Clinical, electrophysiological and neuropsychological findings of twenty-two children with mesial temporal sclerosis

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SUMMARY: Aynacı FM, Özdirim E, Saatçi I, Genç D, Topçu M, Turanlı G, Topaloğlu H, Aysun S. Clinical, electrophysiological and neuropsychological findings of twenty-two children with mesial temporal sclerosis. Turk J Pediatr 2003; 45: 221-230.

Twenty-two patients, followed with the diagnosis of epilepsy between the ages of 8.5 and 19 years who were found to have mesial temporal sclerosis (MTS) on brain magnetic resonance imaging (MRI) were evaluated according to their clinical, electrophysiological and neuropsychological characteristics, and assessed for the significance of neuropsychological tests on lateralization. In both MTS groups, a remarkable number of patients had their intial seizure before one year of age (45.5% in the right MTS group, and 36.4% in the left MTS group). Half of the patients were seizure-free for a period of two months-9.5 years (average 3.9 years). The duration between the febrile seizure and first non-febrile seizure was 6.2 years. Eleven patients had MTS on the left temporal lobe. Interictal EEG was normal in five (22.5%) patients; 10 (45.5%) had temporal spike on the corresponding side with MTS. Six (27.3%) patients had paroxysmal activity and voltage asymmetry on cortical areas other than temporal region. The Wechsler Memory Scale (WMS), Visual Reproduction Subtest and Auditory Verbal Learning Test (AVLT) Delayed Recall and Retrieval Subtest performances were poor in the right MTS group.

Key words: mesial temporal sclerosis, childhood, neuropsychologic tests.

Partial seizures originating from the temporal lobe are common in children and adults. The most common pathological lesion in temporal lobe seizures in adults is mesial temporal lobe sclerosis (MTS)[1,2]. In series of temporal lobectomy in adults and in children, this rate has been reported to be 65% and 9-28%.

Mesial temporal lobe epilepsy defines resistant temporal lobe seizures associated with hippocampal sclerosis arising in the first decade of life. Several neuropsychological problems have been defined as associated with temporal lobe epilepsy. While patients with left mesial temporal lobe epilepsy (MTLE) show a material specific verbal memory defect, patients with right MTLE exhibit visual memory defects[5-12].

The aim of our study was to study epileptic patients with MTS regarding etiological, clinical and electrophysiological features, and to assess the value of neuropsychological tests in determining lateralization in patients with MTS.

Material and Methods

Forty cases with MTS on magnetic resonance imaging (MRI) who had been diagnosed with epilepsy at Hacettepe University Children's Hospital, Department of Pediatric Neurology, between May 1997 and March 1998 were included in the study. MRIs were obtained by the primary neurologists of each patient for investigation of epilepsy etiology. Cases with an IQ less than 70 were excluded because these patients were uncooperative with the neurophychological tests performed in our study. Patients with additional abnormal findings on MRI and/or with signs of bilateral MTS were excluded. The remaining 22 cases were studied regarding etiology, clinical features, types of seizures, and electrophysiological findings. The control group consisted of 15 cases with no history of perinatal asphyxia

or febrile or afebrile convulsions, and with normal neurological examination and normal mental development. Neuropsychological tests were applied to all cases. We performed neuropsychological tests in the control group merely for comparison since some of the tests we used were not validated for Turkish children. MRI was not performed in the control group since the group consisted of healthy children with no neurological disorder.

Clinical Evaluation: Medical records were reviewed and a through neurological examination was done to obtain the following information (description of seizure type was made on the medical records and on the history obtained from the parents):

– Age and gender of the patient.
– Identification of the first seizure febrile or afebrile.
– Age at seizure onset, duration and frequency of seizures before the initiation of treatment.
– Interval between febrile and afebrile seizures.
– In patients in whom the initial seizure was afebrile, the age of seizure onset, the frequency, type and duration of seizures, and the longest seizure-free period.
– Type of seizure and presence of aura at the time of diagnosis.
– Possible etiology (birth trauma, febrile convulsions, head trauma, CNS infections and others).
– Family history of epilepsy or febrile convulsions.
– Assessment of growth and development.

