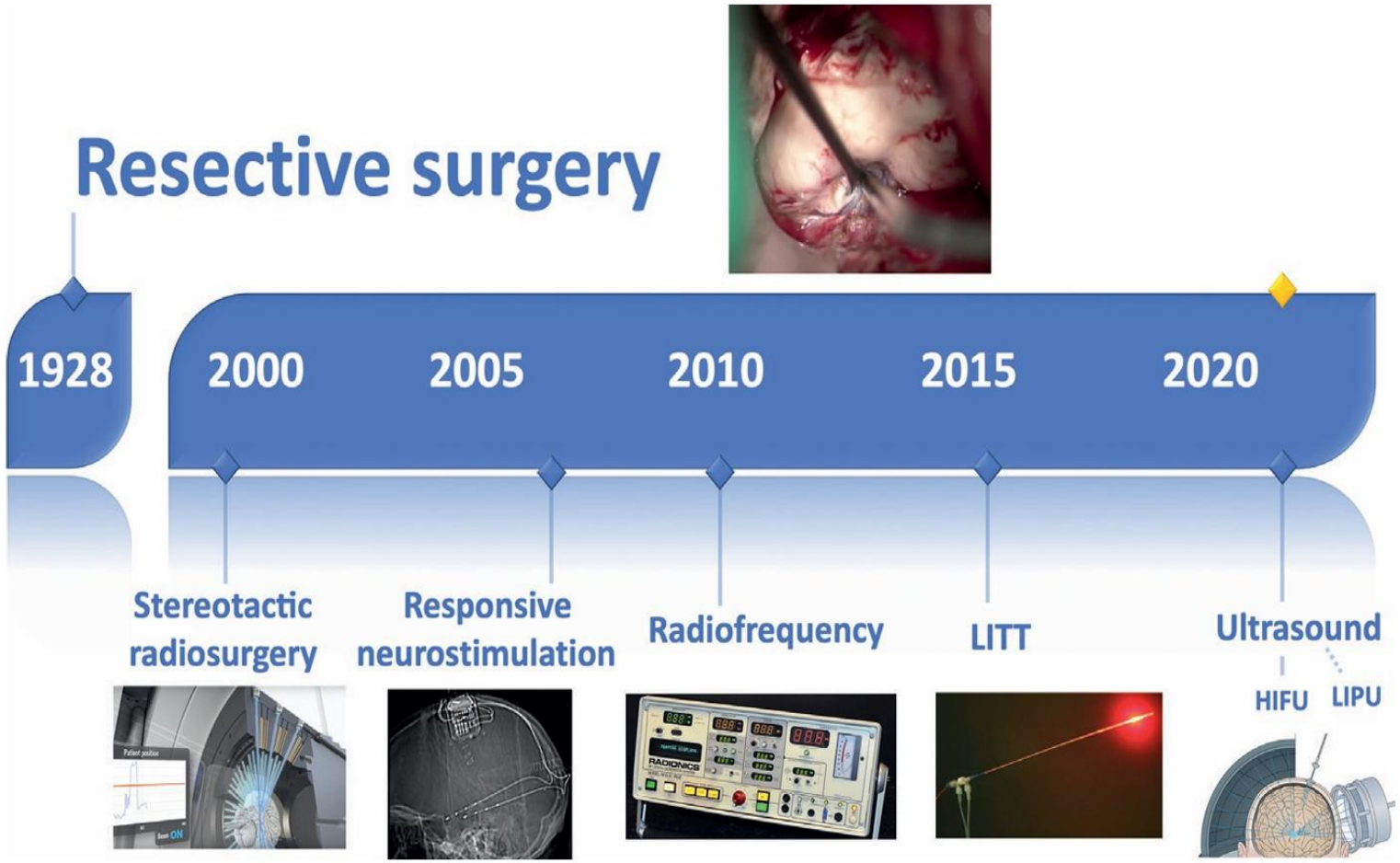
Epilepsy surgical techniques



Historical timeline of surgical techniques used to treat patients with mesial temporal lobe epilepsy.

HIFU, high-intensity focused ultrasound; LIPU, low-intensity pulsed ultrasound; LITT, laser interstitial thermal therapy

B. Mathon and S. Clemenceau



Lesionectomy

- Surgical resection of the lesion causing a patient's seizures
- Indicated for well defined and radiographically-apparent lesions
  - focal cortical dysplasia, low-grade tumors, cavernous malformations, and arteriovenous malformations
- Technique-total resection with minimal cortical perilesional resection
- Up to 100% seizure freedom following lesionectomy
- Neurological sequelae are dependent on the location of the lesion

(Chong et al. 2018)

(Lamberink et al. 2020)

Temporal lobectomy

- Indicated for TLE: MTLE with hippocampal sclerosis and neocortical TLE
- In children low-grade tumors, cortical dysplasia, vascular malformation, gliosis, heterotopia, and trauma can cause TLE
- Techniques
  - Anterior temporal
  - Selective amygdalohyppocampectomy

