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Serial Cognitive Testing in Temporal Lobe Epilepsy: Longitudinal Changes with Medical and Surgical Therapies

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Summary: Cognitive testing was repeated at intervals ranging from 1 to 8 years in 47 adult patients with temporal lobe epilepsy (TLE). Each patient underwent standardized batteries, including the Wechsler Adult Intelligence Scale, Revised (WAIS-R), and Wechsler Memory Scale (WMS). Both surgically treated and nonsurgical patients were examined. The nonsurgical group underwent serial testing for clinical indications, usually for complaints of memory dysfunction. Longitudinal testing could not verify any mean deterioration of intellect or memory in this group; variance over time was similar to test–retest norms in healthy controls. WAIS-R scores before and after resection in the surgical group were similar to our serial WAIS-R data in nonsurgical patients. When we divided surgical patients according to side of epileptogenesis, we noted the expected differences in verbal and visual memory. Right-sided surgery patients improved significantly in Full-Scale IQ (FSIQ) and tended to improve in logical memory on postoperative testing. Patients undergoing left resections had no retest improvement and tended to show decrease in several measures of verbal memory. Our findings should stimulate continued investigation into the natural history of lateralized memory and intellectual function in epilepsy, particularly to clarify long-term cognitive outcome in nonsurgical patients. **Key Words:** Temporal lobe epilepsy—Cognition—Neuropsychometric testing—Epilepsy surgery.

Temporal lobe epilepsy (TLE) may account for more than half the cases of refractory epilepsy in adults (Gastaut et al., 1975). Many investigators have described the cognitive disturbances in TLE and have localized specific verbal and visuospatial memory functions to the dominant and nondominant mesiotemporal structures (Quadfasel and Pruyser, 1955; Milner, 1958; Glowinski, 1973; Delaney et al., 1980; Rausch, 1987). Less attention has been focused on the question of whether these specific cognitive disturbances are static or progressive. Is material-specific memory dysfunction the fixed result of early temporal insults or is it caused by repetitive ictal disruptions? Little information available predicts how memory function in TLE might change in time in the absence of surgical intervention.

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Most recent studies of cognitive function before and after anterotemporal lobectomy support the hypotheses that (a) memory deficits after surgery are related to extent and lateralization of resection, (b) dominant lobectomy may produce more pervasive postoperative cognitive changes, and (c) nondominant lobectomy may often produce improvement in overall or verbal learning if seizures are controlled (Rausch, Crandall, 1982; Novelly et al., 1984; Katz et al., 1989; Hermann et al., 1992). How dramatic these changes are likely to be, how important seizure control is in determining cognitive outcome, and whether factors such as age or preoperative cognitive function influence direction and degree of postoperative change is not clear. Some investigators have suggested that longitudinal test–retest data from groups of similar nonoperated patients would be necessary to establish appropriate baseline information (Ivnik et al., 1987). We made a retrospective analysis to examine changes in specific cognitive functions over time in nonsurgical TLE patients and compared them with our surgically managed patients.

METHODS

We searched neuropsychology records for 1981–1992 to identify all epilepsy patients tested twice after an interval of >11 months. Refractory TLE patients aged >18 years were included if review of their charts demonstrated that they met the following criteria: (a) ictal semiology consistent with TLE; (b) an average of at least one complex partial seizure (CPS) a month; (c) interictal epileptiform activity on scalp EEG consisting of exclusively temporal spikes; and (d) at least one of the following characteristics—history of childhood febrile convulsions, ictal EEG with temporal ictal onset, hippocampal T_2 signal increase on magnetic resonance imaging (MRI), or interictal temporal lobe hypometabolism shown on FDG-positron emission tomography (PET). Age, handedness, age at onset of epilepsy, antiepileptic drug (AED) serum levels at approximate time of each test, educational level, seizure frequency, socioeconomic status, ictal semiology, and neuroimaging data were also determined. All subjects underwent MRI scanning except for 3 in the nonsurgical group, who were examined by computed tomography (CT). In the surgical group, we also ascertained side of resection, degree of seizure control achieved, and the interval between operation and retesting. Patients who underwent resections at our medical center were evaluated and treated according to a previously reported standardized protocol (Henry and Ross, 1992). Five of the patients in the surgical group had temporal lobe mass lesions, including 3 low-grade gliomas, 1 oligodendroglioma, and 1 epidermoid cyst. Postoperative MRI indicated that the structural pathology was within the margins of surgical resection in each case. All surgical patients had left hemispheric language dominance or predominance demonstrated by bilateral intracarotid amobarbital testing.