Electroencephalogram (EEG) was recorded on 8 channel Nihon-Kohden equipment during the interictal period. Electrodes were placed according to 10-20 electrode system. In five cases EEG-video recordings up to three hours were obtained.

Neuroradiological Evaluation: MR imagings were obtained using different devices (0.5, 1.0 and 1.5 T) in different centers, including own. T2-weighted transverse and coronal sections and T1-weighted sagittal and transverse sections were taken in all cases. The evaluation of the images was made by the same neuroradiologist who was blinded to the clinical information. The gold diagnostic criteria for MTS were as follows:

1. Hippocampal atrophy (Fig. 1a).
2. Increased signal intensity in hippocampus in T2-weighted MRI (Fig. 1b).
3. Dilatation of the ipsilateral temporal horn (Fig. 1a).

Fine coronal sections in T2-weighted FLAIR and Inversion Recovery (IR) techniques suppressing

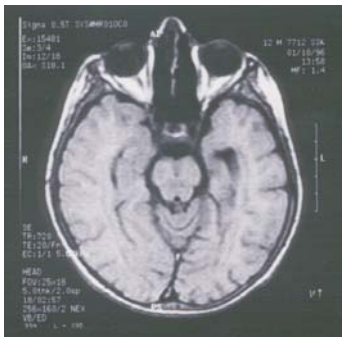

Fig. 1a. T1-weighted magnetic resonance imaging (MRI) (TR/TE=720/20 msn) revealed left hipopcampal atrophy.

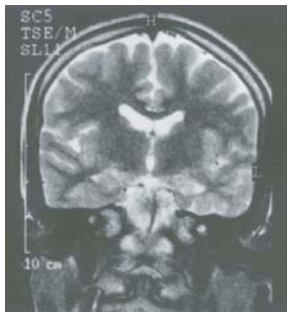

Fig. 1b. T2-weighted coronal magnetic resonance imaging (MRI) (TR/TE=4000/93 msn) demonstrated increased signal intensity in left hippo campus.

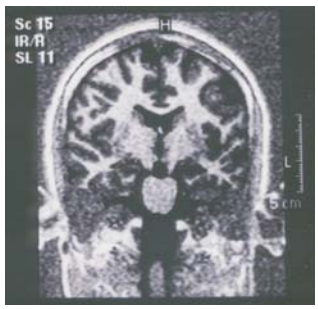

Fig. 2. Inversion recovery (TR/TE/T103000/20/500 msn) revealed dilatation of the left temporal horn.

the cerebrospinal fluid (CSF) were added in cases with clinical history strongly suggestive of MTLE but whose MRI showed only signs of hippocampal atrophy (Fig. 2). Cases with only signs of asymmetrical temporal horn or bilateral dilatation of temporal horn were excluded. Patients with dilatation of temporal horns but with no signal change detected were also excluded in spite of further investigations. Quantitative hippocampal measures were not performed in this study.

Neuropsychological Evaluation: Wechsler Intelligence Scale for Children-Revised (WISC-R) was used to evaluate the intelligence levels, the visual subscales of the Wechsler Memory Scale (WMS) for non-verbal memory defects and the Rey Auditory Verbal Learning Test (AVLT) for verbal memory defects in both groups. The raw scores obtained from WISC-R and AVLT were compared with standard scores established for corresponding age groups in previous studies. We performed WISC-R and WMS which were available in our center. WISC-R is validated for Turkish children; however, our center currently has battery for under 16 years of age; therefore four patients older than 16 years could not be tested.

Diagnoses of right versus left MTS was done based on the results of MRIs and the results of imaging data was compared with lateralizing features in the neuropsychological tests.

