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Original article

THE EFFECT OF ALLERGIC CONJUCTIVITIS ON CHOROIDAL THICKNESS

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Abstract: **Background:** To examine the effects of allergic conjunctivitis and its treatment upon choroidal thickness (ChT) using topical antihistaminic agents.

Methods: 60 eyes of 30 children and adolescents with allergic conjunctivitis and 60 eyes of 30 healthy controls participated in the study. Inclusion criteria for patient groups were best-corrected visual acuity 20/20 or better, normal intraocular pressure (IOP) and no systemic or ocular diseases other than allergic conjunctivitis. Healthy controls recruited from children and adolescents who had no ocular or chronic systemic disorders and had best-corrected visual acuity 20/20 or better and normal IOP. ChT was measuredby using Enhanced Depth Imaging Optical Coherence Tomography (EDI-OCT) before and after treatment by antihistamine agents.

Results: Subfoveal choroidal thicknes mean value was 364.1 ± 63.8 μm in the allergic conjunctivitis group and the first-month values after the treatment were 333.5 ± 52.1 μm. Subfoveal choroidal thickness means value in the control group was 320.6 ± 80.9 μm. There was a statistically significant decrease in ChT after treatment of allergic conjunctivitis patients and there was a significant difference in terms of baseline ChT values between the allergic conjunctivitis group and the control group. There was no significant difference between one month after treatment values and the mean values of the control group.

Conclusions: Our results demonstrate that ChT can increase in allergic conjunctivitis patients and can become normal again with topical antihistamine treatment. In order to support choroidal thickness to be a marker for the diagnosis and follow-up of allergic conjunctivitis, further studies with larger samples and longitudinal studies are needed.

Key words: Allergic conjunctivitis, Antihistamine, Choroidal thickness, Topical eyedrops, Treatment.

INTRODUCTION

Allergic conjunctivitis is one of the most common ocular disorders in pediatric patients and defined as a Type 1 hypersensitivity reaction in which the igE mediated response is involved. There are different types of allergic conjunctivitis such as acute, subacute allergic conjunctivitis, vernal and atopic keratoconjunctivitis. Acute allergic conjunctivitis is a common acute conjunctival reaction in children, which usually develops in spring and summer due to environmental allergens such as pollen (1).

The choroid is a highly vascularized layer of the eye formed of a dense capillary network and nourishes the deep, outer two-thirds of the retina. In a limited number of studies evaluating choroidal thickness (ChT) in children, there are contradictory results reporting that choroidal thickness increases (2) and decreases (3) in healthy children with age. In another study, subfoveal choroidal thickness was thinner in patients with myopia like those in adults (4, 5).

Studies revealed that choroidal thickness was increased in ocular pathologies particularly in central serous chorioretinopathy (CSCR). CSCR is an ophthalmic disease which characterized by pigment epithelial detachment in the neurosensory retina due to increased vascular permeability and hydrostatic pressure and is associated with an increase in choroidal thickness (6-9). In addition, increases in choroidal thickness in many inflammatory diseases with vascular involvement such as Juvenile Systemic Lupus Erythematosus (10), Crohn's Disease (11), Behçet's Disease (12) and

Ankylosing Spondylitis (13) have been determined in previous studies.

Embryologically, eye and brain development are parallel to each other. The retina and the optic nerve are considered part of the central nervous system (CNS). Spectral Optical Coherence Tomography (SD-OCT) is a non-invasive imaging technique that enables in vivo visualization of the eye structures primarily used to monitor retinal changes in glaucoma (14). A method called ***enhanced depth imaging*** *spectral-domain optical coherence tomography* (EDI OCT) has been developed to make possible in vivo cross-sectional imaging of the choroid (15).

Since allergic conjunctivitis is a common inflammatory condition in children, we aimed to investigate the probable relationship between increased choroidal thickness and allergic conjunctivitis. We first aimed to examine whether ChT values showed differences between children and adolescents with allergic conjunctivitisand healthy controls. Our second aim was to investigate the effect of treatment by using topical antihistamine agents on ChT.

METHOD

Sample

The data obtained from the measurements of 60 eyes of 30 children and adolescents with allergic conjunctivitis (study group) and 60 eyes of 30 healthy controls (control group). Patients were admitted to the Ophthalmology outpatient clinic of Ahi Evran University Educational and Research Hospital in February-August 2017. Patients aged 9-17 years who have firstly diagnosed with acute allergic conjunctivitis and haven't received any treatment were included. Healthy controls who admitted to the Child Psychiatry outpatient clinic in the same hospital with minor psychological problems and had no ocular problems were recruited. Allergic conjunctivitis diagnosis was based on detailed history (episodic, seasonal, symptoms consist of itching, burning, watering) and ophthalmic examination by bio-microscope (papillary reaction in upper tarsal conjunctiva or stringy discharge). Patients with allergic conjunctivitis were given emedastine difumarate one drop two times daily after diagnosis and they were advised to stay away from an allergen. Subfoveal choroidal thickness measurements of the patients with allergic conjunctivitis were performed at the first examination and after 1-month than treatment.

