

# Temporal Lobe Epilepsy Surgery in Childhood: Rationale for Greater Use

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**ABSTRACT:** Anterior temporal resection may effectively relieve therapy-resistant seizures in children and give social, psychological and economic benefits. Epidemiological and prognostic data demonstrate that this is an under-utilised procedure: although an estimated 677 Ontario children per year would be candidates for anterior temporal resection, only 18 were performed in a 12 month period.

**RÉSUMÉ:** La chirurgie pour épilepsie du lobe temporal dans l'enfance: justification d'une plus grande utilisation. La résection temporale antérieure peut améliorer l'épilepsie résistante au traitement chez les enfants et amener des bénéfices sociaux, psychologiques et économiques. Des données épidémiologiques et pronostiques démontrent que cette chirurgie est sous-utilisée: bien qu'on estime à 677 par année le nombre d'enfants ontariens qui seraient candidats à une résection temporale antérieure, seulement 18 ont été réalisées sur une période de 12 mois.

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This article presents the sequential components of a contention that anterior temporal resection (ATR) is grossly under-utilised for childhood temporal lobe epilepsy in Ontario and elsewhere in Canada and presents guidelines for earlier evaluation of potential candidates.

## Epidemiology of Temporal Lobe Epilepsy in Childhood

In the classical study of epilepsy in the entire population of Rochester, Minnesota, Hauser and Kurland<sup>1</sup> found the prevalence of temporal lobe epilepsy to be 1.7/1000 population. Rocca et al.<sup>2</sup> also studying the entire Rochester population, found that 72% of complex partial seizures, presumably of temporal lobe origin, began before age 10 years. Fifty-six (91%) of Harbord and Manson's<sup>3</sup> 63 children with temporal lobe seizures had their first attacks at or before age 10 years.

About 5.5 million persons in Canada are 12 years old or younger.<sup>4</sup> Combining the aforementioned prevalence data with the percentage of incidence in childhood suggests that the prevalence of temporal lobe epilepsy in Canada among patients  $\leq$  12 years of age is about 6,700 cases.

## Prognosis

Seizures of temporal lobe origin tend to persist. In analysing temporal lobe seizures of childhood, Wyllie and Lüders<sup>5</sup> caution us to include only studies supported by temporal lobe spike discharges and those which have excluded benign partial epilepsy of childhood. Using these criteria, only studies by Harbord and Manson<sup>3</sup> and Kotagal et al.<sup>6</sup> can be used. These studies found 10% and 18% of patients to be seizure-free at follow-up. That these data are only minimally affected by referral practises is indicated by the population study of Hauser and Kurland<sup>1</sup> in which only 31% of patients with temporal lobe seizures were seizure-free at follow-up and only 21% seizure-free without medication. Combining prevalence and prognosis data indicate

that at least 5,300 Canadian children have temporal lobe epilepsy that will persist.

Annual incidence rates by age and seizure type, using Hauser and Kurland's<sup>1</sup> data, can also estimate this number. Annual incidence of focal seizures in childhood (30 per 100,000) x per cent of focal that were temporal (1/3) x years (12) x Canada's population  $\leq$  12 years ( $5.5 \times 10^6$ ) x persistence (.8) = 5,280 cases of temporal lobe epilepsy in childhood that will persist.

To date, there is no evidence that the newer antiepileptic medications will significantly alter these data. Tanganelli and Regesta<sup>7</sup> found no difference in efficacy between vigabatrin and carbamazepine in monotherapy of newly diagnosed epileptic patients. Gobbi et al.<sup>8</sup> were able to render 70% of children with partial epilepsy seizure-free with vigabatrin but only 19 of these were "symptomatic" and therefore benign partial epilepsies could have been included. No difference in performance between lamotrigine and carbamazepine had been found.<sup>9,10</sup>

## Social and Behavioural Consequences

Wyllie and Lüders<sup>5</sup> summarised the emotional effects of uncontrolled epilepsy on the child. They indicate that a chronic childhood disorder such as epilepsy inhibits development of the personality. Embarrassing attacks in the presence of others lower self esteem. Their unpredictable nature causes anxiety and leads to parental over-protection. Supporting these concerns is the 24-53% incidence of significant behaviour disorders in children with temporal lobe epilepsy.<sup>3,6,11</sup>

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**Localising Capability of Neurodiagnostic Tests in Childhood Partial Epilepsy**

Among children and adolescents undergoing temporal lobectomy for seizure control, principal EEG and neuroimaging abnormalities have indicated the epileptogenic temporal lobe in a high percentage of cases. The principal spike focus correlated with the epileptogenic temporal lobe in 73-100% of such patients aged 15 years or less (Table 1). Localising neuroimaging abnormalities appeared in 62-100% of patients (Table 2). Although this paper concerns children (≤ 12 yrs), most relevant studies include both children and younger adolescents.

