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Predictive effect of preoperative abdominal and emotional aura on temporal lobe epilepsy surgery

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Abstract

Aim: Temporal lobe epilepsy surgery is the most common type of epilepsy surgery. This study evaluates the relationship between preoperative auras and surgical prognosis.

Materials and Methods: The follow-up data of 100 patients who underwent anterior temporal lobectomy surgery after 2 years was reviewed. The patients were divided into two groups based on the presence or absence of abdominal-emotional (AE) aura. Each patient was evaluated with a detailed history, video-electroencephalography (EEG), neuroimaging, and postsurgical outcomes according to Engel classification to predict postsurgical seizure freedom.

Results: After 2 years of follow-up, 71 patients were seizure-free. Based on aura types, univariate analysis showed that the age of disease onset and history of febrile convulsion were higher in the AE (+) group (p=0.013, p<0.001). Additionally, MTS was more frequently observed in the MRI, MRS, and pathology results (p= <0.001, p=0.01, p=0.009). No correlation was found between the presence or type of aura and postoperative seizure-free state.

Conclusion: Our results showed that the presence or type of aura had no prognostic significance for seizure freedom after TLE surgery. However, further studies with larger patient numbers are needed to confirm these findings.

Introduction

Temporal lobe epilepsy (TLE) is the most prevalent refractory epilepsy syndrome in adults. Epilepsy surgery is a frequently applied and effective method for cases of TLE that do not respond to antiepileptic medication [1].

Auras are observed in 56% of patients with epilepsy [2] and are important in determining the surgical site because they are a localization related to ictal activation [3]. Following epilepsy surgery, auras may persist as an isolated phenomenon [4]. It is unclear whether these isolated postoperative auras increase the risk of recurrent seizures.

Temporal lobe epilepsy is the most common type of epilepsy for which surgery is performed. The most common auras observed in TLE are abdominal, emotional, and psychic auras [5]. Following temporal lobectomy, auras may either resolve or persist as isolated postoperative auras, or new auras may emerge. [6,7]. A limited number of studies have evaluated the role of epileptic aura and its effect on surgical outcomes. One such study, which involved 347 patients, found that postoperative auras did not increase the risk of postoperative recurrence [8].

This study presents a 2-year postoperative follow-up of 100 patients with TLE. Our aim was to analyses the effect of auras on postoperative prognosis in patients with refractory temporal lobe epilepsy (TLE).

Materials and Methods

Ethical approval was obtained from the Ethics Committee of Gazi University Faculty of Medicine. A retrospective review was conducted on 100 patients who underwent standard Anterior Temporal Lobectomy for refractory TLE at Gazi University Medical Faculty Epilepsy Centre between 2010 and 2014. In this study, the regression sample size determination condition was N≥8m+50 (N=sample size, m=number of independent variables). Therefore, a sample size of 100 was used because the relationship between 10 independent variables and the presence of aura was analyzed.

The inclusion criteria; age between 14 and 60 years, a diagnosis of TLE localizing a solitary focus, a follow-up

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of at least 1 year after surgery, and discontinuation of antiepileptic drugs after 6 months. The exclusion criteria were decided as the detection of a new ictal focus after surgery, newly diagnosed intracranial lesion, and cerebrovascular disease.

All patients were followed up at the epilepsy center of Gazi University Medical Faculty, and TLE operations were performed by the same surgeon. The patients were followed up by the same epileptologist at the 2nd and 6th months after the operation and annually thereafter.

Engel's classification was used for postoperative evaluation. For the analysis, the seizure-free group (Engel Ia) and the group with seizures (Engel Ib, Ic, II, III, IV) were compared. The seizure status of the patients was recorded firstly at 6 months and then at yearly follow-up. The auras were classified as AE (+) auras originating from mesial temporal structures and AE (-) auras, such as somatosensory, auditory, autonomous, vertiginous, and taste, originating from neocortical/extra temporal structures.

Statistical analysis

All analyses were conducted using the Jamovi project (2022, Jamovi Version 2.3, Computer Software). The findings of this study are expressed as frequencies and percentages. Normality analysis was performed using the Shapiro–Wilk test, skewness-kurtosis, and histograms. Categorical variables were presented as absolute numbers with percentages. Categorical variables were compared using the chi-square test or Fisher's exact test. Univariate logistic regression analyses were performed to identify factors associated with the presence and absence of aura. Statistical significance was set at $P < 0.05$. Odds ratios (ORs) and 95% confidence intervals (CIs) for successful responses in the presence of independent predictors of aura presence or absence were calculated using logistic regression analyses. The number of variables and patients to be evaluated in logistic regression analysis and the association of ten variables with aura were assessed.

