The Choroid and Ocular Blood Flow in Primary Open Angle Glaucoma associated with Age Macular Degeneration

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ACTUALITY

• A choroid plays an important role in blood supply of the pigment epithelium, retina and optic nerve, specifically within the prelaminar area of the optic nerve head, hence a choroidal thickness (CT) is of great importance in Glaucoma and Age Macular Degeneration (AMD) pathogenesis as well (1-5).

• The link between primary open-angle glaucoma (POAG) and CT is unclear (3, 4). CT in POAG associated with AMG has not been studied yet.

PURPOSE

to compare subfoveal choroidal thickness and ocular blood flow parameters in patients with POAG and combined pathology (POAG+AMD)

MATERIALS

- 36 patients with POAG without AMD,
- 33 patients with the same stage of POAG+AMD,
- 30 healthy individuals (control group)

Table 1 summarizes the patient characteristics.

METHODS

- OCT (RTVue-100 OCT, Optovue, Inc., Fremont, CA). Subfoveal CT was measured as shown in **Fig. 1.**
- Standard automated perimetry (Humphrey Field Analyzer; Carl Zeiss Meditec, Inc, Dublin, California, USA; threshold 30-2).
- IOP (Goldmann applanation tonometer).
- Ocular blood flow (Color Doppler imaging: VOLUSON 730 Pro Ultrasound System (“Kretz”) with a 10-16 MHz linear probe.

Table 1. Patients characteristics

	POAG	POAG + AMD	Control
Patients	Female 25 (69,4%) Male 11 (30,6%)	Female 20 (61,8%) Male 13 (38,2%)	Female 18 (60%) Male 12 (40%)
Age	66±5,6	70±4,7	64.27±4.28
	P=0.48		
Pachymetry	540±31	539±30.0	538±25.0
	P=0.52		
Systolic Blood pressure	138,0±35,6	132,0±46,3	139±26,2
	P=0.68		
Diastolic Blood pressure	85,0±12,3	81,0±15,6	81,3±13,3
	P=0.43		
Intraocular pressure	19,79±5,3	17,83±4,58	19±3,4
	P=0,37		
Axial length	23,65±0,3	23,48±0,17	23,64±1,6
	P=0,28		
MD (dB)	-5,64±7,34*	-5,34±0,98*	-1,36±0,89
	P=0,607		
PSD (dB)	5,16±4,24*	4,84±0,55**	1,53±0,48
	P=0,247		

* Statistical significance between groups of patients with glaucoma and healthy subjects (p<0.01) , ** - p<0,001

Table 2. Subfoveal CT parameters

Groups	POAG without AMD	POAG with AMD	Control
CT (μm)	294,56±95,3*	234,55±96,81*	312,6 ± 27,1
p	0,003		

*The difference compared to the control (p<0,001)
CT - choroidal thickness

Table 3. RNFL and GCC in POAG and POAG with AMD

	POAG without AMD	POAG with AMD	P
RNFL	88.1±17.18	88.53±16.9	0,99
GCC	80.42±12.26	81.70±11.02	0,94
FLV	4.54±5.16	6.53±11.66	0,18
GLV	16.63±11.82	15.44±10.41	0,97

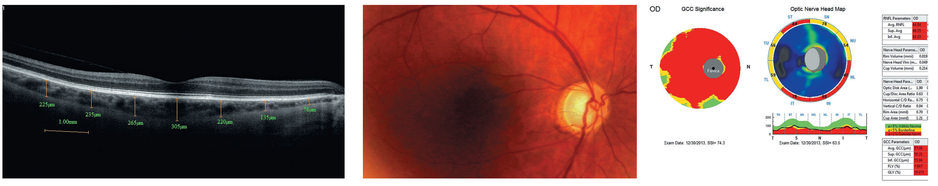

Fig. 1. Optical coherence tomogram (enhanced depth imaging mode) of the subfoveal choroid; GCC significance; Optic Nerve Head map and the picture of the fundus in glaucoma patient without AMD

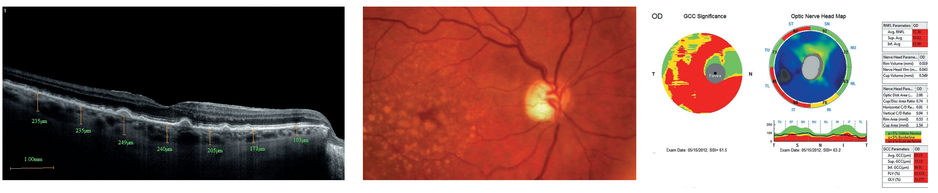

Fig. 2. Optical coherence tomogram (enhanced depth imaging mode) of the subfoveal choroid; GCC significance; Optic Nerve Head map and the picture of the fundus in glaucoma patient with AMD

STATISTICAL ANALYSIS

Analysis was performed with “SPSS11.0 for Windows” software.The statistical analysis included the calculation of means, standard deviation, standard error as well as Pearson’s correlation coefficient. Statistical significance was defined as p<0.05.

RESULTS

There was no any significant difference in analysis of RNFL and GCCavg between glaucoma groups (**Table 3**).

Statistically significant subfoveal CT reduction was revealed in POAG+AMD comparing to POAG patients and the healthy subjects.

Examples of enhanced depth imaging mode of the subfoveal choroid.GCC significance map, Optic Nerve Head map and the picture of the fundus in POAG and in POAG with AMD are shown in **Fig. 1** and **2.**

The blood flow in glaucoma patients was reduced in comparison with healthy subjects. Blood flow velocities in short posterior ciliary arteries were reduced statistically significant in POAG+AMD patients comparing to POAG group (**Table 4**).

Both of the study groups captured correlation between subfoveal CT and PSV in temporal short posterior ciliary artery (0.4, p=0.005).

CONCLUSION

The results demonstrate a role of the choroid and ocular blood flow in POAG and AMD.

POAG might be a negative condition for AMD development in the same eye.

Table 4. Blood Flow Parameters in POAG and POAG with AMD

Blood Flow Parameters	POAG	POAG with AMD	Healthy subjects
AO V syst	34,63±8,34*	33,6±8,30	40,66±7,60
AO V diast	9,6±3,26	8,7±5,37*	9,3±3,70
AO V mean	18369±5,3*	14,61±5,4	17,21±4,5
CRA V syst	12,47±5,07	13,4±4,47	14,13±1,8
CRA V diast	3,77±2,41	3,57±2,41	3,68±0,86
CRA RI	0,87±0,99*	0,74±0,14	0,74±0,04
sPCA lat. V syst	12,81±2,62	7,61±5,35*	14,33±1,82
sPCA lat. V diast	4,57±0,34	3,42±2,34*	5,17±1,15
sPCA lat. RI	0,64±0,11	0,66±0,14*	0,63±0,07
sPCA med. Vsyst	11,91±2,5*	10,27±2,64	13,83±2,23
sPCA med. V diast.	4,3±1,44*	3,64±1,89	5,05±1,56
sPCA med. RI	0,65±0,14*	0,62±0,13*	0,60±0,07

OA — ophthalmic artery, CRA — central retinal artery, SPCA — lateral and medial short posterior ciliary arteries, Vsyst — peak systolic blood flow velocity, Vdiast — diastolic blood flow velocity, Vmean — mean blood flow velocity, RI — resistiv index. Blood flow velocities showing a statistically significant difference in POAG and POAG+AMD are given in red bold.
* indicates, that the difference between the studied group and the healthy control subject group is statistically significant (p<0.05).

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