We analyzed selected portions of our standardized cognitive battery, which was administered by trained technologists and supervised by neuropsychologists unaware of any future research design. Data evaluated included summary scores from the Wechsler Adult Intelligence Scale, Revised (WAIS-R) (Wechsler, 1981), a self-rating scale with higher values indicating higher self-rating (Berent et al., 1982), and the Wechsler Memory Scale (WMS) (Wechsler 1945), with specific emphasis on visual and verbal memory through the logical memory, paired associate, and visual reproduction scores. We used Russell's version of the memory subtests and a gist scoring system that allowed subjects to earn partial credit (Russell, 1975). We included data on the "composite score" (Milner, 1975), which is composed of the sum of the correctly recalled items after a delay from both the logical memory scale and the paired associates subtest. Statistical comparisons of demographic data and nonsurgical test–retest scores were made by independent two-tailed *t* tests. Scatterplots were examined to screen for factors that might contribute to individual variation. Scores before and after temporal lobe resections were evaluated separately by paired *t* tests to answer specific questions for left and right lobectomy groups. Pearson product-moment correlations were used when appropriate. A repeated-measures analysis was made for the left and right pre- and postoperative groups.

RESULTS

Demographics of 47 patients who met inclusion criteria are shown in Table 1. Twenty-eight patients were managed only medically between serial tests, including 12 patients serially examined for several years before anterotemporal lobectomy (their serial preoperative results were included in the nonsurgical group). Thirty-one patients were tested before and after resection, 14 on the right and 17 on the left. There were 17 men and 11 women in the nonsurgical group; the right surgical group comprised 6 men and 8 women; the left surgical group comprised 11 men and 6 women. Age at testing, age at

TABLE 1. *Patient demographics*

Parameter	Nonsurgical (mean ± SD)	Surgical (mean ± SD)	
		L	R
n	28	17	14
Mean age (yr)	31.29 ± 9.52	29.00 ± 8.12	31.36 ± 9.93
Mean age at seizure onset	11.86 ± 12.34	11.18 ± 10.32	14.21 ± 11.74
Mean frequency of complex partial seizures (per month)	8.05 ± 6.11	8.29 ± 4.55	12.21 ± 7.95
Mean years of education	12.39 ± 1.77	12.38 ± 1.67	12.21 ± 1.12
Mean retest interval (yr)	2.36 ± 1.87	1.8 ± 0.7	1.93 ± 0.92
Mean postoperative interval (mo)	—	5.06 ± 4.92	6.64 ± 4.97

seizure onset, seizure frequency, and education were not significantly different between either the surgical and nonsurgical groups or the right and left lobectomy groups. Two of the mass lesions were on the left and three were on the right; these patients did not have pre- to postoperative change scores significantly different from others in their respective groups. The test–retest interval in the nonsurgical group ranged from 1 to 8 years. In the surgical group, the postoperative retest interval varied between 2 and 17 months. Seizure frequency did not change significantly in the nonsurgical group. Twenty of the 31 surgical patients were completely seizure-free postoperatively.

