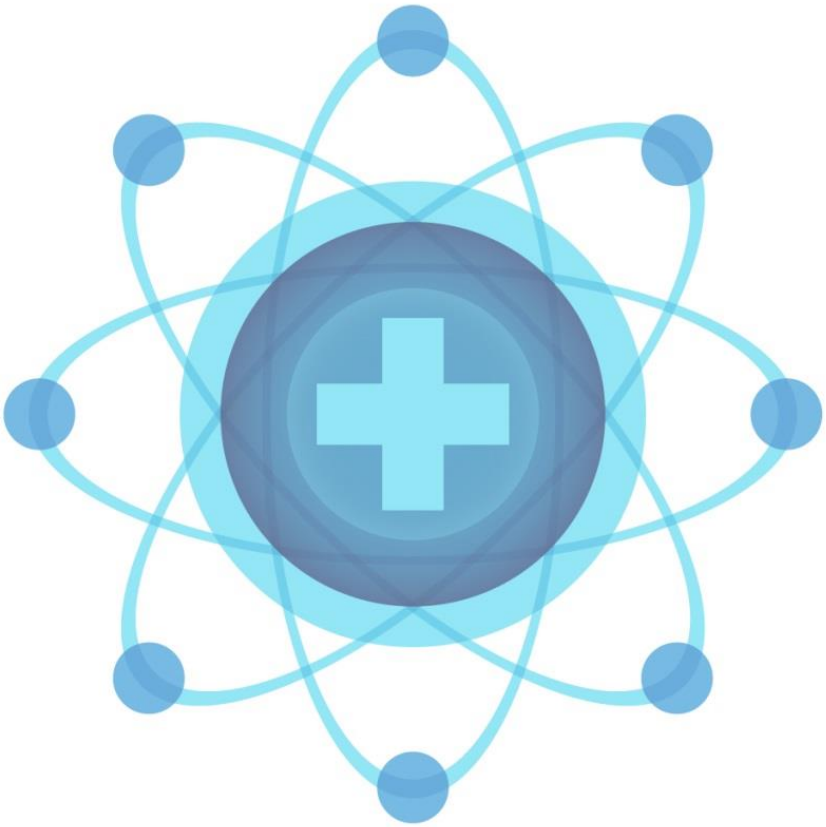

INTERNATIONAL MEDICAL SCIENTIFIC JOURNAL

ART OF MEDICINE

10.5281/zenodo.5517016

Art of Medicine International Medical Scientific journal

Founder and Publisher **Pascual Izquierdo-Egea**
Published science may 2021 year. Issued Quarterly.
Internet address: http://artofmedicineimsj.us
E-mail: info@artofmedicineimsj.us
11931 Barlow Pl Philadelphia, PA 19116, USA +1 (929) 266-0862

10.5281/zenodo.5517016

THE VALUE OF PERIMETRIC AND ELECTROPHYSIOLOGICAL DIAGNOSTIC CRITERIA IN EARLY PRIMARY OPEN-ANGLE GLAUCOMA

Yusupov Azamat Farkhadovich, M.D, Director of the State Institution "Republican Specialized Scientific and Practical Medical Center of Eye Microsurgery", Tashkent, 100173, Uzbekistan, eye-center@inbox.ru

Karimova Muyassar Khamitovna, M.D, Professor, Deputy Director for Scientific Work of the State Institution "Republican Specialized Scientific and Practical Medical Center for Eye Microsurgery mkarimova2004@mail.ru Tashkent, 100173, Uzbekistan

Zakirkhodjaeva Mastona Azizkhodzhayevna, Basic doctoral student, ophthalmologist, State Institution "Republican Specialized Scientific and Practical Medical Center of Eye Microsurgery", mastonaz@bk.ru Tashkent, 100173, Uzbekistan

Abdushukurova Asal Azamat kizi, clinical resident of the State Institution "Republican Specialized Scientific and Practical Medical Center of Eye Microsurgery", yusupovaasal0917@mail.ru Tashkent, 100173 ,Uzbekistan

Abstract

The purpose of the study to study and analyze electrophysiological indicators in the early diagnosis of primary open-angle glaucoma.

