COMBINED USE OF ADAPTIVE OPTICS AND CALIBROMETRY IN RETINAL VEIN OCCLUSION PROGNOSIS IN VENOUS OCCLUSION OF FELLOW EYE IN PATIENTS WITH REFRACTION ANOMALIES

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The aim of the investigation is to study the diagnostic value of combined use of an adaptive multispectral fundus-camera and calibrometry for retinal vein occlusion prediction in patients with venous retinal occlusion and refraction anomalies on the fellow eye.

Materials and Methods. 30 patients with retinal vein occlusion on the fellow eye were examined using combination of an adaptive optics and calibrometry.

Results. The use of adaptive multispectral fundus-camera and calibrometry calculating arteriolovenular coefficient is an informative technique for retinal vein occlusion prediction in patients with venous retinal occlusion on the fellow eye. If the coefficient calculated is lower 0.73, venous embolism is likely to develop.

Key words: calibrometry, adaptive optics, angioretinopathy.

Retinal vein occlusion is a widespread retinal vascular pathology, making up 70% of all retinal vessels disorders and only being inferior to diabetic angioretinopathy in severity of ocular posterior segment damage and complications development [1–3]. Its prevalence is 2.14 per 1000 people at the age over 40, going up with time and mounting to 5.36 per 1000 people over 64 [4]. Lately, increase in the retinal venous thrombosis frequency has been indicated among young patients [5, 6]. Occlusion of the central retinal vein and its branches is dangerous not only by rapid decrease in visual functions, but because of developing such serious complications as recurrent hemorrhages, cystoid macular dystrophy, secondary neovascular glaucomathat aggravate previous low visual acuity leading to irreversible disability in 15% of cases [7–9]. According to the data presented in the report of V.E. Tankovskiy, 18.5% out of 76% of patients with retinal venous thrombosis suffered from retinal vascular disease on the fellow eye during 7 years. Damage to the fellow eye occurred in 16% of patients during 2 years, in 64% of cases — between 2 and 5 years, in 20% of cases — in 5 years and more [10].

Investigation of the retinal vessels functional state is of great importance for early and differential diagnosis of retinal vascular pathology as well as for revealing concrete pathogenic links. Disadvantage of modern methods of retinal vascular pathology investigation such asbiomicroophthalmoscopy, fundus photoregistration with the aid of a serial fundus-camera, fluorescent angiography (FA) is inabilityto get an image with high dimensional resolution that is explained by the eye optical system aberrations.

One of the objective methods for retinal vessels function studyis ophthalmocalibrometry. An adaptive multispectral

fundus-camera (AMFC), created in Lomonosov Moscow State University is a device that allows us to registerand correct eye aberrations and to get fundus pictures with high spatial resolving capacity.

Combined use of AMFC and calibrometry is of great interest for retinal angiopathy revealing and retinal venous occlusion prediction, especially in the cases of venous embolism on the fellow eye. Therearenoscientific worksdevoted to predicting the fellow eye thrombosis development in accessible literary sources.

The aim of the investigationis to study the diagnostic value of combined use of an adaptive multispectral fundus-camera and calibrometry for retinal vein occlusion predicting in the patients with retinal venous thrombosis and refractive errors on the fellow eye.

Materials and Methods. 30 patients with retinal veins occlusion on the fellow eye at the age of 26–65 were examined. There were 16 female and 14 male patients examined. The observation period lasted from 2 to 5 years.

All patients were divided into 2 groups depending on refractive type: 1st one included 14 cases (14 eyes) with emmetropia (Em) and the 2nd group consisted of 16 patients (16 eyes) with ametropias (myopia and hyperopia) and astigmatism (Am+Ast).

The investigation included visometry, autorefractometry, biomicroophthalmoscopy, fundus photoregistration with the help of AMFC and a serial fundus-camera Topcon (Japan) TRS-NW200, fluorescent angiography, calibrometry by means of the computer programme "Image Y" (USA). Diameter of the vessels was measured by A.A. Trjaskova method [11]. Central retinal artery and vein branches were investigated after their second bifurcation, because exactly those gradation vessels were more subject to pathologic changes [12]. Correlation between blood inflow and outflow in microvascular system was estimated on the basis of arteriolovenular coefficient (AVK) quantity, which was the area of arteriole cross section divided by the size ofvenule cross section [13]. Normally, this proportion equals 1:1.2, i.e. normal AVK quantity is 0.83 [11, 13]. It is known, that AVK less than 0.83 indicates the narrowing of arterioles and (or) dilatation of venules, so increased risk of vascular pathology developing [14]. Measurement of an arteriole and a venule diameter at the zone of their second bifurcation was performed from 5 to 10 times and arteriolovenular coefficient was calculated. When AVK was <0.73, venous thrombosis on the fellow (healthy) eye was likely to develop.

Statistic data were done with the programme product "Microsoft Excel" and the applied programmes package "Statistica 6.0" [15].

Results and Discussion. Results of the retinal vessels calibrometry done by means of AMFC, Topcon TRC-NW7SF fundus-camera and fluorescent angiography in patients with venous embolism on the fellow eye and emmetropic refraction (see Table) showed that AVK, calculated with the help of AMFC, was lower than the analogous coefficient, received with the aid of a serial fundus-camera by 11 % (p<0.001). At the same time, AVK counted by means of FA was less than the same index received with the help of a fundus-camera by 11%. All differences in AVK quantities received with the aid of AMFC and FA were not statistically significant.

Arteriolovenular coefficient on the basis of calibrometry data, done with the help of AMFC, a serial fundus-camera and FA (M±m)

Groups of patients	Refraction	AVK quantities		
		AMFC (1)	Serial fundus-camera (2)	FA (3)
1st (n=14)	Em	0.67±0.01 p_{1-2}<0.001	0.75±0.01 p_{2-3}<0.001	0.68±0.01
2nd (n=16)	Am+Ast	0.68±0.01 p_{1-2}<0.01	0.77±0.02 p_{2-3}<0.01	0.7±0.001 p_{1-3}<0.01

N o t e : p_{1-2}, p_{1-3}, p_{2-3} — correlation indexes.

In patients with venous embolism and refractive errors on the fellow eye AVK calculated by using AMFC calibrometry was less than the analogous index, measured by means of both a serial fundus-camera by 12% (p<0.01) and fluorescent angiography by 4% (p<0.01). The coefficientcounted with the aid of FA was lower than the same index received with the help of a fundus-camera by 8% (p<0,01).

Obtained data demonstrated that AVK in both groups of patients was less than normal. It showed the presence of retinal angiopathy in all investigated patients. AVK calculated by means of AMFC was significantly lower than the analogous index received with the aid of a fundus-camera and fluorescent angiography in all examined patients especially with ametropia and astigmatism, demonstrating higher sensitivity of adaptive optics in visualization of initial angiopathy signs. The use of calibrometry and AMFC is likely to be a noninvasive and the most informative method of venous thrombosis prediction on the fellow eye.

Conclusion. Combined use of adaptive multispectral fundus-camera and calibrometry calculating arteriolovenular coefficient is an informative technique for retinal vein occlusion predicting in patients with venous occlusion on the fellow eye. If the coefficient calculated is lower than 0.73, venous embolism is likely to develop. Noninvasiveness and possibility of repeated investigations are the advantages of this method. It gives an opportunity to carryout timely preventive therapeutic measureswith permanent control for the healthy eye state in venous thrombosis on the fellow eye.

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