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The Role of Clinical Examination Early Diagnosis of Glaucoma

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Abstract---*In the structure of the incidence of eye diseases leading to blindness, glaucoma occupies one of the leading places. According to the most recent World Health Organization estimates, about 314 million people worldwide have visual impairments, 45 million of whom are blind (90% of whom live in countries with low living standards). The actual extent of blindness and visual impairment is likely to exceed these indicators since detailed epidemiological information on some of its causes is still missing. That is why the issue of early diagnosis and timely treatment of this disease is relevant and despite numerous research studies, early diagnosis, the level of development, prevalence, and disability resulting from glaucoma remains significant. The problem is that in the early stages the disease is often asymptomatic and for this reason, ophthalmologists are more likely to experience glaucoma complications. Blindness as a phenomenon not only medical but also having deep social and economic significance, attracts attention not only at the medical but also at the state and even interstate level. To combat blindness from glaucoma, groups of specialists develop recommendations for diagnostic and therapeutic measures, conduct educational courses, and conferences to improve the skills of medical personnel. Unfortunately, despite the efforts made, the percentage of blindness in individual countries is still high, this is primarily due to the level of their socio-economic development, which prevents the implementation of preventive measures to combat blindness in an appropriate amount.*
Keywords---*economic factors, epidemiological features, ethnic factors, geographic factors, irreversible blindness, primary glaucoma*

Introduction

In March 2006, a meeting of the members of the World Glaucoma Association was held on the feasibility of widespread introduction of glaucoma screening, directions for studying the economic efficiency of such measures, etc. It was emphasized that the issue of screening is very controversial when it comes to glaucoma. Several questions arise that require answers:

1) Which part of the population should be screened?
2) Who should screen?
3) Where should it be done?
4) What diagnostic techniques should be used?
5) What are the criteria for the diagnosis of glaucoma?
6) What is the cost-effectiveness of screening?

Early detection through regular and complete eye examinations is key to protecting vision from damage caused by glaucoma. A complete eye exam includes five common tests to detect glaucoma. It is important to regularly check the eyes and for this purpose, the European Association of Glaucomatology suggests examining everyone for signs of glaucoma.

- up to 40 years old every two to four years
- from 40 to 54 years old, every three years

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- from 55 to 64 years old, every one to two years
- after 65 years, every 6-12 months

Anyone with a high-risk factor should be screened every year or two after age 35. The question of the frequency of examination is controversial. Since the disease can progress quickly and irrevocably lead to organic changes, therefore, in Uzbekistan, patients with suspected glaucoma are examined 2 times a year (McMonnies, 2017; Cook & Foster, 2012). The comprehensive examination for glaucoma. To be accurate and safe, five factors need to be checked before making a diagnosis of glaucoma:

Optic disc shape and color - ophthalmoscopy (extended eye examination)

Full Field of View - Perimetry (Field of View Test)
Intraocular pressure - Tonometry
Anterior Chamber Angle - Gonioscopy
Corneal Thickness - Pachymetry
Regular glaucoma checks include two routine eye examinations: tonometry ophthalmoscopy.
Determination of the state of the optic nerve from the point of view of glaucoma screening is the leading one at the present stage. The simplest method for detecting changes is ophthalmoscopy (forward and backward). However, the sensitivity and specificity of the method largely depend on the experience and skills of the researcher. More informative and evidence-based is the study of the optic nerve using confocal laser ophthalmoscopy (HRT), optical coherence tomography (OCT), laser polarimetry (GDxVCC), which have high specificity and sensitivity. Their use during screening is more appropriate. However, these devices are cumbersome, expensive, and require highly qualified staff. In addition, the high variability of "normal" optic discs often leads to false-positive results (Wong et al., 2019; Vajaranant et al., 2012).

Determination of the functional state of the optic nerve. Standard automatic perimetry (SAP) is another gold standard for early glaucoma diagnosis, although it has been proven that SAP changes occur when at least 40% of nerve fibers are affected. From the point of view of screening, specialists may be interested in such modern technologies as FDT (Frequency Doubling Technology): this technique allows a study of up to 3 minutes duration, does not need a large place to install equipment and certain lighting conditions and is cheaper in comparison with other modern technologies. Moreover, the results of the study are highly correlated with the results of standard Humphrey perimetry and allow detecting glaucoma much earlier (Rosado et al., 2018; García et al., 2018).

Practitioners often do not have information about the comparability of the technical capabilities of different computer perimeters, the features of assessing the level of retinal photosensitivity, a comparative assessment of the “threshold” and “suprathreshold” levels of the retinal photosensitivity, assessment of the variability and reliability of research results. Therefore, in the absence of expert-class visual field analyzers, one should first of all study well the instructions and technical capabilities of the computer perimeter in operation. To clarify the diagnosis of "suspicion of glaucoma" or the stage of already confirmed glaucoma, as well as to monitor the glaucomatous process, international experts recommend, if possible, to use various methods of computer perimetry, otherwise, to repeat the available perimetric test several times to reduce variability and increase the reliability of perimetric data, necessarily comparing the results of the study of the CPZ with the state of the optic nerve disc (Serdyukova & Simakova, 2018).