Material and research methods. Studies of electrophysiological characteristics were carried out in RSSPMCEM under photopic conditions on a Neuro-ERG device from Neurosoft company using chess receptive fields of 0.75 arc minutes in black and white and blue-yellow versions. Clinical static perimetry was performed in the RSSPMCEM on a TOMEY AP-3000 (Automated Perimeter) device with the ability to conduct threshold and color-opposing methods for studying the central field of view.

Results. When analyzing the main functional perimetric indices and the nature of the topography and depth of defects in the central field of view (MD, PSD, CPSD), a significant change in the light sensitivity thresholds of the blue-yellow perimetry relative to the standard research method was noted.

Conclusion. The complex use of ERG and static perimetry makes it possible to reveal the presence of changes in the visual system at the early preclinical stages of the development of glaucomatous optic neuropathy.

Keywords: oscillator potentials, glaucomatous optic neuropathy, blue cone ERG, retinal ganglion cells.

Introduction. At this time, the problem of early diagnosis of glaucoma, as well as the peculiarities of changes in certain types of ERG at the early stages of the development of glaucomatous optic neuropathy remain very relevant [1, 10, 11, 12, 13, 14]. It is well known that standard static threshold perimetry reveals functional defects in the visual field with the death of 30% of retinal ganglion cells. On the other hand, standard types of ERG are insensitive and nonspecific in the development of

10.5281/zenodo.5517016
glaucomatous primary lesions [2, 6, 7, 19]. In the early preclinical diagnosis of glaucomatous neuropathy, a special position is occupied by disorders in the blue-conical system of the visual analyzer [3, 8, 9, 20]. Blue cones are distinguished by the presence of large receptive fields, pronounced color opposition to yellow, and localization in the paramacular region 7–10 ° from the center of fixation. In this regard, we used a complex of electrophysiological recording methods, in particular, electroretinography (ERG) for a short-wave stimulus [4, 5, 15, 16, 17, 18].

Material and research methods

At the Republican Specialized Scientific and Practical Medical Center of Eye Microsurgery, 42 patients (84 eyes) were examined with a diagnosis of suspected glaucoma. The visual acuity of patients with ametropia correction was 0.9–1.0. Refractive errors did not exceed 3.0 diopters; concomitant disorders of the visual analyzer were not detected. At the time of diagnosis, none of the examined patients received local drug antihypertensive therapy. The average age of the patients was 50.5 ± 2.5 years. The comparison group consisted of 20 people without changes in visual functions of the corresponding sex and age. Electrophysiological and perimetric methods were used: blue-yellow threshold static perimetry, color-opposing blue-yellow electroretinography for examining the visual organ to assess the functional state of the visual system with standard methods for examining the organ of vision.

Clinical static perimetry was performed in the RSSPMCEM on a TOMEY AP-3000 (Automated Perimeter) device with the ability to conduct threshold and color-opposing methods for studying the central field of view. The stimulus parameters corresponded to Goldman 3 standards, the background brightness was 31.5 asB, the program for early glaucoma diagnosis was 30-2 threshold (SAP), 30-2 blue-yellow (SWAP). The stimuli are presented on a white or yellow background using appropriate light filters in the form of blue-yellow or white-and-white (standard) perimetry. The results of the conducted perimetric studies were analyzed using statistical package data: MD, MS, PSD.

Studies of electrophysiological characteristics were carried out in RSSPMCEM under photopic conditions on a Neuro-ERG device from Neurosoft company using chess receptive fields of 0.75 arc minutes in black and white and blue-yellow versions. The results of standard and color-opposing perimetry research methods, as well as electrophysiological indicators were processed using the applied package of research methods Statistica 6.0.

Research results

When analyzing the main functional perimetric indices and the nature of the topography and depth of defects in the central field of view (MD, PSD, CPSD), a significant change in the light sensitivity thresholds of the blue-yellow perimetry relative to the standard research method was noted. The data are shown in Table 1.
Table 1.

