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Original Article

Neurocognitive Function in Children After Anterior Temporal Lobectomy With Amygdalohippocampectomy

Yun-Jin Lee MD, PhD [a], Hoon-Chul Kang MD, PhD [b], Heung Dong Kim MD, PhD [b], Dong-Seok Kim MD, PhD [c], Kyu-Won Shim MD [c], Soyong Eom MA, PhD [d], Joon Soo Lee MD, PhD [b,*]

[a] *Department of Pediatrics, Pusan National University Children's Hospital, Pusan National University School of Medicine, Yangsan, South Korea*
[b] *Department of Pediatric Neurology, Pediatric Epilepsy Clinics, Severance Children's Hospital, Brain Research Institute, Yonsei University College of Medicine, Seoul, South Korea*
[c] *Department of Neurosurgery, Severance Children's Hospital, Yonsei University College of Medicine, Seoul, South Korea*
[d] *Department of Neuropsychiatrics, Severance Children's Hospital, Yonsei University College of Medicine, Seoul, South Korea*

ABSTRACT

BACKGROUND: We assessed the postoperative neurocognitive function after temporal lobectomy in children with temporal lobe epilepsy. **METHODS:** This was a retrospective analysis of the data of 20 patients with Engel's class I or II outcomes after anterior temporal lobectomy with amygdalohippocampectomy between 2005 and 2008. Twenty children underwent resection of either dominant (n = 8) or nondominant (n = 12) temporal lobes, and their median age at surgery was 12.8 ± 3.2 years. We serially assessed intelligence and memory function as measured by the Korean-Wechsler Scales of Intelligence and Rey-Kim Memory test both before and after surgery. **RESULTS:** Intelligence quotient (IQ) and memory quotient scores remained stable during a 3.6-year median follow-up in these children after the surgery. There was no decrease of IQ or memory quotient scores in either the dominant or non-dominant hemisphere groups. Later onset of epilepsy, a shorter epilepsy duration, a smaller number of antiepileptic drugs, and postoperative seizure-free outcomes were significant good predictors of the postoperative IQ. **CONCLUSION:** Temporal lobectomy in children did not provoke a significant decline in intelligence or memory function. Early surgical treatment in children with intractable seizures of temporal lobe origin may result in better neurocognitive outcomes.

Keywords: child, temporal lobe epilepsy, anterior temporal lobectomy, intelligence, memory

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Introduction

Memory disorders in intractable temporal lobe epilepsy, particularly verbal memory deficits, are frequently observed in adults both before and after surgery and likely reflect damage to the hippocampal system.[1] Early-onset temporal lobe epilepsy has a greater risk of inducing severe and/or global memory impairment in adult patients.[2] Resective surgery in children with intractable symptomatic epilepsy has been accepted as a practical treatment option. However, studies concentrating on the cognitive and memory outcome after temporal lobe surgery in children are relatively rare because of measurement scale limitations, a low frequency of complaints about memory problems, and the relatively recent development of early epilepsy surgery.[3,4]

Postoperative effects on cognition have been inconsistent in children after anterior temporal lobectomy.[5-7] Decreased verbal memory has been reported after left-sided temporal lobectomy. A younger age at the time of surgery seemed to be a protective factor in one study,[5]

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* Communications should be addressed to: Dr. Lee; Department of Pediatric Neurology; Severance Children's Hospital; 134, Shinchon-dong; Seodaemun-gu; Seoul, 120-752, South Korea.
E-mail address: joonsl96@yuhs.ac

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whereas in another study investigators reported the opposite finding.[6] Gleissner et al.[8] compared the preoperative and postoperative verbal memory performance in 55 children and adolescents with temporal lobe epilepsy. Decreased verbal memory was demonstrated three months after surgery, but recovery was apparent just one year after surgery. Their data suggested greater plasticity and compensational capacity in childhood during the year of follow-up.[9]

In our 3.6-year follow-up study, neurocognitive function was monitored in 20 children between 5 and 18 years of age who had undergone anterior temporal lobectomy with amygdalohippocampectomy and who also showed a considerable reduction in seizure frequency postoperatively. The purposes of this study were 3-fold. First, we attempted to document the postoperative positive or negative effects of temporal lobectomy on intelligence and memory function in children. Second, we compared the neurocognitive outcomes between patients who underwent dominant and nondominant temporal lobectomy. Finally, we identified the good predictors associated with postoperative favorable neurocognitive outcomes.