Temporal lobectomy

- Outcome
  - Seizure freedom-76%, reduced SUDEP, better outcomes with sclerosis on MRI
  - Morbidity
    - Cognition- 1% global memory deficits, verbal memory worse after dominant hemisphere resection
    - Psychiatric- mood disturbances and paranoia
    - Superior quadrantopia
    - Hemiparesis- injury to anterior choroidal artery, vasospasm, damage to motor pathways

(Mathon and Clemenceau 2022)

(Kovanda, Tubbs, and Cohen-Gadol 2014)

Extra temporal cortical resection

- Approaches range from lesionectomy to multilobar resection/disconnection
- Indicated for FCDs
- Extent of resection is dictated by extent of lesion
- Outcome-central lobule epilepsy
  - Post operative deficits are either transient in nature or predicted and discussed preoperatively
  - 62% seizure freedom in central lobule
  - 19% permanent motor deficit

(Kerezoudis, Lundstrom et al. 2022)

Posterior quadrantectomy

- Resection or disconnection of the posterior quadrant sparing the post central gyrus
- Indicated for multilobar lesions including large cortical dysplasia, neoplasms and leptomeningeal angiomas
- Seizure freedom rates range from 50 to 92%

(Verhaeghe et al. 2018)

Hemispherectomy

- Indications –developmental/congenital, acquired and progressive
- Developmental indications-multilobar cortical dysplasia and hemimegalencephaly
- Acquired- Perinatal vascular insult, Rasmussen's encephalitis and leptomeningeal angiomas
- Bilateral contraindications include lissencephaly and band heterotopia
- Complications include – need for blood transfusions, aseptic meningitis, hydrocephalus, hemosideroris

(Griessenauer et al. 2015)

Disconnection surgeries

Hemispherotomy

Corpus callosotomy

Lobotomy

Lesionotomy

Hemispherotomy

- Disconnecting an entire hemisphere from the contralateral hemisphere, basal ganglia, and brainstem
- Indications include hemimegalencephaly, Rasmussen’s encephalitis, Sturge-Weber syndrome and diffuse unilateral cortical dysplasia
- Contraindications include lissencephaly and band heterotopia
- Bilateral involvement on EEG is associated with unfavorable outcome

  (Grisold et al. 2023)

History

- Anatomical hemispherectomy(AH)-Dandy 1928 for gliomas
- AH for epilepsy- Mckenzie 1938
- Documented use in Sturge-Weber, hemimegalencephaly, extensive hemispheric infarct- 1961-1983
- Complications of AH; blood loss, coagulopathy, metabolic imbalances, superficial cerebral hemosiderosis- Brian et al 1990
- Functional hemispherectomy- Rasmussen 1974

History

The reported mortality has decreased over the last 30 years from 32% to 2%

The evolution from hemispherectomy to hemispherotomy along with neuroanesthesia advances has reduced mortality and morbidity

(Karagianni et al. 2023)

Corpus callosotomy

- **Palliative** surgery for reducing seizure burden
- Techniques
  - Anterior corpus callosotomy
  - Complete
  - Complete corpus callosotomy plus lateralizing strips for multistage surgery
- Indications
  - LGS
- Outcomes
  - Reduces tonic and **atonic** seizures in LGS – 55.3% drop attack freedom
  - Transient hemiparesis and disconnection syndrome

  (Chan et al. 2019)

Multiple subpial transection

- Involves small transections below the pia mater that sever horizontal fibers thought to propagate seizures while leaving vertical fibers and blood supply intact
- Used when the epileptogenic zone encompasses any one of the eloquent zones
  - Motor/somatosensory cortices, Broca's and Wernicke's areas, the occipital pole
  - Used in LKS
- Outcome
  - Not as effective as cortical resection
  - Seizure recurrence is seen in many patients

  (Downes et al. 2015)

Minimally invasive techniques

- Less surgical morbidity
- Includes stereotactic procedures
- Stereotactic radiosurgery using focal ionizing radiation e.g. gamma knife
  - Used for difficult to access lesions such as deep brain tumors and arteriovenous malformations
- Stereotactic radiofrequency thermocoagulation
  - Denaturing of brain tissue via heat with monopolar needle
- Laser induced thermal therapy (LITT) via MRI guided laser ablation

Neuromodulation

- Uses electrical pulses to inhibit seizure networks in the brain
- Indicated as **palliation** for non-surgical candidates
- These treatments provide
  - Non-resective
  - Modifiable in dosage
  - Mostly reversible
- Surgically placed neuromodulation devices
  - VNS, DBS, RNS

Vagus nerve stimulation

- Implant generates periodic impulses to left vagus nerve
- Disrupts synchronized impulses to cortex
- Stimulator can be initiated during aura
- 30% showed improvement by 50%
  - (Toffa, Touma et al. 2020)