Results of serial cognitive testing in the nonsurgical group are shown in Table 2. The data available for most of these patients, including interictal EEG and radiologic findings, were not deemed sufficient to allow us to separate them into exclusively right or left epileptogenic zones with acceptable certainty. Therefore, the group was examined as a whole. None of the nonsurgical patients had ever been fully evaluated in a surgical protocol and rejected. None of these patients expressed a strong desire to pursue epilepsy surgery, but a few had diagnostic monitoring consistent with unilateral TLE. The statistically significant retest changes in the nonsurgical group are a mean 3-point increase in Full-Scale IQ (FSIQ), a 4-point increase in Performance IQ (PIQ), and 10% improvement in delayed visual reproduction. These values are in a range not likely to be clinically significant and resemble changes observed in test–retest studies of normal subjects (described in Discussion section). Scatterplots and linear regression demonstrated no significant correlation between length of interest interval and any cognitive change score.

The surgical group showed a significant difference in preoperative IQ scores for right versus left epileptogenic lateralizations: Initial mean FSIQ, PIQ, Verbal IQ (VIQ), and WMS MQ were significantly lower in left temporal epileptic patients. Several tests of verbal memory also showed significantly lower scores (Table 3). Patients with left TLE tended to have poorer cognitive abilities throughout except in specific tests of visual learning. This difference is even more noteworthy because the left TLE group was, on the average, younger and better educated and experienced fewer seizures per month, indicating that they may have had some relative advantages over the right-sided group.

After anterotemporal lobectomy, a statistically significant improvement in FSIQ and PIQ was documented, but the degree of improvement was clearly greater for the right temporal lobectomy group. For patients with right-sided resections, the mean 5-point improvement resembled the retest changes of the nonsurgical group. Patients with left temporal lobectomy also showed a significant decrease in composite delayed verbal memory score postoperatively as compared with patients with right-sided foci. Patients in the right temporal lobe group had significantly more positive scores on self-rating tests postoperatively. In this series, there was no statistically significant difference between 18 patients tested at postoperative intervals of 2–5 months and 13 individuals retested >5 months after operation.

We examined the possibility that higher preoperative cognitive function would predict greater postoperative losses by correlating change scores with baseline values. Baseline scores and amount of decrease in MQ, VIQ, or visual recall after left-sided resections correlated significantly (correlation coefficients of 0.66, 0.51, and 0.50, respectively). After

TABLE 2. *Serial cognitive performance in the nonsurgical group*

Test	First test (mean ± SD)	Second test (mean ± SD)	Change[a]	*t*-Value	p-Value
WAIS-R					
FSIQ	87.71 ± 8.94	90.39 ± 10.21	+2.68	2.25	<0.04
VIQ	88.64 ± 10.23	90.07 ± 10.48	+0.89	0.82	NS
PIQ	89.64 ± 10.21	94.07 ± 13.54	+4.43	2.40	<0.03
WMS					
MQ	93.61 ± 14.38	96.07 ± 14.78	+2.46	1.19	NS
Logical Memory (WMS IV)	6.47 ± 2.28	6.39 ± 2.77	−0.07	0.20	NS
Delayed Logical Memory (%)	58.07 ± 20.98	51.96 ± 30.69	−5.89	1.00	NS
Visual Reproduction (WMS VI)	10.25 ± 2.94	10.43 ± 2.28	+0.15	0.32	NS
Delayed Visual Reproduction (%)	72.32 ± 20.93	82.07 ± 20.43	+10.19	2.00	NS
Paired Associates (WMS VII)	11.66 ± 4.34	12.38 ± 3.81	+0.72	0.89	NS
Delayed Paired Associates (%)	91.57 ± 18.84	89.12 ± 16.10	−2.45	0.63	NS

WAIS-R, Wechsler Adult Intelligence Scale-Revised; FSIQ, VIQ, and PIQ, full-scale, performance, and verbal intelligence quotient; MQ, memory quotient; WMS, Wechsler Memory Scale.

[a] Second test score minus first test score.