Procedure

Children and adolescents with allergic conjunctivitis and healthy controls were evaluated by a specialist in the outpatient clinic of Ophthalmology. Detailed ophthalmologic examination including visual acuity, intraocular pressure measurement was applied to all cases. Patients with visual acuity ≤ 20/20 and any ocular or systemic disease diseases that might affect the choroidal thickness weren't included in the study. All patients who have allergic conjunctivitis underwent SD-OCT examination before and after one-month antihistamine treatment. Then the initial values were compared with one-month after treatment values. The initial and after one-month values were also compared with the control group values.

The research was carried out in accordance with Helsinki declaration rules and informed consent forms of patients were received.

Oct Measurement

Choroidal thickness was evaluated with Spectral-Domain Optical Coherence Tomography (SD-OCT) (software version 6.3.3.0, Heidelberg Engineering Inc., Heidelberg, Germany). This device produces high-resolution images from low infrared light levels. The device contained a superluminescent diode with a wavelength of 870 nm and could obtain 40.000 A-scans per second. The axial and transverse resolutions were 7 and 14 μm, respectively. All examinations were performed between 9:00 a.m. and 12:00 noon, to avoid the effect of diurnal variation on choroidal thickness (16). These measurements were performed at the fovea on EDI-OCT mode which enables in vivo visualization of the choroid (17). Choroidal thickness measurements were performed in both eyes and the mean of the two measurements was evaluated.

Statistical Analysis

All statistical analyses were performed using Statistical Package for Social Sciences-SPSS for IBM, 20.0. Kolmogorov-Smirnov test was used to assess the normal distribution of continuous variables. ChT values after one-monthof topical antihistamine treatment were compared to the baseline using the paired test; after seeing that all of the continuous variables were normally distributed. The initial and one-month values were compared with the control groupby using student tests.The gender distribution of groups was evaluated by using the Chi-Square test. Statistical significance was accepted as $p < 0.05$.

RESULTS

Thirty children and adolescents with allergic conjunctivitis (17 boys and 13 girls) and 30 healthy controls (16 boys and 14 girls) were included in the study.

Table 1. *Demographics*

		Study group	Control group	p
Gender n (%)	boy girl	17 13	16 14	0.74
Age mean (years)		12 ± 3.5	11,5 ± 4,1	0.48

Table 2. *Subfoveal choroidal thickness value*

	Allergic conjunctivitis - no treatment (Group 1)	Allergic conjunctivitis - Post treatment (Group 2)	Control group (Group3)	P value
Subfoveal Choroidal Thickness (ìm)	364.1 ± 63.8	333.5 ± 52.1	320.6 ± 80.9	*0.04 1 > 2 **0.039 1 > 3 ***0.189 2 = 3

* (Paired sample t test) between baseline and after one month treatment values.
** (Student t test) between baseline and control group
*** (Student t test) between control group an done month after treatment values.

The mean age of study and control groups were 12.4 ± 3.5 years and 11.5 ± 4.1 years, respectively. The groups were similar in terms of age and gender (p = 0.48, p = 0.74) (Table 1).

Sub-foveal choroidal thickness was 364.1±63.8 μm in the allergic conjunctivitis group; the first-month mean values after the treatment were 333.5 ± 52.1 μm. Sub-foveal choroidal thickness means value in the control group was 320.6 ± 80.9. There was a statistically significant decrease in mean ChT value after treatment of allergic conjunctivitis patients (paired sample t-test; p = 0.04) and there was a significant difference between baseline ChT values of allergic conjunctivitis group and control group (student t-test; p = 0.039). There was no significant difference between one-month values after treatment and mean values of the control group (student t-test; p = 0.189) (Table 2). When the choroidal thickness of children and adolescents with allergic conjunctivitis were compared according to gender, the choroidal thickness of boys was found to be higher than girls. However, this difference was not statistically significant (p = 0.357).

DISCUSSION AND CONCLUSION

In this study, we investigated whether there is any difference in terms of choroidal thickness in children and adolescents with acute allergic conjunctivitis. We also examined the effect of conservative and medical treatment on choroidal thickness in children with allergic conjunctivitis.The baseline ChT values of the study group were significantly higher than the control group. And there was a statistically significant decrease in ChT of children and adolescents with allergic conjunctivitis after treatment with topical antihistamine agents.

