Official Journal of the European Paediatric Neurology Society

Original Article

Seizure outcomes in children with epilepsy after resective brain surgery

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ARTICLE INFO

Article history:
Received 6 December 2014
Received in revised form
25 April 2015
Accepted 27 May 2015

Keywords:
Epilepsy surgery
Children
Brain tumours
ECoG
AED withdrawal
Refractory epilepsy

ABSTRACT

Purpose: To assess the role of resective brain surgery in childhood epilepsy.
Methodology: We retrospectively analysed the seizure outcomes in 55 children with epilepsy who had resective brain surgery between 1997 and 2012, at our centre. The children were 1.5–18 years at the time of surgery; their seizure onset was between 0.2 andto 15 years of age. 48 had refractory epilepsy. One child died of tumour progression. Follow-up duration in the survivors ranged from 2 to −16 years (mean: 9).Presurgical evaluation included clinical profiles, non-invasive V-EEG monitoring, neuroimaging with MRIs in all; SPECT and PET in selected patients. 54 had intraoperative ECoG.
Results: An Engel Class 1 outcome was seen in 78% of the cohort, with 67% being off all AEDs at the most recent follow-up. Children with tumours constituted the majority (56%), with 87% of this group showing a Class 1 outcome and 84% being off AEDs. Children with cortical dysplasia had a Class 1 outcome in 56%.
Conclusion: Resective brain surgery is an efficacious option in some children with epilepsy. We found ECoG useful to tailor the cortical resection and in our opinion ECoG contributed to the good seizure outcomes.

1. Introduction

Epilepsy in Children spans a wide spectrum of disorders-from the benign focal epilepsies of childhood to catastrophic syndromes like West and Lennox Gastaut, as well as unique syndromes such as Landau Kleffner syndrome. Antiepileptic drugs remain the mainstay of treatment for childhood epilepsy. However about 20–30% of children have refractory epilepsy, in some of them resective brain surgery would be a suitable option. Advances in neurophysiology, neuroimaging, neuroanaesthetic care and neurosurgery have made epilepsy surgery safer and more readily available to young children. In certain situations such as tumour related epilepsy,

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http://dx.doi.org/10.1016/j.ejpn.2015.05.006
1090-3798/

surgery may be an option that should be considered early. Successful epilepsy surgery may reduce long term cognitive and psychosocial dysfunction, improve quality of life and reduce health care costs.[1,2] Epilepsy surgery however is an irreversible intervention. It is not always successful in achieving seizure freedom or even substantial reduction in seizures. Initial success may be followed by re-emergence of seizures.[3] Epilepsy surgery may have neurodevelopmental consequences and result in new morbidities.[4] It may not have the desired effect of improving cognitive, language and mental health and occasionally even have a detrimental effect. The clinical profile of children with epilepsy who have resective surgery is varied and seizure outcomes in children may not be the same as in adults. For the decision making paradigm regarding surgery in a child with epilepsy, it is useful and important to look at and be cognisant of both the short term and the less well known long term seizure outcomes from different cohorts. In this study we report on long-term seizure outcomes in children with epilepsy after tailored resective surgery from a single child and adolescent epilepsy centre in Australia.

2. Methodology

We retrospectively analysed the clinical profile and seizure outcomes in 55 children with epilepsy who had resective brain surgery at our Centre between 1997 and 2012. Ethics approval was obtained from the PMH Ethics Committee for this GEKO approved retrospective audit.

All children were assessed by a senior child neurologist. Most children had speech and language as well as cognitive assessments preoperatively and on follow up. The clinical profile of the child, including the onset and duration of epilepsy, and treatment with antiepileptic drugs (AEDs) were tabulated. The resection was undertaken by one of two neurosurgeons (ML and SL). Neurophysiological assessment included non-invasive Video-EEG, intraoperative electrocortigraphy (ECoG) and functional mapping (SSEPs, MEPs) when relevant, interpreted by a single senior neurologist (LN). All children had brain MRIs and some had PET, SPECT studies. Children were evaluated and followed up through the Epilepsy clinic. No child had AEDs ceased within 6 months of surgery. Seizure outcomes were classified in accordance with Engel's classification.[5]

In this paper we present the long term seizure outcomes in these children and correlate it with the clinical profile, intraoperative ECoG, site of resection and histopathology. Improvement in quality of life (QOL) of the child and the family as reported by the parents on a 3 point scale (better, same, worse) and the clinical impression of the treating neurologist is reported in this paper. We shall present the speech, language and cognitive outcomes in a separate paper.