TABLE 3. *Surgical group: Comparison by repeated-measures analysis*

Test	Right		Left		Significance levels		
	Preoperative (mean ± SD)	Postoperative (mean ± SD)	Preoperative (mean ± SD)	Postoperative (mean ± SD)	Main effect preoperative side (p-Value)	Main effect preoperative/ postoperative (p-Value)	Interaction (p-Value)
WAIS R							
FSIQ	95.43 ± 8.39	100.79 ± 11.44	86.41 ± 8.02	87.41 ± 8.34	<0.002	<0.005	<0.05
VIQ	96.00 ± 11.33	98.43 ± 13.85	86.38 ± 9.00	85.69 ± 7.79	<0.006	NS	NS
PIQ	95.71 ± 9.38	101.93 ± 10.52	90.24 ± 9.94	92.41 ± 11.76	<0.04	<0.01	NS
WMS							
MQ	106.71 ± 14.52	108.00 ± 15.44	94.65 ± 15.26	90.94 ± 11.45	<0.004	NS	NS
Visual Reproduction	10.54 ± 2.90	10.46 ± 2.11	10.79 ± 2.36	9.91 ± 2.48	NS	NS	NS
Delayed Visual Reproduction (%)	82.79 ± 16.54	79.50 ± 16.10	89.24 ± 11.86	86.47 ± 22.67	NS	NS	NS
Paired Associates	15.86 ± 3.28	16.43 ± 3.98	11.66 ± 3.49	11.25 ± 3.25	<0.0002	NS	NS
Delayed Paired Associates (%)	92.03 ± 10.18	92.26 ± 15.61	96.14 ± 20.25	87.42 ± 14.21	NS	NS	NS
Logical Memory	8.36 ± 2.96	8.39 ± 3.01	6.53 ± 2.86	5.71 ± 2.77	<0.03	NS	NS
Delayed Logical Memory (%)	66.21 ± 19.22	77.79 ± 14.84	64.53 ± 21.41	63.18 ± 32.33	NS	NS	NS
Composite Verbal Memory (score described in text)	14.32 ± 3.64	15.04 ± 3.75	11.97 ± 1.21	10.13 ± 3.71	<0.02	NS	<0.05

Abbreviations as in Table 2.

right temporal resections, patients with the highest initial verbal and visual memory scores had lost more in both types of learning after operation (correlation coefficients 0.66 and 0.63), although overall decreases were minimal.

The possibility that postoperative function might worsen with increasing patient age reached significance only for more severe decreases in FSIQ after left anterotemporal lobectomies in older patients (correlation coefficient 0.58, $p < 0.05$). Decrease in VIQ after left-sided resections was significantly worse in subjects who continued to have seizures postoperatively ($p < 0.05$), but no such relation could be identified after nondominant lobectomy.

DISCUSSION

To assess implications of serial cognitive changes in any population, we must address the issue of longitudinal test–retest changes in normal controls. Investigators have reported test–retest data for the WAIS-R in various circumstances. Kangas (1971) showed a 9-point FSIQ increase in 48 subjects tested 13 years apart and attributed the change to "maturational" gains, as did Shatz later in a similar group (Shatz, 1981). Matarazzo reported a gain of 5 FSIQ points in normal subjects tested 20 weeks apart (Matarazzo et al., 1973) and mean improvements of FSIQ = 6, PIQ = 8, and VIQ = 3 in the same subjects retested after 2–7 weeks (Matarazzo and Hermann, 1984). We believe our study of 28 medically treated TLE patients tested serially for relatively long periods with no intervening surgical procedure to be the first attempt to quantify long-term changes in this population. Cognitive tests were performed a few years apart, and the slight overall gains noted in this group were in the direction and within the range expected for a normal population, although mean baseline IQs were lower than those reported in the test–retest control studies described. The WAIS-R and WMS showed no evidence of cognitive decrease in these adult patients over several years. Nonetheless, refractory TLE patients frequently voice serious concerns about progressively deteriorating memory function. Our findings have not led us to discount these claims, but instead to consider alternative explanations to the prevalent view that cognitive deterioration is common in partial epilepsy. A subset of these patients may experience gradual deterioration in memory or deterioration may occur over longer intervals of time than we were able to examine. Equally possible is that the "memory problems" these patients are concerned about may actually represent types of cognitive dysfunction that do not correspond to the specific types of intellect or memory we routinely measure. Amnesia in ictal and postictal periods may contribute to the perception of gaps in experience, especially for patients who have poor conscious appreciation of seizures when they occur. Fluctuations in medication levels, even as related to dosing, may have some effect on attention or encoding. Finally the incidence of depression in refractory partial epilepsy is high and may also contribute to the perception of poor cognitive skills. These factors may produce more striking effects in patients whose intellectual baseline is already below average. These variables require fur-

