An outcome analysis of seventeen patients treated surgically for intractable extratemporal epilepsy

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Abstract
We studied the outcomes of seventeen patients treated surgically for extratemporal lobe epilepsy. A retrospective case review of medical charts was performed. Seizure freedom post surgery was appraised using the Engel classification system. Post-operatively seven patients (41%) were seizure free (Engel class I), four patients were class II (23.5%), two in class III (11.76%) and four in class IV (23.5%). Three patients (17.6%) suffered traumatic injuries due to seizures. The mean duration of epilepsy prior to surgery was 12.2 years and the mean number of anti-epileptic medications given was 6.5. Seizure freedom rates for surgical treatment of extra-temporal epilepsy in this centre are similar to those of other centres. Post-operative morbidity in this centre was similar to other centres. Any complications resolved with no lasting impairment.

Introduction
Drug resistant epilepsy is a lifelong and harrowing illness which may result in severely impaired quality of life and for which surgery is beneficial. The surgical treatment of temporal lobe epilepsy is well documented and has long been proven to be beneficial 2,3. Resected epilepsy associated non-temporal lesions are diverse and their resection may reduce seizure frequency. Post-operative seizure reduction outcome is measured by the Engel system, whereby Engel class I indicates seizures freedom, Engel class II indicates a significant drop in seizure frequency, class III indicates some reduction in seizure frequency and class IV indicates no worthwhile reduction in seizure frequency 4-6. Almost 70% of patients who undergo extra-temporal resection achieve Engel class I or II post-surgery 5,6, with 47-60% reaching seizure freedom 4-6. Quality of life 5,8,9 is more difficult to measure but in general a reduction in seizure frequency also leads to an improvement in quality of life. In a cohort of 17 patients with drug resistant intractable epilepsy of extratemporal origin and deemed suitable for surgical resection, we sought to determine outcomes in relation (a) seizure frequency and (b) epilepsy related comorbidity. We did not directly measure quality of life.

Methods
Seventeen patients who underwent extratemporal resection between 2006-2009 were included. These patients underwent extensive pre-operative evaluation in the Beaumont Epilepsy Surgery Programme including video-electro-encephalographic monitoring, Wada testing, CT/MRI neuro-imaging and neuropsychological testing. The medical notes, along with pre- and post-operative scans, neuropathology reports, neuropsychological and neuropsychiatric evaluations were reviewed. Surgical procedures consisted of either complete lesionectomy or lobectomy. Patients were evaluated at post-operative outpatient clinics using the Engel classification system.

Results
Patient characteristics
Age
The mean age was 22.06 years (range 2 to 40 years).

Gender
There were nine female patients and eight male patients.

Age at seizure onset
The average age of seizure onset was 9.55 years (range 2 days to 25 years).

Duration of treatment prior to surgery
The average duration of anti-epilepsy drug (AED) use prior to surgery was 12.22 years, the longest being 24 years and the shortest being 2 years.

Early risk factors for epilepsy
Four patients had early risk factors for seizures. These included head trauma with subsequent subdural hematoma formation, developmental delay and instrument assisted delivery.

Family history
Six patients had a family history of epilepsy, with two affected in the immediate family.

Seizure type
Six patients had simple partial seizures (one without any other type, the remainder in conjunction with either complex partial or generalised seizures). Fifteen patients had complex partial seizures (fifteen patients had complex partial seizures, one in conjunction with either complex partial or generalised seizures). Four patients had a combination of simple and complex partial seizures. Four patients showed secondary generalisation. Four patients had generalised seizures in addition to either simple or complex seizures.

Epilepsy related co-morbidity
Three patients had traumatic events necessitating hospitalisation. These events included shoulder dislocation, wrist fracture and burn injuries. Depressive symptoms were common but only 1 patient was diagnosed with a depressive illness. One patient also had panic-type symptoms in relation to her epilepsy.
Surgery
Preoperatively patients had MRI and CT volumetric scans for neuro-navigation. The anatomical lobar distribution of the cases was as follows; seven frontal, six occipital and four parietal.