Deep brain stimulation

- IPG connected to electrode placed at the target
- Targets
    - Anterior thalamic nucleus- focal seizures
    - Centro-median thalamic nucleus- generalized seizures
    - Hippocampal DBS
  - Favorable long-term efficacy and outcome.
  - The SUDEP rate with DBS (2.0) is comparable to other neuromodulation for DRE
- (Vetkas, Fomenko et al. 2022)
- (Salanova, Sperling et al. 2021)

Responsive nerve stimulation

- Closed loop system providing electrical stimulation based on real-time ECoG activities
- Two intracranial leads connected to a cranially implanted neurotransmitter
- Allows for both treatment and data collection
- Long term median seizure frequency reduction of 75%
- (Nair et al. 2020)
- Not available in most parts of the world

Challenges of neuromodulation in limited resource settings

- Cost of device
- Cost of battery
- Technical support in the context of long distances from capable neurosurgical centers
- RNS is not available in most parts of the world

Post-operative phase

0-3 months

- Medical and surgical review

3-12 months

- Brief neuropsychological review

After 12 months

- Reassessment of epilepsy
- neuropsychological review
- Review of goals

(Baite et al, 2023)

Post op outcome measurement Engel and ILAE classification

Engel Class	General Description	Detailed Engel Description	ILAE Classification
I	seizure-free or residual auras	I-A: completely seizure free since surgery	Class 1. Completely seizure free; no auras. Class 1a. Completely seizure free since surgery; no auras. Class 2. only auras; no other seizures
		I-B: nondisabling simple partial seizures only since surgery	
		I-C: some disabling seizures after seizures surgery, but free from disabling seizures for 2 yrs	
		I-D: generalized convulsions with ASM discontinuation only	
II	rare disabling seizures (<3 complex partial seizures per year)	II-A: initially free from disabling seizures, but still has rare seizures	Class 3. 1-3 seizure days/yr; ± auras
		II-B: rare disabling seizures since surgery	
		II-C: occasional disabling seizures since surgery, but rare seizures for the last 2 yrs	
		II-D: nocturnal seizures only	
III	worthwhile improvement	III-A: worthwhile seizure reduction	Class 4. 4 seizure days/yr - 50% reduction in baseline nuber of seizure days; ± auras
		III-B: prolonged seizure-free intervals of seizure days; auras amounting to 50% of follow-up period, but not 2 yrs	
IV	no worthwhile seizure improvement	IV-A: significant seizure reduction	Class 5. <50% reduction in baseline number of seizure days - 100% of baseline number of seizure days; ± auras
		IV-B: no appreciable change	
		IV-C: seizures worse	Class 6. >100% increase in baseline number of seizure days; ± auras

.....How early is too early??..

Drug Resistant Epilepsy in young infants and neonates..

- Differs from DRE in older children in several aspects
    1. The enhanced excitability of the immature brain makes very early onset seizures more challenging to treat
    2. ASMs used in older children and adults are less efficacious in neonates
    3. Unknown long-term consequences on brain development
    4. High risk for long-term developmental delay when the Seizures are drug resistant.

- *Tadic BV, Kravljanac R, Sretenovic V, Vukomanovic V. Long-term outcome in children with neonatal seizures: a tertiary center experience in cohort of 168 patients. Epilepsy Behav. 2018; **84**: 107–13.*

ASMs IN NEONATES AND YOUNG INFANTS …

- The molecular targets of antiseizure medications include ion channels, neurotransmitters, and receptors.
- The same targets regulate brain processes essential for the propagation of seizures, learning, memory, and emotional behavior.
- The association of developmental disorders exposure to antiseizure drugs in utero is well-established in humans

Potential contributors of underutilization of early surgical interventions….

- Ictal behaviors are less lateralizing
- Limitation of neuroimaging in clearly delignating epileptogenic zone (rapid brain growth and myelination)
- Anesthesia and other complications which are inherent to the immature body physiology
- HDC-20%> in hemispherectomies and hemispherotomies
- Risk of bleeding is high with brain friability
- Extensive procedures required to achieve seizure freedom

frontiers in Neurology

CASE REPORT
published: 24 December 2021
doi: 10.3389/fneur.2021.818972

Case Report: Hemispherotomy in the First Days of Life to Treat Drug-Resistant Lesional Epilepsy

Konstantin L. Makridis[1,2,3], Christine Prager[1,2], Anna Tietze[4], Deniz A. Atalay[1,2], Sebastian Triller[1,2], Christian E. Elger[1,2,5], Ulrich-Wilhelm Thomale[6] and Angela M. Kaindl[1,2,3]

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Background: Neonatal drug-resistant epilepsy is often caused by perinatal epileptogenic insults such as stroke, ischemia, hemorrhage, and/or genetic defects. Rapid seizure control is particularly important for cognitive development. Since early surgical intervention and thus a short duration of epilepsy should lead to an optimal developmental outcome, we present our experience with hemispherotomy in an infant at the corrected age of 1 week.