In a study conducted by Yenigun et al. evaluated whether there were any differences in choroidal thickness between allergic rhinitis patients and healthy controls. The mean sub-foveal choroidal thickness was 367.49 ± 92.73 μm in patients with allergic rhinitis and the mean sub-foveal choroidal thickness in patients without allergic rhinitis was 327.62 ± 72.39 μm. In parallel with our study, they found this difference was statistically significant (18). Previous studies indicated that choroidal alterations were determined in several ocular or systemic diseases associated with inflammation. In two adult patients with posterior sclerosis, choroidal thickness measured by OCT was found thickened in the active phase of the disorder and thinned after treatment. The authors suggested that recurrent inflammation of the sclera could induce atrophic changes. In two different studies from the Far East, sub-foveal choroidal thickness measured by EDI-OCT of patients with posterior uveitis due to Behçet's disease was increased in the acute phase of the disease and decreased after the relief of the acute phase. They showed sub-foveal choroidal thickness was correlated with retinal vascular leakage revealed by fluorescein angiography (12, 19). In a case report presents a patient diagnosed with sarcoidosis and having unilateral, multifocal choroidal granuloma, it was revealed that choroidal thickness decreased by steroid treatment (20). In another study examining choroidal changes in toxoplasma cases with retino-choroidal lesions, it was found that choroidal thickness was higher in the acute phase of the disease and was determined normally in the follow-up (21).

Another finding in our study was that boys had higher choroidal thickness than girls. However, this difference was not statistically significant. In a study from Denmark, the sub-foveal choroidal thickness of 1323 healthy children aged 11 to 12 years was measured by using EDI-OCT. It has been determined that the sub-foveal choroidal thickness was higher in fe-

males than in males but the difference wasn't significant (22).

In our study, the sample size was small, so studies with a larger sample are needed to confirm our findings and to fully clarify the mechanism of increased choroidal thickness with allergic conjunctivitis. To track allergic conjunctivitis activity and evaluate the effectiveness of the treatment, choroidal thickness measures can be utilized.

Abbreviations

ChT — choroidal thickness
CSCR — central serous chorioretinopathy
CNS — central nervous system
SD-OCT — Spectral Optical Coherence Tomography
EDI OCT — enhanced depth imaging spectral-domain optical coherence tomography

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Licensing

Sažetak

UTICAJ ALERGIJSKOG KONJUKTIVITISA NA DEBLJINU HOROIDEE

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Cilj: Ispitati efekte alergijskog konjunktivitisa i njegovog lečenja korišćenjem topikalnih antihistaminskih lekova na debljinu horoidee (ChT).

Metode: U istraživanju je učestvovalo 30 dece i adolescenata sa alergijskim konjunktivitisom kao i 30 zdravih kontrola. Kriterijumi za uključivanje pacijenata u istraživanje bili su najbolja korigovana vidna oštrina 20/20 ili bolje, normalan intraokularni pritisak (IOP), i odsustvo sistemskih ili drugih očnih bolesti osim alergijskog konjunktivitisa. Zdrave kontrole su podrazumevale decu i adolescente bez očnih ili hroničnih sistemskih bolesti i koji su imali najbolju korigovanu vidnu oštrinu 20/20 ili bolje i normalan IOP. ChT je merena pomocu EDI-OCT (Enhanced Depth Imaging Optical Coherence Tomography) pre i posle tretmana antihistaminicima.

Rezultati: Srednja vrednost subfovealne horoidalne debljine bila je 364.1 ± 63.8 μm u grupi sa alergijskim konjunktivitisom, a vrednost nakon prvog meseca tretmana bila je 333.5 ± 52.1 μm. Srednja vrednost subfovealne horoidalne debljine u kontrolnoj grupi bila je 320.6 ± 80.9 μm. Došlo je do značajnog smanjenja ChT nakon lečenja pacijenata sa alergijskim konjunktivitisom i postojala je statistički značajna razlika u odnosu na početne vrednosti ChT između grupe sa alergijskim konjunktivitisom i kontrolne grupe. Nije bilo značajne razlike između srednjih vrednosti ChT nakon jednomesečnog lečenja i srednjih vrednosti kontrolne grupe.

Zaključak: Naši rezultati pokazuju da ChT može porasti kod pacijenata sa alergijskim konjunktivitisom i ponovo može postati normalna usled lokalnog lečenja antihistaminicima. Kako bi se podržalo to da horoidalna debljina bude marker za dijagnozu i praćenje alergijskog konjunktivitisa, dodatna istraživanja sa većim uzorcima i longitudinalne studije su potrebne.

Ključne reči: alergijski konjunktivitis, antihistamin, horoidalna debljina, topikalne kapi za oči, lečenje.

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