Results

A total of 100 patients, 58 females (58%) and 42 males (42%), were included in the study. The age range of the patients was 15-57 years and the mean age was 32.16±7.7 years. Disease duration was <10 years in 48 patients, 10-20 years in 41 patients and >20 years in 11 patients. The majority (91%) were right-hand dominant. The most common risk factor was febrile convulsion and the most common epilepsy focus was left temporal. AE aura was present in %57 patients and the most common pathological diagnosis was MTS (Table 1). Demographic and clinical data are given in Table 1.

Table 1. Demographic and clinical data.

Variables		n=100
Age		32.16 ± 7.7
Gender	Female	58
	Male	42
Lateralization	Right	91
	Left	9
Risk Factors	Febrile convulsion	54
	Head trauma	24
	CNS infection	6
	Difficult labor	14
	Consanguineous marriage	18
	Epilepsy in the family	20
MRI	MTS (-)	30
	MTS (+)	74
	Right temporal	34
	Left temporal	56
	Normal	10
MRS	Right temporal	35
	Left temporal	65
Type of Seizures	CPS	100
	CPS+Sec. JTCS	75
	Pseudo seizure	6
EEG-Ictal discharge	Right temporal	35
	Left temporal	65
EEG-Inter ictal discharge	Right temporal	23
	Left temporal	42
	Extra temporal	35
PET	Right temporal	32
	Left temporal	55
	Normal	3
Aura	Abdominal-Emotional (+)	57
	Abdominal-Emotional (-)	43
Type of Operation	ATL	90
	ATL+lesionectomy	10
Pathological Diagnosis	MTS (+)	55
	MTS (-)	45

MRI: Magnetic resonance imaging, MRS: Magnetic resonance spectrograph, MTS: Mesial temporal sclerosis, CP: Complex partial seizure, Sec. JTCS: Secondary generalized tonic-clonic seizure, AE.: Abdominal-Emotional, ATL: Anterior temporal lobectomy.

In CR MR evaluation, 70 patients were MTS positive and 30 patients were MTS negative. In the MTS negative group, cavernoma was found in 2 patients, arterio-venous malformation in 1 patient, DNET in 4 patients, cortical dysplasia in 3 patients, mass lesion in 9 patients and vasculitis in 1 patient. MR examination of the remaining 10 patients was normal. When the pathological results were evaluated, MTS was detected in 55 patients and MTS was negative in 45 patients. In the MTS negative group, 4 patients were diagnosed as focal cortical dysplasia, 2 patients as cavernous hemangioma, 1 patient as meningioma and 6 patients as oligodendroglioma. Histopathological results of 32 patients were normal. We categorized auras as the presence or absence of abdominal and emotional (AE) aura. Accordingly, there were 57 patients (57%) in the AE aura positive group and 43 patients (43%) in the AE aura negative group (Figure 1).

The AE+ group showed a higher rate of MTS detection with pathology result, MRI and MRS imaging compared

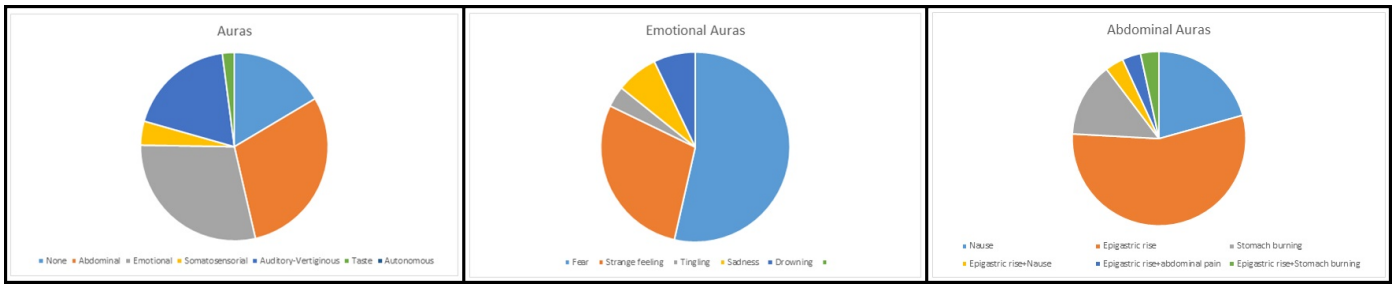

Figure 1. Type of Auras.