ther careful study and may merit individualized attention in patients concerned about memory function without clear measurable deterioration.

The surprising stability of cognition in refractory TLE patients may also be relevant to recent discussions about mesiotemporal sclerosis. Some investigators have correlated the presence or absence of this pathologic finding with preoperative IQ score (McMillan et al., 1987). Most investigators agree that mesiotemporal sclerosis begins in infancy, but debate over whether the lesion is static or progressive, continues (Gloor, 1992). Questions about the effect of ongoing seizures on temporal lobe pathology closely parallel concerns about the effect of refractory seizures on intellect and memory. Although the connection is entirely speculative, the absence of cognitive decrease in such patients may support the argument against damaging progressive pathologic changes. More data about the course of cognitive dysfunction in TLE may eventually help elucidate the physiologic effects of the observed histologic abnormalities.

Many other factors must be considered in test–retest studies of refractory epilepsy patients. In previous studies of mixed populations of generalized and partial epileptic patients, variables associated with an increased risk for cognitive decrease included polypharmacy (Trimble, 1984), uncontrolled frequent seizures (Seidenberg et al., 1981), early age at seizure onset (Bourgeois et al., 1983; O'Leary et al., 1983), and generalized rather than partial epilepsies (Giordani et al., 1985). The small number of patients in our nonsurgical group does not allow us to perform analyses of covariance with all these factors, but careful examination of scatterplots in this more homogeneous population of refractory TLE patients suggested that polypharmacy was the only potentially important variable for a subset of this group.

In the surgical group, we were able to examine the effect of lateralized temporal dysfunction on intellect and learning before and after surgical intervention. In investigating baseline preoperative function, we noted as have other investigators, that single subtest scores do not generally prove statistically predictive for lateralization of the epileptogenic focus (Dennerll, 1964; Glowinski, 1973; Ivnik et al., 1987; Giordani, 1993), but that some trend exists toward greater delayed visual memory disturbances in right TLE patients and a significant difference in verbal learning with left temporal epileptogenic zones. Verbal memory was relatively poor in both left and right temporal epileptic patients, as another recent study also convincingly documented (Hermann et al., 1992). Finally, earlier suggestions were clearly confirmed (Barr et al., 1990; Berent, 1980; Ivnik et al., 1987): Dominant temporal lobe epileptics have lower baseline IQ scores—patients with right TLE had significantly higher FSIQ, VIQ, PIQ, and overall MQ scores and tended to have higher scores in all parameters except visual memory. A particularly striking preoperative difference between dominant and nondominant hemisphere epileptic patients was demonstrated on the Paired Associates subtest of the WMS.

Much information in previous investigations described cognitive changes after dominant and nondominant temporal lobectomy; many findings have been reproducibly demonstrated, but several controversies remain. Most investigators agree that general WAIS-R scores do not change significantly after operation (Meier and French, 1966; Rausch and Crandall, 1982; Ivnik et al., 1988). Nevertheless, many have shown that dominant lobectomy patients have more pronounced losses, particularly in verbal memory function but also in other cognitive areas (Meyer, 1955, 1959; Milner, 1958, Rausch and Crandall, 1982; Ivnik et al., 1987; Barr et al., 1990). Others have noted no lateralized differences in losses, and a few have reported gains in overall memory after right-sided resections (Rausch and Crandall, 1982; Novelly et al., 1984). There is some debate about whether early postoperative losses improve with time. Several studies have documented worse memory function in patients whose seizures are not controlled postoperatively (Rausch and Crandall, 1982; Novelly et al., 1984) and others indicate that the cognitive risk is greater for larger resections (Awad et al., 1989), for older subjects (Meyer, 1959; Hermann and Wyler, 1988), or for those with higher preoperative IQs (Chelune et al., 1991).