Methods: We report successful hemispherotomy for drug-resistant epilepsy in an infant with hemimegalencephaly at a corrected age of 1 week.

Results: The infant was diagnosed with drug-resistant lesional epilepsy due to hemimegalencephaly affecting the left hemisphere. Given congruent electroclinical findings, we performed a left vertical parasagittal transventricular hemispherotomy after critical interdisciplinary discussion. No complications occurred during the surgery. Intraoperatively; 118 ml of red blood cells (30 ml/kg) and 80 ml of plasma were transfused. The patient has been seizure-free since discharge without further neurological deficits.

Conclusion: We demonstrate that early epilepsy surgery is a safe procedure in very young infants if performed in a specialized center experienced with age-specific surgical conditions and perioperative management. The specific surgical difficulties should be weighed against the risk of life-long developmental drawbacks of ongoing detrimental epilepsy.

Keywords: hemispherotomy, epilepsy surgery, epilepsy, drug-resistant epilepsy, infant, pediatrics, EEG

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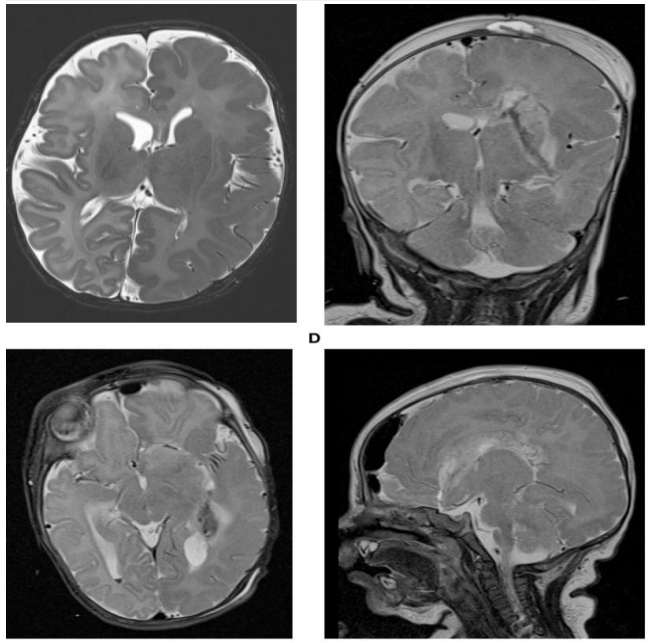
INTRODUCTION

Neonatal-onset drug-resistant epilepsy results from perinatal epileptogenic insults such as stroke, ischemia, hemorrhage, and/or genetic defects. Rapid seizure control is key for the cognitive developmental outcome of affected young individuals. Initial treatment always involves antiseizure medication (ASM), complemented sometimes later by medical diets to inhibit seizure activity. In about a third of all patients with epilepsy, however, two concomitantly or subsequently applied ASM



Drug-resistant lesional epilepsy due to a Hemimegalencephally affecting the left hemisphere with congruent electroclinical findings

- 1-week corrected age
- Presentation associated with status
- No improvement after >5ASMS
- Age appropriate DQ
- Surgical intervention
  - Hemispherotomy with good outcome and good seizure control

Ultra early surgical intervention

- Sixty-four patients underwent 69 surgeries before the age of 3 months.
- The most common pathologies were cortical dysplasia (28), hemimegalencephaly (17), and tubers (5).
- The most common procedures were hemispheric surgeries (48 procedures).
- Good outcome, No death recorded

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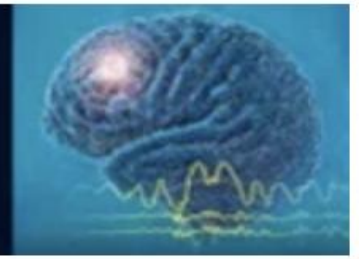