Table 2. MTS rate according to groups.

		A-E Aura (+) N(%)	A-E Aura (-) N(%)	p
Pathology	MTS (+)	38 (69.1)	17 (23.7)	0.009[1]
	MTS (-)	19 (42.2)	26 (57.8)	
MRI	MTS (+)	48 (68.6)	22 (31.4)	<0.001[2]
	MTS (-)	9 (30)	21 (70)	
MRS	MTS (+)	44 (66.7)	22 (33.3)	0.010[3]
	MTS (-)	13 (38.2)	21 (61.8)	

P; [1]: Fisher's exact test, [2,3]: Continuity correction, MRI: Magnetic resonance imaging, MRS: Magnetic resonance spectrograph, MTS: Mesial temporal sclerosis.

Table 3. Relationship between aura and postoperative seizure.

	Postop Seizure (-) N(%)	Postop Seizure (+) N(%)	Total	p
Aura (-)	10 (62.5)	6 (37.5)	16	0.548[1]
Aura (+)	61 (72.6)	23 (27.4)	84	
AE aura	43 (75.4)	14 (24.6)	57	0.302[2]
Other aura	17 (63)	10 (37)	27	

P; [1,2]: Fisher's exact test, AE aura: Abdominal-Emotional aura.

to the other group (p=0.009, <0.001, 0.010, respectively) as shown in Table 2.

71 patients have been seizure-free. 5 patients experienced a seizure in the first postoperative month but did not have another seizure in the following four years. 11 patients experienced only aura, and the type of aura changed in 2 of these patients after the operation. 8 patients had less than three seizures in one year.

No correlation was found between the presence or type of aura and postoperative seizure-free state (Table 3).

Based on aura types, univariate analysis showed that the age of disease onset was higher in the AE (+) group. Additionally, MTS was more frequently observed in the MRI, MRS, and pathology results (Table 4).

Discussion

The study aimed to determine whether the presence and type of aura have prognostic significance for surgical outcomes in patients undergoing TLE surgery. Previous studies have identified several predictive factors for TLE surgery, including hippocampal sclerosis, early onset epilepsy, and a history of febrile convulsions. However, the choice of surgery, such as anterior lobectomy or selective hippocampal resection, does not appear to have an impact [1,9,10].

Auras are electrical activities that originate from cortical areas and are important in determining the seizure focus before surgery. Abdominal auras have a reported localization value of between 45% and 80% for the temporal lobe [11].

In our study, 84% of patients experienced aura, with abdominal and emotional (fear sensation) aura being the most common. Patients with abdominal and emotional aura had MTS in 66.7% of cases (p=0.009), which is consistent with previous research [12].

In our study, no correlation was found between auras and lateralization. Various studies have found no lateralizing value for auras [13,14,16,17], whereas Chun Kuan et al. reported that abdominal auras were associated with left-onset seizures in epigastric auras and right-onset seizures in non-epigastric auras [17].

A history of febrile convulsion is considered a positive prognostic factor, as evidenced by the observation of abdominal and emotional aura in 78% of patients (p=0.0001), which is consistent with the literature [18].

Our study found that patients with AE aura (+) had an early age of disease onset, which is known to be a positive prognostic factor [12,18]. Arifin et al reported that patients with preoperative aura were associated with late-onset epilepsy [19].

Williamson reported that MTS was the most common pathological finding in temporal lobe epilepsies (83%) [20]. Abdominal aura was the most frequently reported aura associated with MTS [21,22]. Fear aura was the most common emotional aura and occurred with activation of mesial temporal structures [23, 24].

In our study, we found that 68.6% of patients with MTS on MR had positive abdominal and emotional aura (p=0.0001), which is consistent with previous literature [21, 25].

When comparing surgical results, the postoperative seizure recurrence rates were 37.5% for patients without aura and 27.4% for patients with aura. There was no statistically significant difference between the two groups.

The literature on this subject varies, with some authors

Table 4. Univariate logistic regression analyses of data according to aura types.