3. Results

Fifty five children (22 girls and 33 boys) with epilepsy had resective brain surgery between 1997 and 2012 at our centre. They ranged in age at the time of surgery from 1.5 years to 18.1 years (median:11, mean: 10.23). Age at onset of epilepsy varied from 0.2 to 15 years (median: 4 mean: 6.2). 48 had refractory epilepsy, whereas in 7 while they had seizures and were on AEDs, the surgery was undertaken because of the lesion in the brain.

ECoG was undertaken in 54/55 children who underwent resective brain surgery. Subdural strips or grids and depth electrodes (when appropriate) were used for ECoG. ECoG was undertaken prior to and after the resection in most children. ECoG showed epileptiform activity in 43 children (79.6%): Fig. 1 illustrates epileptiform activity during ECoG in a child who had an ECoG tailored parietal lobe resection for refractory epilepsy with a cortical dysplasia (see Fig. 2). Two four contact subdural strips, one four contact depth and a 20 contact grid were used. Fig. 1 shows epileptiform discharges on ECoG over several contact points of the subdural strips (Panel A) and grid (Panel B). The resection was tailored based on ECoG and the child has a Class 1 outcome on follow-up. ECoG provided some useful information in 52 of the 54 children who had ECoG (slowing, reduced amplitude, epileptiform discharges). The initial resection was extended based on ECoG in 24 children (44%).

Surgical complications were seen in 7.4%: an extradural collection (that needed drainage), a superficial infection (treated with intravenous antibiotics), a craniotomy in the postoperative period for brain swelling (after hemispherectomy) were seen in one child each in the postoperative period. One child had brain stem dysfunction with hyper-somnolence after a temporal lobectomy: had a small lacunar brain stem infarct on postoperative neuroimaging. One child had the expected, anticipated hemiplegia after a hemispherectomy – this is not included as a surgical complication.

Engel Class I outcome was seen in 78% of children. One child died as a result of the underlying brain tumour 1.4 years after surgery. Follow up duration after surgery was between 2 and 16 years (median follow up of 10 and mean 9). As shown in Table 1, a Class 1 outcome was seen in 76% of children with a temporal resection and in 86% of children with frontal resections. There did not appear to be a difference between Class I outcomes (L: 78.6%, R: 72%) in the 29 left and 26 right sided resections. All children with Class 1 outcome at six months have remained so in the longer term-we did not see evidence of deterioration or loss of seizure control with time.

As shown in Table 2, tumours alone were seen in 22 children and tumours plus cortical dysplasia in a further 9 children. Class I outcomes were seen in 87% of the children with tumours with or without cortical dysplasia. Cortical dysplasia (CD) only was seen in 16 children; this included two Taylor type 2B focal cortical dysplasias, one microdysgenesis plus Chasin's subpial gliosis (the child had hemimegalencephaly in association with Hypomelanosis of Ito).

All children were on AEDs at the time of surgery: 11 on monotherapy, 22 on 2, 17 on 3, 4 on 4, and 1 on 5. The number of AEDs trialled prior to the surgery ranged from 1 to 10 (median: 4 mean: 4.5 AEDs per child). At the last follow up after surgery 36 of the 54 surviving children (66.7%) were off AEDs. Eighteen (33.3%) children were still on AEDs: 7 on 1, 5 on 2, 4 on 3 and 2 on 4 AEDs.

Parents reported that QOL of the child as better in 51 of 54, same in 1 and worse in 2. QOL of family was better in 50 of 54, same in 2 and worse in 2. Clinical impression of the treating