Two of the 22 patients underwent phase I presurgical evaluation in our center. One had right temporal lobectomy and amygdalohippocampectomy. Postoperatively, he has been seizure free for 1.5 years. The other patient was not considered as a candidate for epilepsy surgery due to WADA (intra-arterial amobarbital procedure) failure.

Statistical comparisons were made using the Mann-Whitney U test for non-parametric variables, and Kruskal-Wallis variance analysis to evaluate the differences between groups. A value of $P>0.05$ was accepted as not statistically significant.

Results

Twenty-two cases with MTS and 15 healthy subjects as the control group were included in the study. Their sex distribution is shown in Table I. There was no significant difference in sex distribution between the right and left MTS groups.

Age ranges of the cases are shown in Table I. No significant difference was observed in age distributions between the cases and the control group ($p>0.05$). The mean age of the left MTS group was significantly higher than that of the right ($p<0.05$).

In both MTS groups, a remarkable number of patients had their initial seizure under one year of age (45.5% in the right and 36.4% in the left MTS group). Ages at the time of the first seizure were not significantly different in the right and the left MTS groups ($p>0.05$). The age of onset of afebrile seizures also showed no significant difference between the two MTS groups and was most common between 3-8 years (Table II).

The most common type of first seizure was febrile convulsion in both MTS groups (45.5% and 36.4%, respectively). Complex partial seizures were detected in eight cases (36.4%) as the first afebrile seizure among all MTS cases. Other seizure types are summarized in Table I.

In both MTS groups, the first seizures lasted for more than 15 minutes in six cases (31.6%) and less than 15 minutes in 13 cases (68.4%). In three cases no information could be obtained from their parents. In two cases the histories were suggestive of status epilepticus, and in one of these both prolonged febrile convulsion and status epilepticus were defined by caregivers.

The mean period between febrile and afebrile seizures was 6.2 ± 3.6 years in all MTS cases.

At the time of diagnosis aura was defined in five cases (22.5%) (Table II). Eleven cases were seizure-free (50%) for a period of 2 months-9.5 years, while 11 cases had complex partial seizures (50%). These were accompanied by myoclonic, generalized tonic, generalized tonic-clonic secondary generalized, and atonic seizures (one each in five separate cases).

Four cases were on antiepileptic drugs (AEDs) and seven cases were on single AED therapy. The remaining patients were on polytherapy with either two or three AEDs.

Etiological factors were febrile convulsions in nine cases (40.9%). In five of these cases febrile seizures had lasted for more than 15 minutes. All febrile convulsions were described as generalized tonic-clonic seizures. History of cranial trauma was defined in nine cases (40.9%): major cranial trauma in one, minor in eight. Head trauma

Table I. Clinical Features of the Right and Left MTS Groups

Features		Right (n)	MTS (%)	Left (n)	MTS (%)	Total n	Total %
Age (years)							
	≤12	6	54.6	1	9.1	7	31.8
	12-15	4	36.4	5	45.5	9	40.9
Sex							
	Male	7	63.6	7	63.6	14	63.6
	Female	4	36.4	4	36.4	8	36.4
WISC-R Verbal IQ							
(n=18)	70-90	2	20.0	3	37.5	5	27.8
	91-100	6	60.0	3	37.5	9	50.0
	≥101	2	20.0	2	25.0	4	22.2
WISC-R Performance IQ							
(n=18)	70-90	6	60.0	4	50.0	10	55.6
	91-100	2	20.0	1	12.5	3	16.7
	≥101	2	20.0	3	37.5	5	27.7
WISC-R Total IQ							
(n=18)	70-90	5	45.5	3	37.5	8	44.5
	91-100	3	30.0	3	37.5	6	33.3
	≥101	2	20.0	2	25.0	4	22.2
Age at first seizure (Febrile-afebrile)							
	≤1	5	45.5	4	36.4	9	40.9
	1-3	2	18.2	2	18.2	4	18.2
	3-8	2	18.2	3	27.3	5	22.7
	8-13	2	18.2	2	18.2	4	18.2
Type of first seizure							
	FC[a]	5	45.5	4	36.3	9	41.0
	CP[b]	2	18.2	2	18.2	4	18.2
	GTC[c]	1	9.1	0	–	1	4.5
	FM[d]	1	9.1	0	–	1	4.5
	GT[e]	0	–	2	18.2	2	9.1
	Atonic	1	9.1	0	–	1	4.5
	CP+SG[f]	0	–	1	9.1	1	4.5
	CP+GTC	1	9.1	2	18.2	3	13.7
Duration of first seizure (n=19)							
(n=19)	0-15 mins	7	70.0	6	66.7	13	68.4
	≥15	3	30.0	3	33.3	6	31.6