Our results confirm some of these hypotheses indicating (a) dominant TLE is associated with significantly poorer preoperative IQ scores and verbal memory, (b) significant gains are evident in FSIQ after non-dominant lobectomy, and (c) little change is evident in any parameter after dominant resection except for a trend toward decrease in some measures of delayed verbal memory. Only combined measures of verbal memory demonstrated a significant decrease in left lobectomy patients. These findings must be examined in light of our test–retest data in the nonsurgical group. Does the absence of improvement of the nonsurgical group in FSIQ, PIQ, and visual memory actually indicate a slight decrease after operation? In the right TLE group, the mean gains observed after lobectomy were equivalent to normative test–retest changes in PIQ but exceeded retest norms in FSIQ and delayed log-

ical memory. The lack of improvement in nonsurgical patients in visual memory also may be significant. We conclude that left TLE patients may decrease slightly as compared with predicted values and that right TLE patients achieve some minor improvement beyond that expected for retest gains.

We noted no significant difference between testing in the first 5 months after operation and later examinations, but the number of patients was limited. Preoperative predictors of cognitive outcome appeared to be most helpful in the dominant hemisphere group. Higher preoperative scores correlated best with memory decrease after left temporal lobectomy, and significant losses in FSIQ were correlated with increasing age in this group. Finally, among all patients, those who were seizure-free after resection appeared to have slightly better cognitive outcome. This finding may represent either the ongoing effect of postoperative seizures on cognition or dysfunction in the contralateral hemisphere that could contribute to both larger cognitive losses and continued seizures.

Our results suggest that little change occurs in measurable memory or intellectual function of medically managed TLE patients over relatively long times. We found it useful to compare this group with our surgical patients. Results indicate that significant improvement in some aspects of cognitive function after nondominant temporal lobectomy, and dominant lobectomy may cause a very mild decrease in expected retest improvements. These findings should lead to continued prospective investigation of the long-term cognitive implications of medical versus surgical therapies, eventually allowing us to provide the best possible information for our patients.

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RÉSUMÉ

Des tests cognitifs administres a 45 patients souffrant d'epilepsie du lobe temporale ont été répétés a intervales d'une a huit années. L'Échelle d'intelligence de Wechsler pour adulte revisée (WAIS-R) et l'échelle de memoire de Wechsler (WMS) ont été administrées aux patients soumis a une intervention chirurgicale ainsi qu'aux patients non operés. Ces tests furent administrés a plusieurs occasions aux patients non operés, generallement à cause de complaintes de troubles de memoire. Cependant, les tests longitudineaux n'ont pas detectés une deterioration intellectuelle ou de la memoire chez ce groupe. La variance temporelle était similaire aux normes de test–retest établies chez les sujêts de controle. Les scores du WAIS-R obtenues avant et après la resection par les patients operés etaient similaries au scores obtenues par les patients non operés. Lorsque les patients operes furent divisés accordement au côte de la zone epiloptogene, les differences expectées en memoire verbale et visuelle ont été obtenues. Les auteurs ont trouvés que les patients operés sur le côte droit ont eu une amelioration postoperatoire significante de l'échelle totale du quotient d'intelligence ainsi que de leur memoire verbale. Les patients operés sur le côte gauche n'ont pas eu d'amelioration postoperatoire, avec même une tendence a un decliné du quotient de memoire du WMS. Les auteurs concluent que ces decouvertes devraient stimulées une continuelle étude de la progression naturelle de la lateralisation de la memoire et de la performance intellectuelle chez les patients épileptiques, surtout pour clarifier le résultat a long terme de la cognition chez les patients non operés.