**Table 1:**

TLE SURGERY CANDIDATES < 15 YEARS: PRINCIPAL SPIKE FOCUS AT EPILEPTOGENIC AREA			
	No. Patients	Localising Spikes	%
Jensen & Vaernet <sup>27</sup>	12	12	100
Blume & Kaibara <sup>28</sup>	21	16	76
Hopkins & Klug <sup>29</sup>	11	8	73
Adelson <sup>30</sup>	33	33	100
Grattan-Smith <sup>31</sup>	39	36	92
Blume <sup>32</sup>	14	14	100

TLE = temporal lobe epilepsy

**Table 2:**

TLE SURGERY CANDIDATES < 15 YEARS: CT/MRI ABNORMALITY AT EPILEPTOGENIC AREA			
	No. Patients	CT/MRI +	%
Hopkins & Klug <sup>29</sup>	6	5	83
Adelson <sup>30</sup>	33	26	79
Cascino <sup>33</sup>	16	10	62
Duchowny <sup>15</sup>	16	11	69
Grattan-Smith <sup>31</sup>	53	40	76
Peacock <sup>34</sup>	-	-	> 80
Blume <sup>32</sup>	14	14	100

**Efficacy of Temporal Lobectomy for Seizure Control**

Table 3 reviews the efficacy of temporal lobe epilepsy surgery in childhood among several studies totalling 309 patients. A one-year follow-up period has been shown to be adequate to assess effectiveness for seizure control.<sup>12</sup> Thirty-three to 80% of patients were rendered seizure-free by the procedure and an additional 8-43% were improved for a total of 73-100% of patients receiving benefit. Improved neuroimaging and a renewed reliance upon clinical assessment and electroencephalography may augment such performance in the future. Moreover, 64 to 78% of children have obtained a beneficial social/behavioural outcome from temporal lobectomy.<sup>13-15</sup>

No significant complications occurred in a recent series of temporal lobectomies in childhood.<sup>16</sup> Four of Duchowny's 16 patients developed transient complications of which 3 had undergone chronic subdural implantation.<sup>15</sup> The fourth developed a transient hemiparesis.

Pilcher et al.<sup>17</sup> have documented complications of anterior temporal lobectomy in all age groups. Although his review found transient or permanent hemiparesis in 2-4% of patients undergoing temporal lobectomy, permanent hemiparesis has occurred in only 2 of all 400 temporal lobectomies in our centre (unpublished data). Superior quadrantic field defects occur in about 50% of patients but symptomatic deficits appear in only about 2-6%.<sup>17,18</sup> A reported operative mortality of four patients in 1,356 was gleaned from the Pilcher et al.<sup>17</sup> study.

**Table 3:**

EFFICACY OF TLE SURGERY IN CHILDREN AND ADOLESCENTS				
	No. Patients	SF	Improved	Total
Davidson & Falconer <sup>13</sup>	40	22 (55)	7 (18)	29 (73)
Jensen & Vaernet <sup>27</sup>	12	9 (75)	1 (8)	10 (83)
Rasmussen <sup>35</sup>	68	31 (46)	22 (32)	53 (78)
Meyer <sup>14</sup>	50	39 (78)	5 (10)	44 (88)
Harbord & Manson <sup>3</sup>	15	5 (33)	?	-
Adams <sup>36</sup>	44	29 (66)	7 (16)	36 (82)
Hopkins & Klug <sup>29</sup>	10	8 (80)	2 (20)	10 (100)
Adelson <sup>30</sup>	33	23 (70)	3 (9)	26 (79)
Duchowny <sup>15</sup>	16	10 (62)	3 (19)	13 (81)
Jay <sup>37</sup>	7	3 (43)	3 (43)	6 (86)
Blume <sup>32</sup>	14	11 (79)	3 (21)	14 (100)
Total/range	309	(33 - 80)	(8 - 43)	(73 - 100)