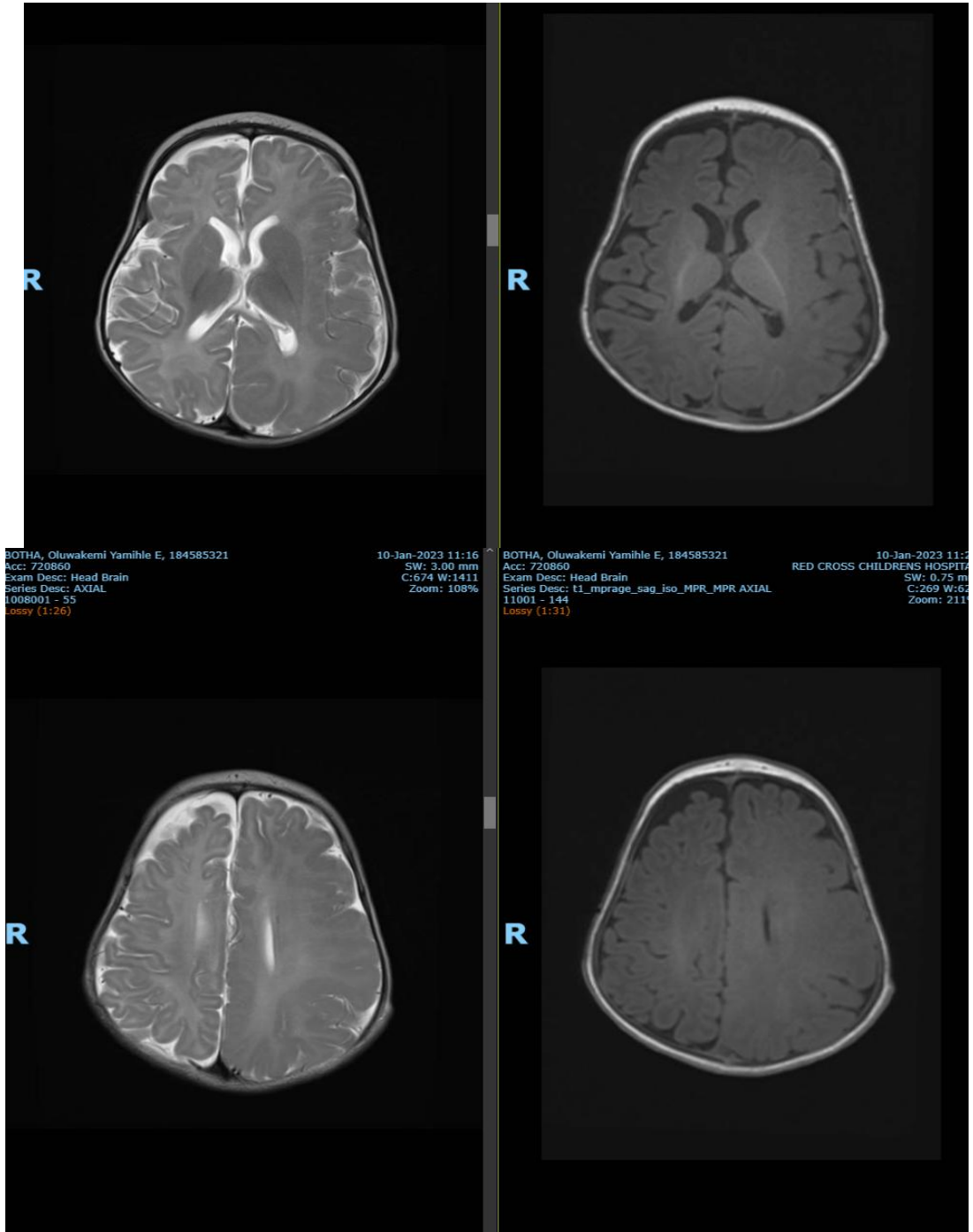
FULL-LENGTH ORIGINAL RESEARCH | Full Access

Epilepsy surgery in infants up to 3 months of age: Safety, feasibility, and outcomes: A multicenter, multinational study

Jonathan Roth, Shlomi Constantini, Margaret Ekstein, Howard L. Weiner, Manjari Tripathi, Poodipedi Sarat Chandra, Massimo Cossu, Michele Rizzi, Robert J. Bollo ... See all authors

Case 1
B.O.
Surgery at **3 months**

- 2 Years and 5 months, F
- Delivered at term with no significant perinatal history
- Presented with Seizures
  - Initial events at 10 weeks, febrile provoked status
- Semiology
    - Clusters of right-sided focal onset motor seizure with involvement of the contralateral side and impaired awareness
    - No other seizure types
- Examination:
    - No neurocutaneous stigmata
    - Not dysmorphic had FTT
    - Right-sided hemiparesis with long tract signs



Neuroimaging…

- EEG
  - Ictal recording revealed a left central epileptogenic activity correlating to the right-side motor manifestation

Course , 3 Months old..

- Developmental delay was obvious
- Adequate sequential trial of phenobarbitone and Keppra with no control
- Multiple, daily life-threatening events necessitating NG feeding
- Right side hemiparesis established