(*Translation supplied by authors*)

RESÚMEN

Series de tests cognitivos fueron administrados en intervalos de 1 a 8 años a 45 pacientes con epilepsia temporal (TLE). Cada paciente completó baterías estandarizadas que incluyeron la Escala de Inteligencia de Wechsler para Adultos, Revisada (WAIS-R) y la Escala de Memoria de Wechsler (WMS). Grupos de pacientes tratados con cirugía pacientes no quirúrgicos fueron examinados. El grupo no quirúrgico completó los tests seriados por indicaciones clínicas, generalmente por quejas relacionadas con disfunciones de la memoria. Los tests longitudinales no fueron capaces de demostrar deterioros en la función intelectual o mneumónica de estos sujetos; su variación a lo largo del tiempo fué similar a aquella demostrada tras la administración de tests seriados en sujetos sanos. Los resultados del WAIS-R antes y tras la resección en el grupo quirúrgico fueron similares a aquellos encontrados en los pacientes no quirúrgicos. Cuando los pacientes quirúrgicos fueron divididos de acuerdo a su zona epileptogénica, se observaron las diferencias esperadas en memoria verbal y visual. Encontramos que pacientes con cirugía en el lado derecho mejoraron significativamente en la escala general de inteligencia (FSIQ) y en memoria verbal en tests postoperatorios. Pacientes que se sometieron a resecciones del lado izquierdo no demostraron mejoras tras la operación y tendieron a empeorar en los resultados del Coeficiente de Memoria del WMS (MQ). Nuestros resultados sugieren la necesidad de estudiar la historia natural de la memoria lateralizada y la función intelectual en la epilepsia, especialmente para la clarificación de cambios en la función cognitiva a largo plazo en pacientes no quirúrgicos.

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ZUSAMMENFASSUNG

Bei 45 Patienten mit Temporallappen-Epilepsie (TLE) wurden in Zeitäbstanden von 1 bis 8 Jahren Wahrnehmungsprüfungen durchgeführt. Jeder Patient wurde einer Reihe von Standardprüfungen unterzogen, einschließlich der Verbesserten Wechsler-Erwachsenen-Intelligenzskala (WAIS-R) und der Wechsler Gedächtnis-skala (WMS). Chirurgisch behandelte, sowohl als nicht-chirurgische Patienten wurden dabel untersucht. Die nicht-chirurgische Gruppe wurde auf klinische Symptome hin Serienprüfungen unterzogen, meistens wegen Gedächtnisstörungen. Unter dieser Gruppe konnte bei länglichen Prüfungen keine durchschnittliche Deterioration des Intellektes oder des Gedächtnisses festgestellt werden. Unterschiede über Zeit waren den Test-Retestnormen bei gesunden Kontrollpatienten ähnlich. WAIS-R-Ergebnisse bevor und nach der Resektion in der chirurgischen Gruppe entsprachen unseren WAIS-R-Seriendaten bei nicht-chirurgischen Patienten. Wenn die chirurgischen Patienten je nach der Seite der Epileptogenese aufgeteilt wurden, waren die erwarteten Unterschiede in Wort- und Sichtgedächtnis vorhanden. Bei postoperativen Prüfungen deuteten unsere Befunde auf eine wesentliche Besserung bei rechseitigen chirurgischen Patienten unter vollen IQ (FSIQ)-und Wortgedächtnisskala-prüfungen. Patienten mit linksseitigen Resektionen wiesen keine Besserung bei wiederholter Prüfung auf, und der WMS Gedächtnisquotient (MQ) neigte bei ihnen zur Verminderung. Unsere Befunde sollten weitere Forschung in die Entwicklung des laterisierten Gedächtnisses und der intellektuellen Funktion bei Epilepsie, besonders zur Aufklärung von langfristigen Wahrnehmungsergebnissen bei nicht-chirurgischen Patienten anregen.

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