[a]Febrile convulsion, [b]Complex partial, [c]Generalized tonic-clonic, [d]Focal motor, [e]Generalized tonic, [f]secondary generalized.
MTS: mesial temporal sclerosis; WISC-R: wechsler intelligence scale for children-revised.

Table II. Clinical Features of the Right and Left MTS Groups

Features	Right (n)	MTS (%)	Left (n)	MTS (%)	Total n	Total %
Age at afebrile seizure (n=20)						
(years) ≤1	1	11.1	2	18.2	3	15.0
1-3	2	22.2	0	–	2	10.0
3-8	3	33.3	6	54.6	9	45.0
8-13	3	33.3	3	27.3	6	30.0
Aura						
Epigastric rising	1	9.1	0	–	1	4.5
Sense of blank	0	–	1	9.1	1	4.5
Abdominal pain	0	–	1	9.1	1	4.5
Odor+nausea+flushing	0	–	1	9.1	1	4.5
Paresthesia of hand+sweating	1	9.1	1	9.1	1	4.5
Seizure type at diagnosis						
CP[b]	4	36.4	7	63.6	11	50.0
Seizure-free	7	63.6	0	–	11	50.0
Possible etiological factors						
Head trauma	4	36.4	5	45.5	9	40.9
FC[a]	5	45.5	4	36.4	9	40.9

was the only etiological factor in three cases, but the remainder were associated with other factors such as prolonged febrile convulsion (1 case), anoxic birth (2 cases), meningitis (1 case) and status epilepticus (1 case). Association of head trauma, status epilepticus and anoxic birth was described in one case. One case had acute lymphoblastic leukemia (ALL). In three cases, etiology was unknown.

The EEG findings of the patients in the MTS group are summarized in Table III. Five cases had an EEG video-monitoring study which was normal in two cases with right MTS and in one case with left MTS. There was a right temporal focus in one, and left temporal focus in the other.

When the neuropsychological tests were compared, the control group had higher verbal performance and total intelligence scores in WISC-R test in comparison to the MTS group

Table III. EEG Findings of the Patients with MTS

EEG	M Right (n)	M MTS (%)	R Left (n)	G MTS (%)	Total n	Total %
Normal	3	27.3	2	18.2	5	22.7
Right temporal focus	5	45.4	1	9.1	6	27.2
Left temporal focus	–	–	5	45.4	5	22.7
Post-paroxysmal abnormality	1	9.1	–	–	1	4.6
Central EA[a]	1	9.1	1	9.1	2	9.2
Generalized PA[b]	1	9.1	–	–	1	4.6
Background abnormality	–	–	1	9.1	1	4.6
Left voltage asymmetry	–	–	1	9.1	1	4.6

(p<0.05) (Table IV). Differences between the mean subscale scores of WMS and AVLT tests of the two groups were not statistically significant.

In three subscale scores of WISC-R test, there was no significant difference between the right and the left MTS groups (p>0.05). The right MTS group had significantly lower scores in two subscales of the WMS test (compared to the left MTS group). In the AVLT test, the right MTS group had significantly lower scores compared to the left MTS group in delayed recall and retrieval subscales measuring the AVLT (p<0.05) (Table V).