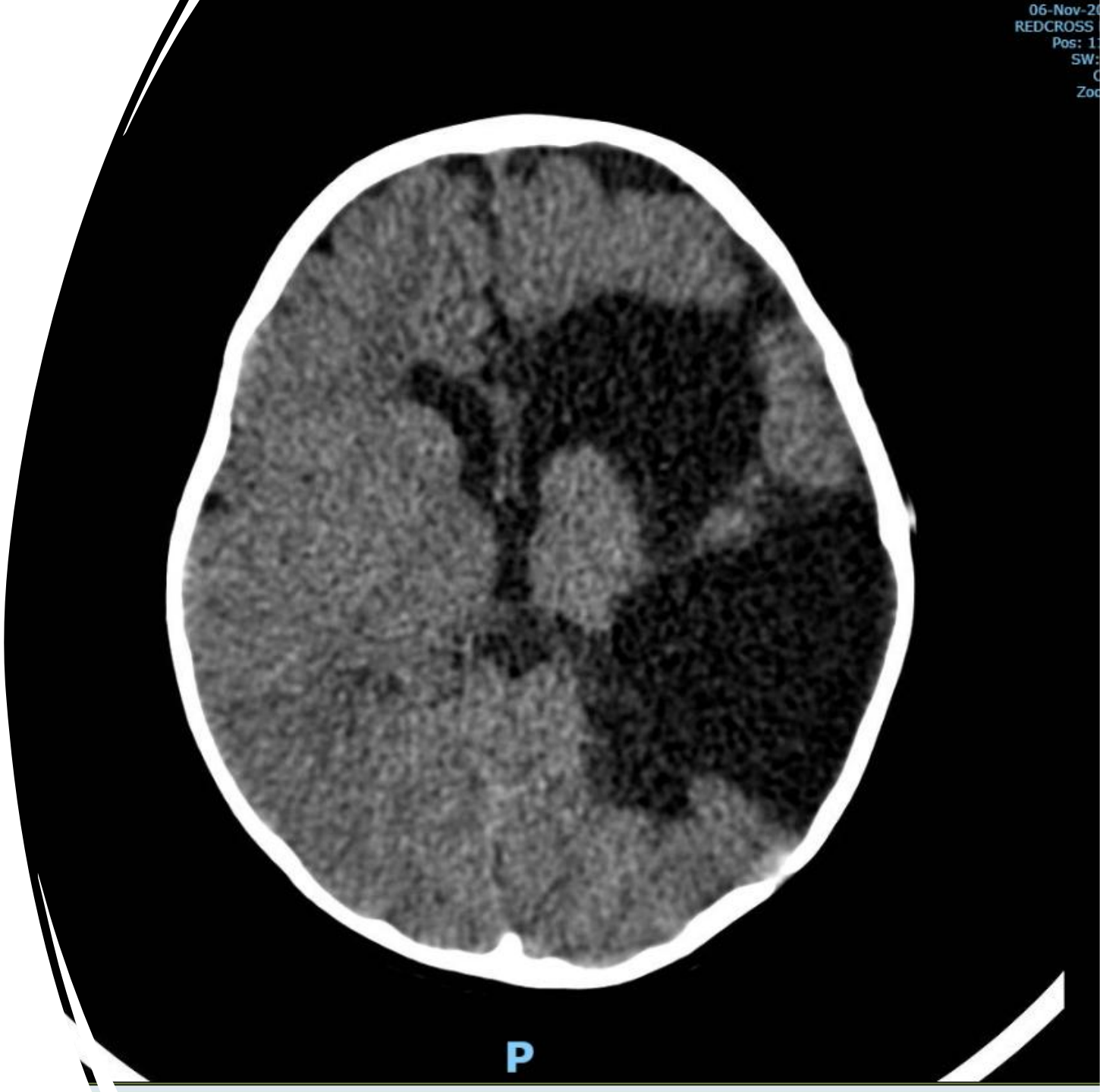
- MDT discussion-Neurology/Neurosurgery

Video telemetry

- Asymmetric background activity
- Multiple electric events were recorded on the left occipital, parietal central region with propagation to the entire hemisphere
- Right-sided semiology with purposeless movements on the left

Neurosurgery

- Peri insular hemispherectomy done
  - No major complications intra-op
  - Hemiparesis as expected
  - No immediate post-op complications
- Resumed oral feeding before discharge
- No seizures since surgery
- Weaned off ASMS
- Followed by Neuro Dev-DQ 44
- Awaiting Attached to CP clinic



