LOCALIZATION EPILEPSY SURGERY IN CHILDREN AT THE VIETNAM NATIONAL CHILDREN'S HOSPITAL

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ABSTRACT

Purpose: *To describe some clinical manifestations and some characteristics of the epileptogenic lesion in children suffering from drug-resistant localization-related epilepsies. To retrospectively analyze the post-surgical outcome among these patients based upon Engel classification system.*

Methods: *Hundred and two patients, younger than 18 years, operated on from 2010 to 2021 and followed-up for at least 1 year were identified at Vietnam National Children's Hospital. Individualized microsurgical resections, aimed at removal of the epileptogenic lesion, were performed as indicated by the results of presurgical evaluations, which included video-electroencephalographic monitoring, specialized MR Imaging and PETCT scan when needed.*

Results: *Some clinical characteristics: Male: 52,4%, Female: 47,6% Mean age at surgery: 82,8 months. Mean duration before surgery: 51,4 months. Mean age at seizure onset: 33,7 months. Seizure semeiology: simple partial seizure: 33%, complex partial seizure: 8.3%, partial seizure with 2nd generalization: 33% and generalized seizure: 25%. EEG abnormalities were ipsilateral to the epileptogenic lesion in 58,3 % of cases, contralateral in 8,3% and bilateral in 33,3 %. Anatomically, temporal lobe involvement accounted for 58,3% of cases, extra-temporal lobe and multi-lobar involvements accounted for the remaining 41.6%. Histopathologically, focal cortical dysplasia: 41,6%, low-grade tumors: 25%, hippocampal sclerosis: 8,3%, Rasmussen syndrome 16,6 % and unremarkable: 8,3 %. At post-surgical follow-up, 87 patients (83,3%) were seize-free, in Engel's class IA & IIA. Temporal lobe group had the best outcome (with 71,4 % of cases had Engel class IA and 28,6% had Engel class IIA).*

Conclusion: *Drug-resistant localization-related epilepsies in children could be cured successfully by resective surgery in the majority of cases.*

Keyword: *Drug-resistant localization-related epilepsies, Epileptogenic lesion, Presurgical evaluation, Epilepsy surgery, Outcome of epilepsy surgery.*

I. OVERVIEW

Drug-resistant localization-related epilepsy is a complex group of disorders in pediatric neurology. According to Jerome Engel Jr., the rate of drug-resistant epilepsy accounts for about 30-40% of the total cases of epilepsy. Meanwhile, Sandipan Pati and Andreas V. Alexopoulos suggest a rate of almost 33% for drug-resistant epilepsy, and up to 60% of patients with epilepsy originating from a focal lesion will eventually develop drug resistance.

Uncontrolled recurrent epileptic seizures can result in serious consequences such as cerebral hypoxia, developmental delays, and cognitive-motor disturbances. Seizures can lead to injuries, accidents, and life-threatening situations. Additionally, patients with epilepsy have to endure the side effects of using multiple

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antiepileptic drugs concurrently, often at high and prolonged dosages.

Thanks to advancements in diagnostic exploration and therapeutic intervention, an increasing number of patients with drug-resistant localization-related epilepsy can now undergo surgeries to remove epileptogenic brain lesions, either eliminating or significantly reducing seizure occurrences.

Globally, epilepsy surgeries for drug-resistant localization-related cases have been performed for many years, yielding encouraging outcomes by various authors. Stefano Francione and colleagues, in an 8-year study (1996-2004) involving 113 children with drug-resistant localization-related epilepsy, demonstrated that post-surgery, up to 68% of patients were seizure-free, accompanied by significant improvements in cognitive-motor development.

In Vietnam, since 2010, the Vietnam National Children's Hospital has been implementing surgical procedures for the treatment of drug-resistant localization-related epilepsy.

1.1. Definition

Drug-resistant localization-related epilepsy: refers to epilepsy with recurrent, persistent seizures that do not respond to appropriately chosen antiepileptic drugs (even when multiple drugs are used in high doses) along with an epileptogenic lesion causing localization-related epilepsy in a cerebral hemisphere.

1.2. Causes of drug-resistant localization-related epilepsy in children

Cortical dysplasia: 42%. Benign tumors of central nervous system: 19%. Post-infectious central nervous system disorders/stroke/ traumatic brain injury: 10%. Other causes (increased proliferation of glial tissue, unknown causes): 7%. Hippocampal sclerosis: 6%. Focal cortical dysplasia: 5%. Subcortical band heterotopia: 4%. Sturge-Weber syndrome: 3%.

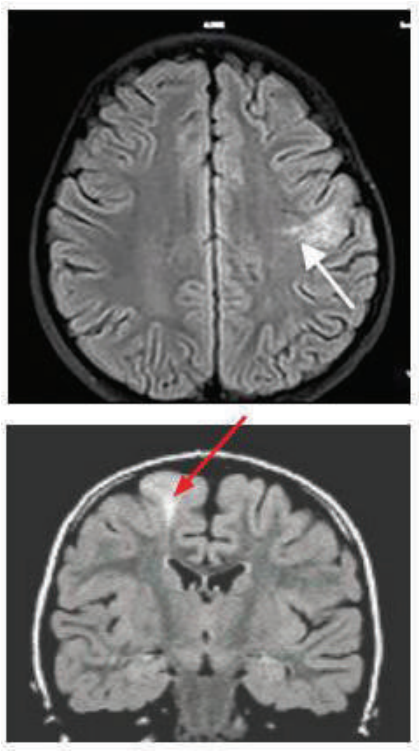

Figure 1. Focal cortical dysplasia surrounding the central sulcus of the left cerebral hemisphere

1.3. Treatment of drug-resistant localization-related epilepsy through surgery

This involves precise surgical excision of abnormal brain tissue causing seizure-generating areas. It's an extremely stringent procedure in terms of accuracy and safety at all stages, from patient selection to pre-operative in-depth investigations and intraoperative neurosurgical techniques using specialized equipment like neuro-navigation systems, surgical microscopes, and ultrasonic aspirators (CUSA).