It is generally accepted that the earlier from the moment of the onset of the disease, treatment is started, the more chances are to stabilize the pathological process and preserve visual functions. To identify and confirm the diagnosis of glaucoma, it is necessary to conduct several studies to assess the general condition of the visual analyzer, which often reveals only the advanced stages of the disease. It is known that changes in the layer of nerve fibers can sometimes occur several years before changes in the visual field, which are still often the first clinical signs of the disease (Lima et al., 2010; Stamper, 2011). Therefore, the most important issue in the early diagnosis of preclinical manifestations of glaucoma. One of the solutions to this problem lies in the improvement of methods for assessing functional disorders of the layer of nerve fibers resulting from the effects of the glaucomatous process and preceding organic changes.

Purpose and Objectives of the Study

Screening of morbidity in the early stages; Determination of the main effective and available research methods for the early diagnosis of glaucoma. Comparative analysis of methods for early diagnosis of primary glaucoma. Selection of the optimal methods of glaucoma examinations for our region (Tham et al., 2014; Koh et al., 2021).

Research Methods and Discussion

To investigate the degree of functional disorders of the peripapillary zone of the retina in patients with suspected glaucoma and with an already established diagnosis of glaucoma according to the assessment of the layer of nerve fibers on the spectral optical coherence tomograph RTVue-100 and the MP-1 microperimetry, compare the results with morphological changes and evaluate the possibility of using the obtained results in clinical practice for the early diagnosis of glaucoma (Serdyukova & Simakova, 2018; Aznabaev et al., 2017). Microperimetry is a combined use of computerized perimetry and retinal examinations, which are performed using a fundus camera. Microperimetry correlates visible defects in the fundus (anatomy) and defects in the visual field (function). This study maps the light sensitivity of the retina, expressed in decibels (dB).

Thus, microperimetry makes it possible to assess the light sensitivity threshold of the retina at any of its specific points and transfer this data to the fundus image. Investigating the photosensitivity of the retina in the peri-papillary zone, one can judge the functional changes of the visual analyzer that developed as a result of exposure to glaucomatous lesions. Optical coherence tomography is an ophthalmic examination method that allows obtaining intravital images of optically transparent eye tissues with high spatial resolution. The physical principle of OCT operation is similar to the ultrasound principle, but with the difference that optical radiation of the near-infrared range (843 nm) is used in coherence tomography (Shpak et al., 2012; Kliuchnikova et al., 2016).

Analysis of the thickness of the layer of nerve fibers with optical coherence tomography allows identifying early glaucoma damage to the optic nerve. The measurement of the thickness of the layer of nerve fibers is carried out according to the results of scanning the peripapillary zone concentric to the circumference of the optic nerve head, the measurement results are presented in the form of a TSNIT sweep graph, as well as in quantitative values and statically compared with the normative database differentiated by age and race.

Examination of eyes with a previously established diagnosis of stage II-III glaucoma (21 eyes, according to the current classification) revealed an average decrease in the photosensitivity of the retina in the peripapillary region to 6 dB (with a norm of 13-14 dB). At the same time, the functional changes in the layer of nerve fibers according to the results of microperimetry were ahead of the changes detected during optical coherence tomography in 76% of cases, in 14% the changes were parallel, in 9% the changes during tomography were more pronounced. In the case of a diagnosis of suspicion of glaucoma (11 eyes), an average decrease in the photosensitivity of the peripapillary region to 9.8 dB was revealed. At the same time, in 82% of cases, changes in the layer of nerve fibers detected by microperimetry were ahead of the normal values obtained by tomography (Flanagan, 1998; Kang et al., 2012). This made it possible to confirm the diagnosis of glaucoma in 5 patients. In 18%, neither microperimetry nor tomography revealed pathological changes.

Thus, in the course of the study, it was found that microperimetry with sufficient accuracy allows tracing the earliest functional changes in the layer of nerve fibers in glaucoma. Microperimetry successfully complements optical coherence tomography, since it provides a more accurate and early assessment of the degree of pathological changes (Lima et al., 2010; Aznabaev et al., 2017). Comparative analysis of microperimetry with standard perimetry revealed that the mean age and mean deviation was 60.8 (13.4) years and -7.3 (6.1) dB, respectively. There was a significant correlation between results and standard achromatic perimetry (SAP) in all quadrants (r (2)> or = 0.68, p <0.001). All abnormal quadrants of the standard perimetry had a corresponding abnormal microperimetry (MP) quadrant. However, 21% of the normal quadrants had abnormal microperimetry results; a corresponding significant reduction in total macular thickness, as measured by OCT, was observed in 75% of these quadrants.