When the right MTS, the left MTS and the control groups were compared, the control group had significantly higher scores in subscales of the WISC-R test compared to the other two. The right MTS group had lower scores in two subscales of the WMS test, in delayed recall and retrieval subscales of AVLT.

Discussion

Our study included 22 cases who were followed-up for childhood epilepsy, and had MTS on MRI, to investigate seizure types, history of febrile convulsions, other clinical features, and predisposing factors. Previous studies on MTLE patients had been done largely in adult patients including adolescents[13-15]. Few studies had been done in children[16,17].

Frequency of the febrile convulsions had been reported to be 30-78% in MTS[3,13,16,18]. The onset of febrile convulsion in temporal lobe epilepsy is between 6-12 months of age[19]. In

Table IV. Median and p Values of MTS and Control Cases in Neuropsychologic Test

NWU[a] Test	MTS Median	MTS Range	Control Median	Control Range	p
Age (Months)	13.5	(8.5-19)	13	(10.5-18.5)	0.89
WICS-Verbal IQ	89	(75-108)	107	(84-138)	0.0058
WISC-Permance IQ	89	(68-113)	103	(72-134)	0.0078
WISC-Total IQ	91	(75-107)	104	(80-130)	0.0057
WMS-Immediate memory	9.7	(5.5-3.5)	11.5	(4.5-14)	0.21
WMS-Delayed memory	7.7	(3.5-1.4)	9.5	(5-14)	0.2
AVLT-Immediate recall	6.2	(5.4-7.8)	6.5	(5.8-7.3)	0.28
AVLT-Total	59.9	(46.7-57.3)	53.0	(46.7-57.3)	0.256
AVLT-Destruction	6.0	(5.5-7.7)	6.2	(5.7-6.9)	0.128
AVLT-Retrieval	10.6	(9.3-12.7)	11.6	(9.3-12.7)	0.33
AVLT-Delayed recall	10.8	(9.6-13.5)	11.0	(9.6-13.5)	0.39
AVLT-Recognition	14.2	(13.8-14.6)	14.4	(13.8-14.6)	0.13

[a]Mann-Whitney U.

MTS: mesial temporal sclerosis; WISC: Wechsler Intelligence Scale; WMS: Wechsler Memory Scale; AVLT: Auditory

Table V. Median and p Values of Right and Left MTS Cases in Neuropsychologic Test

Test	Right median	MTS range	Left median	MTS range	NWU p
Age (Month)	12	(8.5-19)	15	(12-18)	0.0137
WISC Verbal IQ	95	(80-108)	95	(75-107)	0.93
WISC-Performance IQ	88	(73-113)	93	(70-105)	0.50
WISC-Total IQ	92	(74-107)	91	(70-107)	0.86
WMS-Immediate memory	7.5	(5.5-12)	12.5	(6.5-14)	0.0037
VMS-Delayed memory	7	(3.5-12)	10	(4-14)	0.041
AVLT-Immediate recall	6.2	(5.4-6.9)	6.2	(5.8-7.8)	0.067
AVLT-Total	46.9	(46.7-53.4)	50.3	(46.9-57.3)	0.051
AVLT-Distruction	5.9	(5.7-6.2)	6.1	(5.5-7.7)	0.11
AVLT-Recall	9.5	(9.3-11.8)	11.8	(9.5-12.7)	0.008
AVLT-Delayed recall	9.9	(9.6-11.7)	11.4	(9.6-13.5)	0.009
AVLT-Recognition	14	(14-14.5)	14	(13.8-14.6)	0.13

MTS: mesial temporal sclerosis; NWU: Mann-Whitney U; WISC: Wechsler Intelligence Scale for children; WMS: Wechsler

our cases febrile convulsions were the most common type of seizures (40.9%) and the age of onset was between 6-36 months.