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Comparative analysis of perimetric parameters in patients with suspected glaucoma

Perimetric indices	Control group		Clinical group	
	SAP	SWAP	SAP	SWAP
MD, db	0,75 ± 0,25*	0,93 ± 0,5	–1,57 ± 0,45	* –1,75 ± 0,75
MS, db	21 ± 1,5	25 ± 2,75	18 ± 2,5	22 ± 3,5
PSD, db	2,37 ± 0,75	3,25 ± 1,5*	3,37 ± 1,5	5,75 ± 2,5*

These indicators in patients with suspected glaucoma were two times higher than those in the control group, which indicates a higher sensitivity of the SWAP technique in the early diagnosis of glaucoma. The topography of visual field defects during SWAP perimetry did not differ from that with standard, however, the depth of defects was significantly higher with SWAP perimetry.

When conducting electrophysiological studies, the criteria were selected that are most similar in damage to the S-cone system of the retina: PERG, oscillatory potentials, blue-cone electroretinography (S-CON ERG). The data are shown in Table 2.

Table 2.

Comparative analysis of electrophysiological parameters in patients with suspected glaucoma.

Pattern-ERG complex N95	Black and white chess stimulus	Blue and yellow chess stimulus	Black and white chess stimulus	Blue and yellow chess stimulus
Amplitude, μV	5 ± 0,75	5,28 ± 0,45*	4,75 ± 1,25	3,78 ± 1,75
Latency, ms	95 ± 2,5*	97 ± 2,5*	112 ± 3,0*	117 ± 3,8*
Oscillatory Potential Index	9,75 ± 1,75	10,73 ± 1,85*	14,4 ± 1,85	17,2 ± 2,5*
D-wave amplitude, mV blue-conical ERG	-	34 ± 0,75*	-	28 ± 1,25*

In the study of the color channels of the retina in patients with suspected glaucoma in the blue-yellow variant to a stimulus of 0.75 arc minutes according to PERG data, a change in the culmination time of the N95 complex to 117 ± 3.8 ms, as well as a change in the amplitude to 5 ± 2.3 mB. In patients of the "suspected glaucoma" group, the PERG data for a black-and-white checkerboard pattern of 0.75 also differed from normal values and amounted to 112 ± 3.0 ms and 6.5 ± 2 mA in terms of culmination time and amplitude, respectively. In the control group, the value of the culmination time and amplitude of the N95 complex was 95 ± 2.5 ms and 5.5 ± 0.75 mA. The results obtained, presented in table 1, indicate a greater sensitivity of blue-yellow PERG relative to the standard technique of glaucomatous lesions of retinal ganglion cells in early diagnosis (POAG). When studying the index of oscillatory potentials for a white stimulus in patients of the "suspected glaucoma"

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group, it was 14.4 ± 1.85 mV, and for a blue stimulus - 17.2 ± 2.5 mV. In the control group, the OP index was 9.75 ± 1.75 mV for the white stimulus and 10.73 ± 1.85 mV for the blue stimulus, respectively.

The data reflect the presence of overexcitation processes at the level of the inner layers of the retina at the preclinical stages of development of glaucomatous optic neuropathy. The variant of the study of OP neither blue stimulus showed significantly more sensitive results with respect to oscillatory potentials to a white stimulus, which suggests the presence of its better informative value in the diagnosis of primary open-angle glaucoma.

During studies of the blue-cone ERG (S-CON ERG), the amplitude of the D-wave generation was 28 ± 1.25 mV in the group of patients with suspected glaucoma and was characterized by a decrease in the amplitude of the off-blue cone response. In the control group, the above S-CON ERG index was 34 ± 0.75 mV. An increase in the latency and a decrease in the amplitudes of the D wave in the S-CON ERG in patients with suspected glaucoma relative to the control group indicates the likelihood of damage to the off-short-wave channels at the level of retinal ganglion cells during the development of excitotoxic glaucoma reactions.

Conclusions

1. Indicators MD.MS.PSD in patients with suspected glaucoma were 2 times higher than those in healthy subjects during SWAP perimetry, which makes it possible to use it for early diagnosis of ischemic changes in the retina in glaucoma.

2. Oscillatory potentials (OP) to a blue stimulus are significantly more sensitive, relative to (OP) to a white stimulus, which is informative in the diagnosis of POAG.

3. The complex use of ERG and static perimetry makes it possible to reveal the presence of changes in the visual system at the early preclinical stages of the development of glaucomatous optic neuropathy.

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