SF = seizure free

( ) = percentages

**The Economic Aspect**

Wiebe et al.<sup>19</sup> evaluated the costs and consequences of surgical vs. medical treatment of temporal lobe epilepsy in adults using decision-analysis modelling and an intention-to-treat approach based on a critical appraisal of the literature, local surgical experience, and a community patient survey. About \$20,000 per patient would be saved by surgery as compared to medical treatment over a 35 year follow-up period as estimated from these sources. Thirty-five years is the approximate life expectancy for a typical adult patient at the time of surgery. Although surgery required a larger initial expenditure, the cost-time curves intersected at 8.5 post-operative years and surgery remained cheaper thereafter.

If these data can be extrapolated to childhood, the duration of saving would be lengthened and the cost difference favouring surgery would be augmented.

**Synthesis**

Table 4 presents data which can be employed to calculate the number of children who would be candidates for temporal lobe epilepsy surgery every year in Canada and in Ontario. In categories 6 and 7, for which a range of statistics could apply, those least favouring surgery were utilised. These data indicate that there are currently about 5,416 children in Canada whose temporal lobe seizures will not be adequately controlled by medical therapy and 2,033 such children in Ontario! If one-third of these would be candidates for surgery,<sup>20</sup> then figures for Canada and Ontario would be about 1,805 and 677, respectively, at any one time.

**Table 4:**

NUMBER OF CANDIDATES ANNUALLY: AN ESTIMATE	
Data	
1. Population of Canada 1996: <sup>4</sup>	29,857,369
2. Population of Canada ≤ 12 yrs: <sup>4</sup>	5,531,262
3. Population of Ontario ≤ 12 yrs: <sup>4</sup>	2,076,600
4. Prevalence of temporal lobe epilepsy: <sup>1</sup>	1.7 x 10 <sup>-3</sup>
5. Proportion beginning in childhood: <sup>2</sup>	0.72
6. Proportion medically refractory: <sup>3,6</sup>	.80
7. Proportion as surgical candidates: <sup>20</sup>	0.33
Calculations	
(2) x (4) x (5) x (6) x (7)	= 1,805
(3) x (4) x (5) x (6) x (7)	= 677

These figures compare strikingly with the 18 temporal lobectomies performed last year in patients 12 years in Ontario<sup>20</sup> (Personal Communications, D. Keene, H. Otsubo).

### A Consequent Management Plan

Evidence that episodic abnormal sensations or impaired awareness represents temporal lobe seizures would be sought by a careful history from the patient and observers of attacks. The patient may describe an aura such as an abdominal sensation, fear or other experiential phenomena. Observers may report intra-ictal behaviour such as loss of awareness and oral-alimentary and/or manual automatisms<sup>22,23</sup> (Table 5). Expectedly, the proportion of children in whom an aura can be elicited increases with age.<sup>24</sup> Aurae were obtained in 13 of 14 children in a temporal lobectomy series.<sup>16</sup>

Table 5:

#### PROCESS TO IDENTIFY TLE SURGERY CANDIDATES

Question or Subject	Procedure
1. Could the episodes represent temporal lobe seizures?	1. Description of attacks from patient, observers.
2. Electrophysiological support that seizures arise in one temporal lobe.	2. EEGs (2 or more): high quality performance and interpretation.
3. Is there an epileptogenic lesion in the same temporal lobe?	3. MRI: high quality performance and interpretation.
4. Are the seizures medically refractory?	4. 2 sequential first line antiepileptic drugs in low-middle "therapeutic range".
5. Surgical option.	5. Introduce this possible alternative to patient, family. Refer to experienced centre.

This analysis would be supplemented by sequential EEGs seeking the location of a principal spike focus. If both historical and EEG data indicate temporal lobe seizures, a *high quality* MRI scan could be performed, scrutinising for single or double temporal lobe pathology.

Seizure control with two sequential first-line antiepileptic drugs would be attempted at doses that do not impair school performance.

If these clinical, laboratory and therapeutic data suggest intractable temporal lobe seizures, then referral to an experienced epilepsy centre would be indicated. Complete congruency of all data for unifocal temporal lobe epileptic dysfunction is obviously preferable but not fully requisite. A full account of assessment procedures and criteria for surgery lies outside the scope of this paper, but are available.<sup>25,26</sup>

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