Complications of surgery
Post-operative complications occurred in three patients and included meningitis, brain abscess and a wound infection which necessitated bone flap removal and titanium plate insertion. All were dealt with using standard practices and all patients made uneventful recoveries with no long-term deficits. Minor complications occurred in 4 patients including occasional blurring of vision in two patients, mild motor disturbance (trembling) in the arm of one patient and a cephalocele in another. All patients were discharged in a stable condition and returned for outpatient follow-up.

Neuropathology
Gross and microscopic evaluation of all resected resection specimens showed that five patients had brain tumours [3 low grade oligoastrocytomas; 1 low grade astrocytoma and 1 pleomorphic xanthoastrocytoma], seven had cortical dysplasia, two had gliosis, one had chronic encephalitis, one had a cavernoma and in one patient with normal pre-operative imaging a lesion was not found. Palmini grading12 was applied to the cases of cortical dysplasia, these included 6 patients with focal cortical dysplasia (one Ia, one Ib and four IIb) and 1 with mild cortical dysplasia, type I.

Follow-up: Seizure Outcome/Engel Classification
Patients were routinely assessed in the outpatient department and interviewed. Seven patients (41%) were seizure free [Engel class I] at three [2], ten [2], twelve [1], eighteen [1] and twenty four months [1] post surgery. Four (23.5%) patients had significant decrease in seizure frequency, [Engel class II]. Two (11.76%) showed worthwhile improvement in seizure frequency, [Engel class III]. Four (23.5%) patients reported no worthwhile improvement in seizure frequency, [Engel class IV]. The mean follow-up time for all patients was one year.

Epilepsy related co-morbidity pre and post surgery:
Trauma
Three of our patients (17.6%) had suffered from injuries requiring hospital admission due to seizures. These included shoulder dislocation, fractures and burns. Two of these patients are now in Engel class II, and one in Engel class III. It is reasonable to assume that with decreased seizure frequency, the future risk of seizure-related trauma is also decreased.
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Pre-operative seizure burden and AED use

The preoperative seizure burden of patients varied widely. On average, patients were having 2 seizures per day, with the highest seizure frequency being 10 per day, and the lowest being 2 per month. On average, patients were prescribed on average 6.5 medications prior to surgery, with 16 out of 17 patients being exposed to polypharmacy. Nine patients experienced side effects due to medication. The following side effects were reported and were serious enough to require medication alteration: lamictal/ insomnia, anxiety, rash, low platelet count; phenytoin/ balance disturbance, visual disturbance, perineal itching; clonazepam/behavioral disturbance, zonisamide/ increase in seizure frequency, excessive fatigue; carbamazepine/diplopia, skin rash; vigabatrin/visual disturbance.

Discussion

In this retrospective study of the effects of surgical resection for intractable, lesional, extratemporal epilepsy we have shown that over half of the patients had significant improvement in seizure frequency with minimal post-operative complications and no persistent post-operative neurological deficits. These results are similar to other studies. Needless to say this level of seizure reduction will impact on patients lives as it has been shown that quality of life after extratemporal epilepsy surgery is directly related to the level of reduction of seizure frequency has been documented that patients with epilepsy have an increased risk of injury due to seizures. Patients in Engel class I, and probably Engel class II, due to their reduced seizure frequency, should expect reduced injury risk post-surgery. Three patients experienced post-operative complications (17.6%) but each made a full recovery without a lasting neurological deficit. Four patients experienced minor complications (23.5%). Other studies have described similar rates of complication for this type of surgery. These rates of complication illustrate the safety of this operation, and whilst patients must be made aware of the potential for serious complications, they may also be reassured that the risk of major neurological deficit as a result of this operation is unlikely.

We also found that on average our patients waited 12.2 years for surgery. This shows the long duration of epilepsy prior to evaluation for epilepsy surgery. We also found that they were prescribed 6.5 different medications beforehand. Given that medically refractory epilepsy can be defined as the failure of two or more AEDs, this may be an area where one can improve current practice, with earlier referral for epilepsy surgery. This may reflect a lack of awareness among physicians of the benefits of epilepsy surgery for extratemporal pathology. This study highlights these benefits which include reduction in seizure frequency and the safe nature of the operation.

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References

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Neurophysiological

Seven of our patients had learning difficulties as diagnosed by a neuropsychologist and these were unaffected by surgery.