In MTLE, first attacks of afebrile seizures have been reported to be complex partial or secondary generalized seizures and tend to recur in adolescence while responding to treatment initially[18]. Lagae et al.[20] had reported typical complex partial seizures in six cases with MTS (75%), generalized tonic-clonic seizures in two (28%), and no seizure in six (75%). In our study, afebrile seizures started as complex partial seizures in 16 cases (80%). Regarding seizure types of our patients, focal motor, atonic and myoclonic seizures are not expected to be manifestations of temporal lobe epilepsy. In our study, description of seizure type was made on a clinical basis and depended on the medical records and on the history obtained from the parents. We have no video recordings of the actual typical seizures. Different seizure types may be due to these factors. French et al.[14] had reported that 22% of cases were seizure-free after afebrile seizures for a period of 3-14 years (average 5.9 years). In our study, 11 cases (50%) are in follow-up without any seizure. All these cases except one are in the adolescent age group and have been seizure-free for a period of 2 months-9.5 years (average 3.9 years). Follow-up of our seizure-free cases is continuing regarding recurrences. Our results are similar to those of Lagae et al.[20] but our rates for seizure control (50%) are lower. This may be due to the small number of cases in each study.

The latent period between febrile convulsion and afebrile seizures was reported to be between 1 to 15 years[21]. In our study, the latent period between febrile and afebrile seizures was found to be between 1 year and 10 months to 10.5 years (average 6.5 years).

Some etiological factors have been described in MTS etiology. Whether the febrile seizures, especially the complicated and long-lasting ones, are associated with MTS is controversial[18]. Some studies suggest that long-lasting seizures accelerate hippocampal atrophy[22-24]. VanLandingham et al.[25] performed MRI after complex febrile convulsions (CFCs) in 27 infants. Definite MRI abnormalities were seen in six of the 15 infants with focal or lateralized CFCs and in none of the 12 infants with generalized CFCs. Finally, they suggested that evidence of preexisting hippocampal abnormalities in several infants and electrographical temporal lobe seizure activity in one suggest the possibility that CFCs actually originated in the temporal lobes in of some patients. Studies in children with MTLE show that prolonged febrile convulsions occur in 56.3% of cases[3,16,26]. We described five cases with prolonged febrile convulsion (22.7%). This finding is of interest, since a higher ratio of patients with prolonged febrile convulsions would be expected in such a selected patient population. We think that this could be related to seizure history obtained from parents.

History of status epilepticus has been reported in 4.5-29% of cases with MTLE[13-15,20]. In our study it was found to be 9.1%.

Development of focus in temporal lobe seizures has been reported to be associated with cranial trauma. History of head trauma has been reported as 8-15% in MTS[14,15, 19]. In our study it was higher (40.9%). In 27.3% of cases, cranial trauma was found to be the only etiological factor. High rates of head trauma in our series could be related to environmental factors, level of education, and caregivers. However, minor head trauma is common in children and mostly benign, so we could not say that there was a relationship between minor trauma and mesial temporal sclerosis.

In a recent study conducted on twins, it was suggested that perinatal problems and birth are not determining factors in the development of hippocampal sclerosis and that the complex febrile seizures are secondary[27]. Association of hippocampal sclerosis with birth trauma has been reported to be insignificant[28,29]. In our study three cases with a history of birth trauma (14.6%) were found to be associated with other etiological factors.

Mesial temporal sclerosis (MTS) has been detected in association with tumors such as meningioma, ganglioglioma, and oligodendroglioma in 56.2% of cases in a study[30]. We did not detect any of these tumors in our cases. One patient was diagnosed as having ALL at seven years of age and received chemotherapy for three years. This patient had complex partial and secondary generalized seizures two to three times per day since eight years of age. We suggest that our patient with ALL could have developed MTS following seizures related to chemotherapy and the resultant

vascular problems.

The risk of development of neocortical focus is increased following encephalitis and the risk f MTS is increased following meningitis[31]. History of central nervous system infections has been detected in 10.4% of cases with MTLE[14]. In our series one patient (4.5%) had a history of meningitis at 2.5 years of age. If we consider the high prevalence of infections in our country, the occurrence of MTS following meningitis and encephalitis is rather low. The history of meningitis was also present in two of three cases with bilateral MTS, but these cases were excluded. When they are included, meningitis is responsible in the etiology of MTS in 10% of cases.

