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# MODERN METHODS OF DIAGNOSTICS OF GLAUCOMA OPTIC NEUROPATHY IN CONGENITAL GLAUCOMA IN CHILDREN

**Arzibekov Abdikadir Gulyamovich**
candidate of medical sciences, docent
Head of the "Pediatrics" department for the
medical faculty of ASMI

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**Abstract:**

The article presents the results of application of modern highly informative methods of studying the structures of the posterior segment of the eye in various forms and stages of congenital glaucoma in children: the method of confocal laser scanning ophthalmoscopy (HRT), the technique of spectral optical coherence tomography (S-OCT). The obtained morphometric data and a number of pathognomonic symptoms of damage to the optic nerve, retina, choroid, main branches of the central artery (CRA) and central retinal vein (CRV) in congenital glaucoma are necessary for studying the pathogenesis of congenital glaucoma, clarifying the diagnosis, determining the prognosis of the disease, assessing the stabilization of the glaucomatous process and developing treatment tactics.

**Keywords:** congenital glaucoma, glaucomatous optic neuropathy, confocal laser scanning ophthalmoscopy method.

## INTRODUCTION

Due to the high proportion of disability in children suffering from congenital glaucoma, studying the pathogenesis of this severe congenital disease and the mechanisms of visual impairment is an important task in pediatric ophthalmology. Currently, there is no consensus on the causes and mechanism of development of congenital glaucoma. Glaucoma optic neuropathy (GON) in this disease is determined by the combined compressive effect of increased IOP on the membranes, optic nerve and other structures of the eye, causing their stretching, deformation and dystrophy. As congenital glaucoma develops and progresses, changes in the optic nerve and retina increase, morphological abnormalities occur in all structures, the negative dynamics of which serves as a criterion for the progression of the glaucomatous process [1-3]. The main reason for the decrease in visual acuity in children with congenital glaucoma, along with changes in the structure of the cornea and disruption of the anatomical proportions of the eye, is the development of GON. At the same time, according to the literature of recent years, little attention is paid to the study of the mechanisms of development of glaucomatous changes in the optic nerve and retina in congenital glaucoma. The relevance of a detailed characterization of changes in the optic nerve and retina is determined by the need for further study of the pathogenesis of congenital glaucoma, the choice of reliable criteria for early diagnosis and assessment of stabilization.

## MATERIALS AND METHODS

In recent years, methods have emerged that allow obtaining information on the state of the internal structures of the eye, in particular, clear morphometric parameters of the retina and optic nerve (the confocal laser scanning ophthalmoscopy method - HRT). The accuracy and information content of the above-mentioned method in the diagnosis of primary open-angle glaucoma (POAG) have been proven [4]. The advent of the optical coherence tomography (OCT) method in clinical practice made it possible to obtain a layered image of the structures of the posterior pole of the eye in the form of a slice with previously inaccessible high resolution. A low-coherence beam is used for the study, allowing for a two-dimensional image (B- and C-scan) and a three-dimensional image (3D reconstruction). Spectral OCT (S-OCT) has a number of undeniable advantages, in particular high resolution (3 μm), high repeatability and low variability of the results obtained, which gives highly reliable results when measuring the thickness of the retinal nerve fiber layer (RNFL) [5].

## RESULTS AND DISCUSSION

The study using the HRT-3 method allowed us to obtain a set of objective data and a number of pathognomonic symptoms of optic nerve damage in congenital glaucoma in children.

At all stages, a pronounced deviation from the norm of the parameters characterizing the state of the excavation was revealed, in the form of deep and volumetric excavation at the onset of the manifestation

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of the glaucomatous process, a decrease in the area and volumetric values of the neuroretinal zonule (see table).

In all children with congenital glaucoma, an increase in the volumetric values of the optic disc excavation was noted, even with normal sizes of the optic disc itself: cup volume - 0.25-0.62 mm3, maximum cup depth - 0.11-1.13 mm, as well as the excavation area (cup area) - 0.76-1.37 mm2 (see table). In eyes with an optic disc size (disc area) exceeding the norm, emphasis was placed on the analysis of the parameters of the ratio of the excavation area to the optic disc (cup/disc area) and the area of the neuroretinal rim to the optic disc (rim/disc area). In children with a sagittal increase in eye size, the age norm by 4–8 mm, large optic discs (disc area parameter) and deviations from the norm of the cup/disc area and rim/disc area parameters were detected.

A particularly significant indicator of atrophy of the structures of the visual conduction system was the parameter reflecting the average RNFL thickness in the peripapillary zone on the temporal side (mean RNLF thickness temporal), which was significantly reduced to 0.01–0.07 mm. When analyzing the HRT indicators, it was noted that at the developed stage of glaucoma, the above-described changes were less common than in children with an advanced stage. A comparative analysis of morphometric parameters by stage revealed an inverse correlation between the stretching of the eye membranes and the parameters of the excavation. In patients with a large stretching of the eye membranes, deviations from normal values of the parameters of the optic disc excavation depth were less pronounced than the parameters of the excavation area and volume. This is explained by the special nature of structural changes and deformation of the child's eye, as a result of which the stretching of the membranes to a certain extent neutralizes the pathological effect on the nerve fibers in the optic nerve disc area. In some cases, denser and more elastic membranes prevent their significant stretching under the influence of increased IOP, which leads to the course of the disease according to the "adult" type and a deeper and larger excavation of the optic nerve disc.

S-OCT revealed certain features of changes in the topography of the structure of the juxtapapillary retina, choroid, main branches of the CRA and CRV in children with congenital glaucoma.

In all the examined eyes with glaucoma (9 children, 12 eyes), a decrease in the thickness of the nerve fibers of the juxtapapillary retinal zone by 6-36% of the norm was noted in different quadrants of the study area.

A relationship was found between the number of interested zones of change in retinal thickness and the stage of the glaucomatous process. At the initial stage, changes were more often noted in only one of the quadrants. In eyes with a developed stage, in 50% of cases, a decrease in the thickness of the RNFL affected 1 quadrant, in 50% of cases - 2 quadrants. A larger area of change in the thickness of the RNFL was detected in eyes with an advanced stage: in 75% of eyes, 3 quadrants were affected, in 25% of eyes, 2 quadrants of the retina.

## CONCLUSION

Thus, the peculiarity of glaucomatous optic neuropathy in congenital glaucoma is the combined pathological effect of hypertension and secondary eye stretching on the visual conduction system and the vascular bed of the eye membranes. We have identified a variety of pathological changes in the state of the visual conduction system in each studied group of children with congenital glaucoma formed according to the stage principle. This study has established that the existing classification does not fully reflect the functional content of the disease stages. We believe that a detailed assessment of the RNFL thickness in congenital glaucoma can serve as a new additional information and diagnostic criterion in determining the stage of the glaucomatous process in congenital glaucoma. The use of HRT and S-OCT methods for the first time allowed us to obtain a set of objective morphometric data confirming the presence of significant structural and hemodynamic disorders of the posterior segment of the eye in congenital glaucoma. In different stages of congenital glaucoma, we discovered the following.

- The most significant indicator is the parameter reflecting a decrease in the RNFL thickness in the temporal zone of the peripapillary retina (mean RNLF thickness temporal), revealed in all stages of the glaucomatous process.
- There is a relationship between the number of zones with changes in the peripapillary retinal thickness (RNFL) and the progression of the glaucomatous process.
- There were violations of the hemodynamics of the vascular branches of the CRA and CRV in the form of a decrease in their caliber.

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