Seizure Outcome After Functional Hemispherectomy For Drug-Resistant Epilepsy in Children and Adolescents: A Retrospective Review of 64 Patients - Mashael O Al.Khateeb


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Background

The term hemispherectomy refers to the complete removal or functional disconnection of a cerebral hemisphere.

It produces remarkable results in terms of seizure outcomes and quality of life for drug-resistant hemispheric epilepsy mostly in children and adolescents.

Here, we report a retrospective analysis of seizure outcome post functional hemispherectomy procedure.
Objective and Purpose

Hemispherectomy produces remarkable results in terms of seizure outcomes and quality of life for medically intractable hemispheric epilepsy.

We reviewed the neurophysiology, neuroradiological findings, pathological findings, epilepsy characteristics, and clinical long-term outcomes in childhood and adolescence patients following a hemispherectomy.

- This study explores the post hemispherectomy seizure outcomes.
Retrospective review of all patients who had underwent functional hemispherectomy in our institution between 1995 and 2014.

- We collected clinical, EEG, imaging, surgical data and evaluated seizure outcomes at one, three, and five-year follow up (minimum follows up 1 year after surgery).

We summarized the data using proportions for the categorical data and means from continuous variables and calculated them using SPSS 18.
Patient selection

- Retrospectively reviewed the medical records, findings of presurgical evaluation, surgical procedures, and outcomes of children and adolescents who underwent hemispherectomy for drug resistant epilepsy at our Centre. Patients were assessed and followed-up for at least 1 to 5 years after surgery.
The first criterion was the drug resistance of the epilepsy Drug-resistant epilepsy is defined as follows: a failure of adequate trials of two appropriately chosen, tolerated and commonly used anti-epileptic drugs (AEDs), whether as monotherapy or in combination, to achieve sustained seizure freedom.

All resections were performed by different neurosurgeons using functional hemispherectomy surgical approaches whether modified Rasmussin or peri-insular technique.
Pre-surgery evaluation

- The pre-surgery evaluations included comprehensive medical history, a full neurologic examination, long-term scalp video-electroencephlography (EEG) recordings, a high-resolution Magnetic Resonant Imaging (MRI), and neuropsychological assessment in some cases.

- All preoperative data were reviewed at a multidisciplinary meeting before proceeding to each surgery. The decision to proceed to surgery was based on lateralizing EEG or MRI findings, seizure semiology, and neurologic deficit.

- The indication for surgery was carefully considered against the risk of neurologic deterioration and the general risks of a major neurosurgical procedure.
Seizure evaluations

✧ Etiology was classified as congenital, acquired, or progressive, according to neuroimaging and histopathology findings.
✧ The Seizures were classified according to the International League Against Epilepsy (ILAE) classification:

✧ 1. Completely seizure free, no auras
✧ 2. Only auras; no other seizures
✧ 3. 1-3 seizure days/year; ± auras
✧ 4. Four seizure days/year to 50% reduction of baseline seizure days; ± auras
✧ 5. Less than 50% reduction of baseline seizure: ± auras
✧ 6. More than 100% increase of baseline seizure: days: ± auras
Ictal EEG Location

- **Seizure Onset Localization**

- Hemispheric ictal EEG onsets were found in 29.69% of patients, 9.38% were temporal, 10.94% were frontal, 7.81% were fronto-temporal, 3.13%, and 4.69% were occipital.

- In 6.25% of cases, ictal EEG onset were generalized and 1.56% each were central, parieto-occipital, temporo-parietal, anterior temporal, and fronto-polar.

- The remaining 20.31% showed unclear EEG onset and seven cases (10.94%) required an invasive EEG using subdural electrode recording for more precise seizure localization.
Pre-surgical neuroimaging MRI brain

- Multiple Loops
- Hemisphere
- Brain Stem
- Basal Ganglia
- Insula
- Occipital Lobe
- Tempero-Parietal
- Tempero-Occipital
- Temporal Lobe
- Fronto-Temporal
- Frontal Lobe
- Missing

Cumulative Percent
Cumulative Frequency
Percent
Frequency
Neuropathological causes of refractory epilepsy
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Postoperative course

✧ Of the 64 patients, 14 had been operated on during their first year of life, with the earliest surgery at age of 4 months.

✧ Epilepsy was diagnosed during the first year of life in 35 patients, 29 of them during the neonatal period. The postoperative course was uneventful in all patients.

✧ No significant complications were observed in 35 patients (54.69%).

Late hydrocephalus development was found in 3 patients (4.69%), which required a ventriculoperitoneal shunt. Ventricular hemorrhage was seen in one patient (1.56%), and ‘Transient worsening in hemiparesis or plegia 7 patients (10.94%) although most of our cases presented with hemiparesis or plegia prior surgery.
Seizure outcomes and follow up

- At the first year follow up 39 patients (67.24%) had achieved seizure freedom (ILAE I), two patients had ILAE III (3.45%), and ILAE IV seizure outcome was seen in 17 patients (29.31%), 6 patients no show up in the clinic.
Seizure outcomes and follow up

- At three-year follow-up, Thirty-nine patients were evaluated, and among those 23 patients (59% must be 53% not 59%) had achieved seizure freedom (ILAE I), 2 (5%) patients were seizure free with aura (ILAE II), 3 patients (8%) (ILAE III) and more than three seizures in 11 patients (28%) (ILAE IV).
Five years after hemispherectomy only 16 patients had completed clinical follow up. Out of those, 7 patients (44%) had ILAE I, two patients (13%) had ILAE III, and 7 patients (44%) had ILAE IV.
During the follow up, in all patients postoperative withdrawal of antiepileptic drugs commenced after one year following surgery if seizure freedom or significant improvement (ILAE I and II).
Figure 3: Seizure frequency One, Three and Five-years after surgery following ILAE
Results

♡ Our cohort consisted of 64 patients, 26 male and 38 female children, and adolescents.

♡ The majority of seizure onset had occurred during the neonatal period, and the youngest age at surgery in our study was 4 months old.

♡ Hemispherectomy was performed early in the majority of cases.

♡ Seizure frequency recorded at home as daily in 36 patients (56.25%), with significant impacts on their life. Thirty-eight patients (59.38%) experienced secondary generalized seizures and twenty-six (40.63%) focal seizures, whereas thirty-six patients (56.25%) had an average of 50 seizures per day at the time of surgery.
Conclusion

ㅇ This study shows positive in seizure control and quality of life after hemispherectomy.

ㅇ One-year seizure freedom was consistently higher after hemispherectomy. On the other hand, the long-term (5 years) seizure outcomes following hemispherectomy showed decline in seizure freedom.