The correct lateralization range in EEG is 83-96% in patients with MTLE[1,15,16,32]. Our result of 45.5% is lower. As we aimed to investigate the value of neuropsychological tests, in lateralization of MTS determined by MRI, the study was not conducted in association with EEG signs directly. EEG was done previously, and recordings were evaluated by different pediatric neurologist. Evaluations were done retrospectively using the EEG reports as some records were not available. We believe lack of ictal EEG recordings and of prolonged interictal EEG recordings also influenced our results.

Neuropsychological tests revealed that the control group had higher verbal performance and total intelligence scores in the WISC-R test in comparison to the MTS group. We performed IQ tests at the time we obtained MRIs. Therefore we were not able to conclude whether deficits in IQ were a result of ongoing seizure disorder, of the effect of AED treatment or a cumulative result of both versus IQ deficits present early on in the course of epilepsy.

Hippocampal sclerosis impairs the ability to learn associations and to retain information over a delay interval[5]. For the function of learning and retention of verbal material, the left hippocampus is more important than the right. In some studies, a difference in performance between patients with temporal lobe epilepsy and those with other types of seizures and healthy subjects could not be shown[7], and in some other studies, memory defects were not found to be different from lateralization of the seizure focus[6,9]. However some studies have shown that verbal deficits are associated with left temporal lobe epilepsy while visual memory deficits are associated with right temporal lobe epilepsy[4,5]. There are few studies conducted on the cognitive effects of temporal lobe epilepsy in children[10,11,17]. These studies have been done in cases who underwent temporal lobectomy and it was reported that the IQ remains stable but that memory functions could be decreased[11].

Wechsler memory scale-revised (WMS-R) could lateralize the left hemispheric abnormalities but it is insufficient in evaluating the right hemispheric abnormalities[33,34]. In our study, results of the two subscales of WMS supported the presence of visual memory defects in patients with right MTS.

The auditory verbal learning test (AVLT) has been used to evaluate short term verbal memory, verbal learning, post-interference recall and recognition of visually presented material[35]. Helmstaedter et al.[8] using the German adaptation of AVLT, concluded that in the preoperative period patients with left temporal lobe epilepsy had lower performance in long-term consolidation/retrieval (delayed recall) than those with right temporal lobe epilepsy. In another study[6], no significant difference was detected in immediate and delayed recall between the groups. Delaney et al.[12] has also reported that the immediate recall tests could not be discriminating. We, too, found no significant difference in immediate recall, destruction, and recognition subscales of AVLT between the groups (p: 0.067 for immediate recall, p. 0.051 for total recall). By increasing the number of the cases, a statistically significant difference could be achieved. Thus we propose to evaluate these tests in larger series.

In our study the right MTS group had lower scores in a group of subscales measuring only the delayed recall and retrieval of AVLT, contrary to the results reported in literature which show impairment in the verbal test results in left MTS patients. However the mean age of the left MTS group was significantly higher than that of the right MTS group. The difference between the two groups could have been related to the age factor since it affects verbal learning[36]. It has also been reported that linguistic activity plays a major role in

memory disturbance in left temporal lobe epilepsy[6,7]. Differences in age distribution, the socio-economic levels, and environmental factors may explain our results of AVLT.

Studies on the application and the adaptation of neuropsychological tests in children with MTS are not yet sufficient. The low number of our cases, their electrophysiological and clinical features not exactly fulfilling the diagnostic criteria of MTLE, the lack of some test forms adapted to our population, and the difference in the mean age, with the left MTS group being older, could have affected our results. Thus we suggest that the value of neuropsychological tests should be studied in larger series of patients with MTS, to detect lateralizing features and patterns specific to MTS.

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