Macular sensitivity, assessed by microperimetry, correlates significantly with paracentral SAP defects and MP has found decreased retinal sensitivity in areas of structural damage OCT with normal SAP and suggests that subtle paracentral functional deficits may be present in many more eyes with established glaucoma than is customary to think (Lima et al., 2010). Currently, there are many tonometers and methods for measuring intraocular pressure (IOP) that are different in their effect on the eye. In Russia, the most common applanation tonometers of Maklakov and Goldman, non-contact tonometers. To obtain more accurate and objective results, devices are used that work on new principles: PASCAL, ORA, ICare tonometers. But, despite the latest advances, there are situations when the complexity of the technique, the size of the tonometer (stationary devices), price issues, the need for self-monitoring of IOP at home, etc., play an important role. In such situations, a transpalpebral tonometer and an IOP indicator come to the rescue. The new device was compared in effect with Maklakov's tonometer. IOP was measured with an IGD-03 indicator and a Maklakov tonometer in turn in 60 people (118 eyes), individuals with normal IOP, and glaucoma patients with uncompensated ophthalmotonus (Hirooka et al., 2012; Trofimov et al., 2017).

Results

In the course of the study, tonometry data were divided into 2 groups; the first included eyes with normal IOP, and the second with moderately increased and high IOP. The analysis of the material was carried out both for each group separately and for the entire data set. The results obtained indicate a high correlation dependence of the indicators of the IOP indicator IGD-03 and the Maklakov tonometer. The new device has become more convenient in operation due to its automatic transfer to the working position and one-time setting on the eyelid. Portable indicator IGD-03 is easy to operate, measures IOP through the eyelids, no anesthesia is required when using it. Conclusion: the new indicator IGD-03 can be used by ophthalmologists, general practitioners, paramedics, optometrists, as well as specially trained relatives of glaucoma patients to measure IOP at home. The use of transpalpebral tonometry is promising in wartime and emergencies (Iwase et al., 2021; Varma et al., 2011).

There is a method of two-beam non-contact pneumooptical measurement of IOP. Unlike other non-contact methods for measuring IOP, when using the presented two-beam method, there is no need to create a strong pneumatic effect, leading to flattening of the cornea. Small periodic pressure changes near the cornea are sufficient to cause corresponding fluctuations in the light reflected from the cornea. This circumstance seems to be especially important for reducing the trauma of measurements (Trofimov et al., 2017). The practical implementation of the proposed non-contact method for measuring intraocular pressure is the subject of a separate publication (Stamper, 2011).

Morphology of the anterior chamber angle. From the point of view of screening for angle-closure glaucoma, gonioscopy is the gold standard. Although modern technologies such as ultrasound biomicroscopy and optocoherence tomography of the anterior part of the eye have high specificity and diagnostic sensitivity, they are very expensive, which makes their use in screening impossible. ... At the same time, they are increasingly used for the diagnosis and monitoring of patients with angle-closure glaucoma.

Conclusion

The retina is a thin tissue at the back of the eye that contains various types of nerve cells. These include retinal ganglion cells (RGCs) - and they are especially important in glaucoma because they are cells that are damaged primarily by disease. It was found that in glaucoma patients with normal IOP, pachymetry data are lower, and in patients with some form of eye hypertension, higher CRG values. The study of the MDG in healthy patients showed that its values vary widely. According to L.I.Balashevich et al., The minimum thickness of the normal cornea were 441 microns (1 eye), the maximum thickness was 644 microns (1 eye). The average value of the CTR is 534 microns, while its values range from 510 to 578 microns. Patients with an established POAG diagnosis had the mean pachymetry value or data with significant scatter. In a study of a group of patients with ocular hypertension, the presence of a thin cornea convincingly predicted the onset of POAG development when conducting a correlation analysis with defects in the visual field, changes in the optic nerve head. However, such an analysis did not give a positive correlation in patients with an already established diagnosis of glaucoma (Ventura et al., 2001). According to the Ocular Hypertension Treatment Study (OHTS), a thin cornea is considered a risk factor for developing glaucoma. However, the opinions of researchers on this issue are contradictory and mutually exclusive, which requires further research.

The issue of studying modern methods of early diagnosis of glaucoma is one of the most important in the field of ophthalmology since the incidence and complications of this pathology are often encountered with everyone. If there is a possibility of research innovation, it is necessary to study in a comparative order all the optimal methods and select the optimal survey scheme for the population, taking into account all risk factors, for the early diagnosis of glaucoma. It is necessary to carry out ophthalmoscopy, computer perimetry, tonometry, gonioscopy, and optical coherence tomography promptly during preventive examinations of the population for the early diagnosis of glaucoma.

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