Variables		AE (-)	AE (+)	p	OR	CI
Gender	Female	27 (46.6)	31 (53.4)	0.421	1	-
	Male	16 (38.1)	26 (61.9)		1.42	0.58-3.45
Age at start	<10 age	14 (29.8)	33 (26.8)	**0.013**	1	-
	10-20 age	22 (50)	22 (50)		0.42	0.16-1.09
	>20 age	7 (77.8)	2 (22.2)		**0.12**	**0.02-0.77**
Febrile convulsion	(-)	31 (67.4)	15 (26.2)	**0.0001**	1	-
	(+)	12 (22.2)	42 (77.8)		**7.23**	**2.73-19.6**
Head trauma	(-)	34 (44.7)	42 (55.3)	0.639	1	-
	(+)	9 (37.5)	15 (62.5)		1.35	0.48-3.84
CNS infection	(-)	42 (44.7)	52 (55.3)	0.233	1	-
	(+)	1 (16.7)	5 (83.3)		4.04	0.43-94.96
Newborn distress	(-)	38 (44.2)	48 (55.8)	0.772	1	-
	(+)	5 (35.7)	9 (64.3)		1.42	0.39-5.39
MRI	MTS (-)	21 (70)	9 (30)	**0.0001**	1	-
	MTS (+)	22 (34.1)	48 (68.6)		**5.09**	**1.84-14.42**
MRS	MTS (-)	21 (61.8)	13 (38.2)	**0.01**	**1**	-
	MTS (+)	22 (33.3)	44 (66.7)		**3.23**	**1.26-8.39**
	Right temporal	21 (60)	14 (40)	**0.019**	1	-
	Left temporal	22 (33.8)	43 (66.2)		**2.93**	**1.16-7.51**
Pathology	MTS (-)	26 (57.8)	19 (42.2)	**0.009**	1	-
	MTS (+)	19 (30.9)	38 (69.1)		**2.74**	**1.13-6.68**
Postop seizure	(-)	28 (39.4)	43 (60.6)	0.275	1	-
	(+)	15 (51.7)	14 (48.3)		0.61	0.23-1.58

AE: Abdominal-Emotional aura, OR: Odds Ratio, CI: Confidence interval, CNS: Central nervous system, MRI: Magnetic resonance imaging, MRS: Magnetic resonance spectroscopy, MTS: Mesial temporal sclerosis.

suggesting that the presence of preoperative aura is an indicator of a good prognosis [12,26,27,28]. Arifin et al. reported that the presence of preoperative somatosensory aura was associated with postoperative seizure absence [19]. On the other hand, Ashalatha et al. reported that the presence or absence of preoperative auras has no prognostic significance in TLE surgical patients [29].

When we compared our 2-year postoperative follow-up according to aura types, we did not find a prognostically significant difference between the AE aura (+) group and the AE aura (-) group. The data in the literature differ in the relationship between aura types and postoperative seizure freedom.

A study analyzed the abdominal auras of patients with TLE after epilepsy surgery and found no relation between abdominal auras and postoperative prognosis [22]. Zare et al. reported that there was no relation between aura types and postoperative seizure freedom in patients with MTS who underwent TLE surgery. According to Yu et al., patients with auras originating from the temporal lobe had better surgical outcomes than those with auras originating from extra temporal or deep brain regions [31]. In another study in which TLE patients with somatosensory auras were analyzed, it was reported that half of the bilaterally symptomatic patients had postoperative seizures [32].

It was reported that somatosensory auras occurring contralateral to hippocampal sclerosis were suggestive about poor surgical prognosis. The same study also reported that extra temporal auras were a poor prognostic factor [33]. Ashalta et al. They found the presence of auditory and vertiginous auras as a poor prognostic value [29].

TLE surgery is a successful treatment for refractory epilepsy caused by idiopathic or structural lesions [34]. The predictive value of auras in terms of seizure freedom after TLE surgery, or whether persistent auras are a risk factor for postoperative seizures, remains unclear. Further studies are needed to answer these questions.

The limitations of this study is the small sample size and a short follow-up period.

Conclusion

The results indicate that patients with AE aura (+) had early onset epilepsy, a history of febrile convulsions, and were more likely to have MTS pathology. However, the presence or absence of preoperative aura and aura type did not have any prognostic significance after surgery.

Ethical approval

Ethical approval for this study was obtained from Gazi University Clinical Research Ethics Committee (Decision no: 436)

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