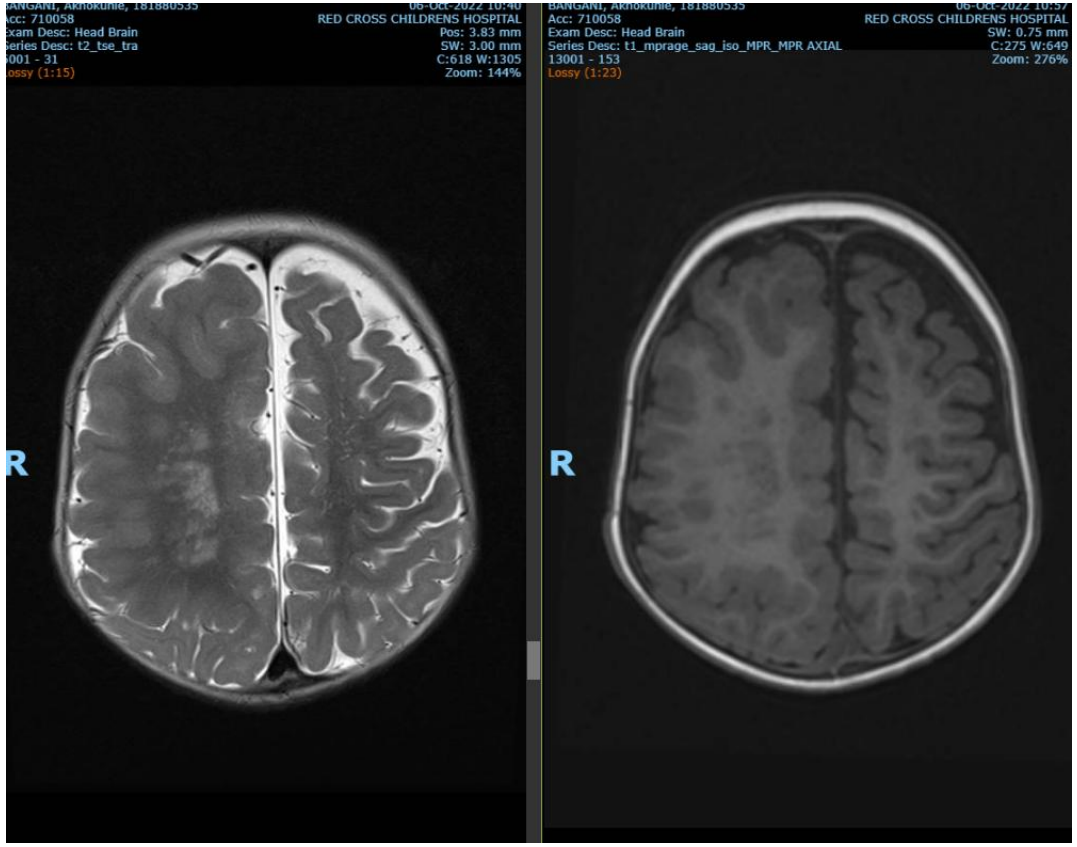
Case 2...AK Surgery at **1 year**

- 4 years and 5 months
  - Came at Rx at 5 months of age, from E.C
  - Normal perinatal and birth history
- Seizures
  - Onset at 1 month, described as GTCs
  - Second events at 6 months of age
  - Described as clonic jerks of both arms and legs
  - Brief events initially
  - Right-hand dominance was noted at 10 months
  - Notable developmental delay
- Examination
  - Non-syndromic dysmorphisms, OFC at +1SD
  - Features of Lt sided hemiparesis
    - poor fine motor function of the ipsilateral hand
    - Good function on the lower limb

Course... 1 year

- ASM trials-Phenobarbitone/ Valproate/Keppra sequentially with no seizures control
- Multiple episodes of SE
  - Left sided tonic seizures, brief, multiple events per day
- EEG-right subclinical focal status
- Feeding challenges, necessitating NGT feeds at this point
- MRI –done
- MDT –Discussion

Imaging…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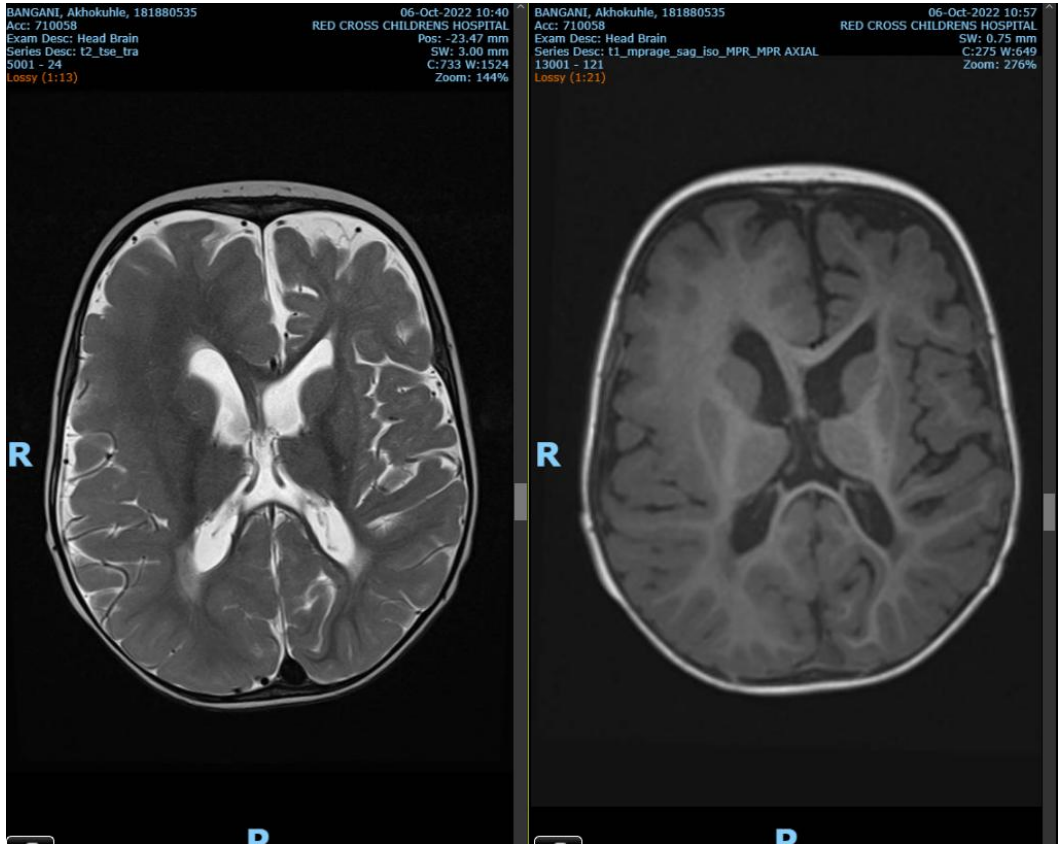
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Surgery..

