Posterior Ocular Structure Parameters by Optical Coherence Tomography Angiography in Pediatric Epilepsy Patients

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OBJECTIVES

To evaluate the quantitative measurements obtained by optical coherence tomography angiography in children with epilepsy using three different antiepileptic drugs (AED) and to compare them with healthy subjects and newly diagnosed epileptic children without treatment.

MATERIAL AND METHODS

We enrolled 124 eyes of 124 children with epilepsy who were referred consecutively to the Ophthalmology Clinic from the Pediatric Neurology Department of Ankara City Hospital, in this observational, and case control study.

The children with epilepsy were grouped according to their current antiepileptic drug (AED) as monotherapy. The control group consisted of the 31 eyes of 31 age- and sex-matched healthy subjects who had presented consecutively to the Ophthalmology Clinic for a routine eye examination and who had no systemic and ocular disease.

All the subjects (155 patients) were divided into 5 groups: Group-1: healthy controls (n=31), group-2: patients receiving carbamazepine (n=30), group-3: patients receiving levetiracetam (n=31), group-4: patients receiving valproic acid (n=32), group 5: newly diagnosed epileptic patients without treatment (n=31).

The relationship between the disease duration and p-RNFL thickness were also analyzed.

Effect of treatment duration and vascular density parameters were also evaluated. A fully automated microstructural analysis of retinal superficial capillary plexus (SCP), deep capillary plexus (DCP) and the choriocapillaris layer (CL) of vascular density (VD) and radial peripapillary capillary VD, foveal avascular zone (FAZ), choriocapillaris (CC) flow area, non flow area, total retinal thickness and p-RNFL thickness were analyzed by using OCT-Angiography and compared among the groups.

RESULTS

There was no significant difference between the groups in terms of age, sex and the duration of epilepsy. Significant difference was found between p-RNFL thickness and perifoveal total retinal thickness of the groups (p<0.05).

Table 1. Comparision of peripapillary retinal thickness, cup/disk ratio and total retinal thickness between groups

Parameters (µm)	Group-1 (n=31)	Group-2 (n=30)	Group-3 (n=31)	Group-4 (n=32)	Group-5 (n=31)	p
Peripapillary RNFL thickness						
Superior quadrant	145±31	**128±21.3**	134.6±15.3	**127.3±16.6**	134.8±14.7	**0.018***
Nasal quadrant	115.7±26.8	**98.9±15.4**	105.8±14.4	**94.3±13.9**	102.8±12.8	**<0.001***
Temporal quadrant	81.7±18.3	**70.1±10.1**	72.5±10.4	**70.7±10.3**	74.3±9	**0.009***
Inferior quadrant	166.7±45.4	**130.6±20.1**	146.1±18.4	**136.2±21**	144.5±18.5	**<0.001***
C/D, (%)	0.1±0.01	0.1±0.01	0.1±0.08	0.1±0.01	0.01±0.07	0.118*

RNFL: retina nerve fiber layer, c/d: cup/disk ratio, Group 1: healthy controls, Group-2: patients receiving carbamazepine, Group-3: patients receiving levetiracetam, Group-4: patients receiving valproic acid, Group-5: newly diagnosis epilepsy patients without treatment. *: Kruskal wallis test, **: One-way ANOVA test

The p-RNFL thickness for all quadrants (including superior, inferior, nasal, temporal) was lower in patients receiving carbamazepine and valproic acid than healthy subjects (Table 1).

Total perifoveal retinal thickness was statistically lower in patients receiving valproic acid than healthy subjects, however, there was no statistically significant difference between the AED groups. There was significant difference between groups in terms of choriocapillaris (CC) VD andCC flow area($p< 0.05$).

When we evaluated the CL of macula, the lowest CC VD and CC flow area values were found in newly diagnosed epilepsy group. However, there was no statistically significant difference between AED groups in terms of CC VD and CC flow area values (Table 2)

Table 2. Comparison results of superficial, deep and choroidal capillary plexus of vascular density values, flow and non flow area between groups.

VD (%)	Group-1 (n=31)	Group-2 (n=30)	Group-3 (n=31)	Group-4 (n=32)	Group-5 (n=31)	p
CC						
Whole	72.6±1.7	70.7±3.3	70.8±4.8	72.1±2.5	**58.4±11.1**	**<0.001****
Fovea	72.9±4.5	71.8±5.7	70.6±5.8	72.8±3.8	**47.4±22.2**	**<0.001****
Parafovea	71.1±2.9	69.4±4.7	69.9±3.8	71.3±3.8	**58.3±9.7**	**<0.001****
Perifovea	73.4±1.7	71.4±3.1	72.4±3	72.7±2.5	**58.6±11.7**	**<0.001****
FAZ area (mm^2)	0.25±0.1	0.22±0.1	0.23±0.1	0.24±0.1	0.28±0.1	0.131**
AI	1.1±0.06	1.1±0.03	1.1±0.03	1.1±0.05	1.1±0.03	0.281**
Flow area cc (mm^2)	2.2±0.1	2.2±0.14	2.2±0.11	2.2±0.12	**1.7±0.4**	**<0.001****

CC: Choriocapillaris, Group 1: healthy controls, Group-2: patients receiving carbamazepine, Group-3: patients receiving levetiracetam, Group-4: patients receiving valproic acid, Group-5: newly diagnosis epilepsy patients without treatment. *: One Way ANOVA test, **: Kruskal Wallis test

CONCLUSIONS

This study aimed to observe whether RNFL or vascular density is affected by antiepileptic drugs or epilepsy itself. Our findings suggest an association between VPA and CBZ monotherapy and decreased RNFL thickness independent of epilepsy itself which may be a result of different mechanisms of drug action.On the other hand, the lowest vascular density of CC flow was detected only in newly diagnosed epileptic patients.

Previous studies have shown that seizures cause prolonged hypoperfusion / hypoxia due to local changes in the postictal period, cerebral blood flow and glucose metabolism, and it has been stated that periods of ischemia/hypoxia may cause neurodegenerative changes.

As a result, we can postulate that different biological mechanisms might play role on retinal layer thickness and ocular vascular structure.

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