Compared to adults, children are undergoing continuous brain functional maturation. Hence, experts suggest that epilepsy surgery in children should be performed as early as possible when indicated. The potential for postoperative recovery in children is better than in adults.

In Vietnam, the Vietnam National Children's Hospital is at the forefront of applying surgical

treatment for drug-resistant localization-related epilepsy, with continuous advancements in techniques:

Hippocampus and anterior segment of temporal lobe resection (2010)

Frontal lobe resection (2011)

Anatomical hemispherectomy (2011)

Multiple lobe lesion resection (2013)

Corpus callosotomy (2013)

Improved functional hemispherotomy (2016)

Intraoperative electrocorticography (2017)

Assessment of postoperative progress: According to the Engel classification scale

Class I (Excellent):

I A: Completely seizure-free

I B: Occasional aura only

I C: Some seizures immediately post-surgery, completely seizure-free for at least 2 years later

Class II (Good): Very rare seizures

Class III (Fair): Significant reduction in seizure frequency

Class IV (Poor):

IV A: Slight improvement

IV B: Unclear change

IV C: Getting worse

II. RESEARCH SUBJECT AND METHOD

102 children with drug-resistant localization-related epilepsy underwent surgery between 2010 and 2021 at the Vietnam National Children's Hospital (with complete medical records and postoperative assessments).

Method: Retrospective study

Data collection and analysis were conducted using SPSS 20.0 software.

III. RESEARCH RESULT

3.1. Clinical and subclinical characteristics of drug-resistant localization-related epilepsy in children

Average age: 82.8 ± 52.2 months (youngest: 9 months, oldest: 17 years)

- Average age at onset of first seizure: 36 ± 33.4 months (earliest: 2 days, latest: 12 years)

- Most common clinical seizure type: generalized secondary tonic-clonic seizures: 50%.

- Daily seizure frequency: 63.6%

- Focal neurological deficits: 62.1%

- Delayed cognitive-motor development: 99%

Epileptogenic brain lesions:

- Abnormal EEG findings: 89.4%, focal hemisphere localization: 43.9%.

- On imaging diagnosis (CT or PET): 63.2% focal lesions on the left hemisphere; 36.8% on the right hemisphere.

- On brain CT: 87.9% showed focal abnormalities.

- Among those with no abnormalities on CT scans, the most common lesion on PET scans was multiple hypometabolic foci in cerebral lobes: 62.5%.

- The most common lesion types on CT scans were focal cortical dysplasia (42.4%) and calcified nodules (21.2%).

- Common anatomical locations: multiple lobes (50%), followed by the frontal lobe (27.6%).

- Pathology: the most prevalent was focal cortical dysplasia: 42.4%. Next was benign tumors: 21.2%.

3.2. Results of surgery for drug-resistant localization-related epilepsy

Average surgery duration: 320 minutes ± 37 minutes

Shortest: 244 minutes (during transection of the temporal lobe)

Longest: 540 minutes (during anatomical hemispherectomy)

Intraoperative electrocorticography: 100% of patients detected specific epileptic spikes before resection.

Surgery-related complications: Early and postoperative complications: intracranial hemorrhage was the most common, accounting for 10.15%, followed by meningitis: 10.61%.

Intraoperative mortality: 3.03%, primarily due to substantial bleeding during anatomical hemispherectomy.

Average hospital stay duration: 32 ± 2.7 days (shortest: 10 days, longest: 61 days).

Assessment at the third month after surgery (according to Engel): 76.5% were seizure-free or had over a 50% reduction in seizure frequency. This includes:

+ In pure lobe resection: majority were amygdalohippocampectomies (40.9%) with a seizure-free and over 50% reduction rate of 88.9%. Next was frontal lobe resections: 31.8%.

+ In multilobar or combined temporal-parietal resections, the majority were temporal-parietal resections (50%) with a seizure-free and over 50% reduction rate of 80%.

+ In hemispherectomy, functional hemispherectomy was the majority (71.4%) with a seizure-free and over 50% reduction rate of 80%.

Regarding intraoperative mortality (3.03%) due to massive bleeding in anatomical hemispherectomy. In extensive focal cortical dysplasia involving multiple lobes, vascular supply to the dysplastic area may be abnormal, making blood loss a significant concern, especially in initial surgeries with less experience. Even in major epilepsy surgery centers worldwide, anatomical hemispherectomy remains a complex and high-risk procedure, especially in terms of intracranial hemorrhage during and right after surgery.

IV. CONCLUSION

Epilepsy surgery at the Vietnam National Children's Hospital achieves favorable outcomes with minimal complications and adverse events. Surgery stands as a valuable option for children with drug-resistant localization-related epilepsy, demonstrating positive results in a considerable number of cases.

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