- Peri-insular hemispherotomy (03/11/2022)

- No unexpected complication
- SSI
- Continued with ASM
  - Weaned off Phenobarbitone
  - Weaned of Keppra subsequently

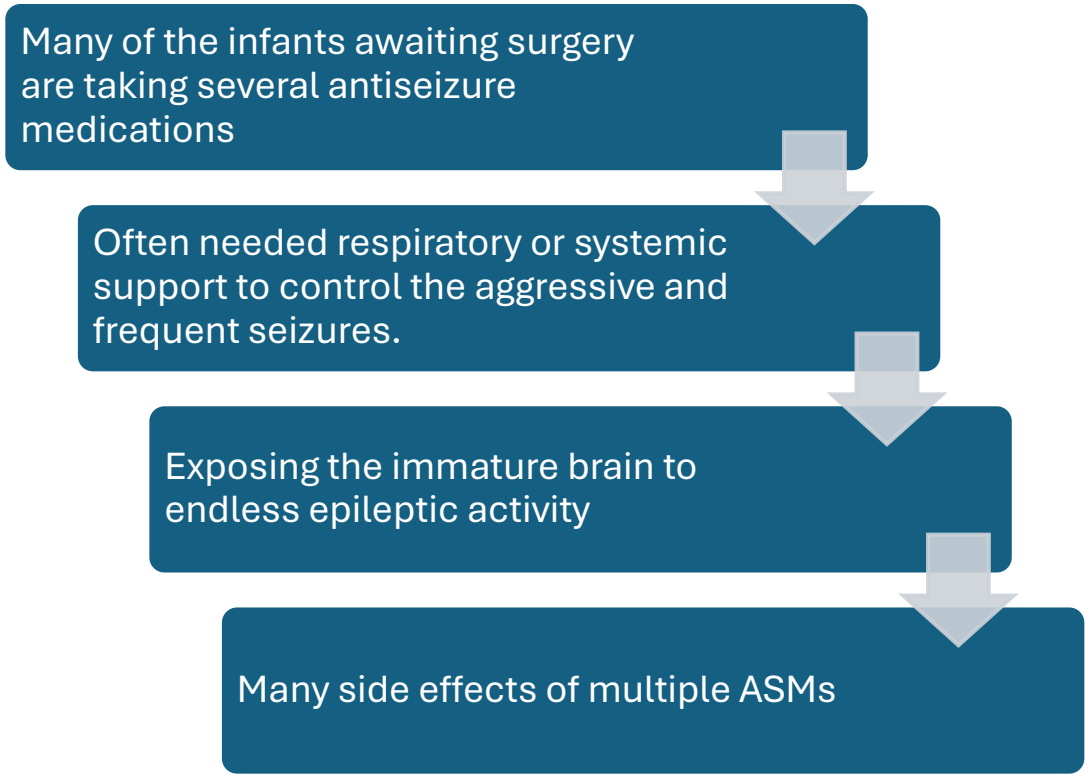
- Seizures recurred after 8
- LF focal motor seizures
- MRI-Tractography
  - connection on the right frontal lobe
- Day telemetry
- Electroclinical congruency
  - Ictal activity originating from right frontal region with LT side propagation
- Re do OP –complete disconnection
- One year Sz free
- CP service-Noted developmental improvement-under

EPILEPSY SURGERY-RXH MDT

Patients are flagged by neurology	2 Monthly, Hybrid MDT (international)	Neurology, neurosurgery, neuropsychology, Neurophysiology, radiology	Review electroclinical and imaging data, need for invasive monitoring
Type of surgery-discussed by neurosurgery	Good anesthesia team and neurocritical care	Follow-up by both team, rehabilitation	2000-2021-83 patients, youngest 3 months

“*No child is too small or too young if seizures are severe enough*”[1]

Postponing surgery may lead to prolonged ineffective medical treatment



Judicious surgical judgment should be used

- In light of the potential risks of epilepsy surgery in the very young, as well as the benefit of early surgery
  - infants should be referred to tertiary centers with experience in complex surgeries in the very young as early as possible

1. *Roth, Jonathan, et al. "Epilepsy surgery in infants up to 3 months of age: safety, feasibility, and outcomes: a multicenter, multinational study." Epilepsia 62.8 (2021): 1897-1906*