Patients and Methods

Patients

We retrospectively studied 20 children who had undergone resection of either the left temporal (n = 8) or the right temporal lobe (n = 12) for medically intractable epilepsy. The data were retrospectively obtained from the physicians' medical records. Surgeries were performed at the Pediatric Epilepsy Clinic at Severance Children's Hospital in Seoul, South Korea, between 2005 and 2008. All 20 children were referred for neuropsychological evaluation both before and after surgery for temporal lobe epilepsy. To be included in the study, children had to meet the following criteria: (a) 5-18 years of age, (b) medically intractable seizures of temporal lobe origin, (c) unilateral temporal lobe lesion on magnetic resonance imaging (MRI), (d) right-handedness, (e) surgical treatment of anterior temporal lobectomy with amygdalohippocampectomy, (f) favorable seizure control after surgery (Engel's class I or II), and (g) neuropsychological testing both preoperative and postoperatively. To select a homogeneous population, we excluded left-handed participants and individuals with major behavioral disorders. We also did not include children with unfavorable seizure outcomes (Engel's class III or IV) after surgery. Eighteen patients (8 in the left and 10 in the right temporal lobe) were subjected to intracarotid sodium amobarbital testing, and 14 patients (7 in the left-lobe, 7 in the right-lobe) underwent functional MRI testing before surgery, suggesting left language dominance in all patients. Therefore, the left and right temporal lobes corresponded to the dominant and nondominant lobes, respectively. There were no differences between the patients of dominant and of nondominant lobes in terms of demographic data, including age at surgery, onset and duration of epilepsy, gender ratio, hand dominance, number of antiepileptic drugs (AEDs), type of surgery, and postoperative seizure outcomes (Table 1).

Operative procedures

The median age at the time of surgery was 12.8 ± 3.2 years (range 6.5–18.1). Preoperative evaluation in all children included seizure semiology evaluation, ictal and interictal surface video-electroencephalography (V-EEG) monitoring, high-resolution MRI, positron emission tomography with F18-labeled fluorodeoxyglucose, interictal/ictal single photon emission computed tomography, neuropsychological testing and intracranial electroencephalography monitoring in 12 patients (6 in left-lobe, 6 in right-lobe). Surgery consisted of temporal lobectomy in all 20 patients and included the temporal pole, hippocampus, amygdala, parahippocampal gyrus, and a variable extent (3.3-8.0 cm from the temporal

TABLE 1.
Demographic Data in the Dominant and Nondominant Resection Groups

	Dominant resection (n = 8)	Nondominant resection (n = 12)	*P* value
Boys/girls	7 (87.5)/1 (12.5)	5 (41.7)/7 (58.3)	0.070
Age at epilepsy onset, years	7.8 ± 2.6 (3.0-11.0)	6.9 ± 3.2 (1.0-10.0)	0.521
0 < ≤ 5	1 (12.5)	4 (33.3)	
5 < ≤10	6 (75.0)	8 (66.7)	
10 < ≤15	1 (12.5)	0 (0.0)	
Age at surgery, years	11.7 ± 2.1 (11.0-16.0)	14.1 ± 4.0 (6.5-18.1)	0.473
5 < ≤10	0 (0.0)	3 (25.0)	
10 < ≤15	6 (75.0)	4 (33.3)	
15 < ≤20	2 (25.0)	5 (41.7)	
Duration of preoperative epilepsy, years	4.7 ± 2.6 (1.3-9.0)	7.8 ± 3.0 (2.7-11.7)	0.157
Number of preoperative AEDs	3.0 ± 1.0 (2.0-5.0)	2.5 ± 0.9 (2.0-5.0)	0.624
Retest intervals after surgery, years	3.8 ± 2.3 (2.5-4.8)	3.5 ± 1.9 (2.5-4.3)	
Surgical method			
ATL/AH	7 (87.5)	9 (75.0)	
ATL/AH plus extensive resection	1 (12.5)	3 (25.0)	
Extent of resection, cm	4.4 ± 1.0 (3.3-6.5)	5.0 ± 1.3 (4.0-8.0)	0.192
Pathological findings			
Hippocampal sclerosis	5 (662.5)	7 (58.3)	1.000
No hippocampal sclerosis	3 (37.5)	5 (41.7)	1.000
Tumor	2	2	
Microdysgenesis	0	2	
Cortical dysplasia	1	1	
Outcomes			
Engel class I	7 (87.5)	7 (58.3)	0.325
Engel class II	1 (12.5)	5 (41.7)	

Abbreviations:
AEDs = antiepileptic drugs
ATL/AH = anterior temporal lobectomy with amygdalohippocampectomy
Data are expressed as median ± SD (range), or n (%).