DIAGNOSTIC PERFORMANCE OF GCIPL AND CIRCUMPAPILLARY RETINAL NERVE FIBER LAYER PARAMETERS IN EARLY GLAUCOMA WITH CONSIDERATION OF VISUAL FIELD DEFECT TOPOGRAPHY

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ABSTRACT

Glaucoma remains one of the leading causes of irreversible blindness worldwide, and early diagnosis plays a crucial role in preventing the progression of visual impairment. Modern imaging techniques, particularly optical coherence tomography (OCT), allow detection of structural retinal changes even before the development of significant functional defects [1,2]..

Introduction. Glaucoma remains one of the leading causes of irreversible blindness worldwide, and early diagnosis plays a crucial role in preventing the progression of visual impairment. Modern imaging techniques, particularly optical coherence tomography (OCT), allow detection of structural retinal changes even before the development of significant functional defects [1,2].

In recent years, special attention has been given to the assessment of macular ganglion cell complex thickness, including the ganglion cell and inner plexiform layers (GCIPL), as well as the circumpapillary retinal nerve fiber layer (cpRNFL), as key biomarkers of glaucomatous damage [3,4]. It has been established that ganglion cell damage may occur in the early stages of the disease and may precede pronounced thinning of the nerve fiber layer [1,5].

However, the diagnostic value of these parameters may vary depending on the topography of visual field defects. Several studies suggest that macular parameters are more informative in central (parafoveal) defects, whereas cpRNFL analysis may be more advantageous in peripheral defects [2,6]. Despite accumulating evidence, the comparative effectiveness of GCIPL and cpRNFL with consideration of functional defect localization remains insufficiently studied and requires further clarification.

Therefore, a comparative analysis of the diagnostic performance of these parameters in different patterns of early glaucoma appears to be highly relevant.

Aim. To evaluate the comparative diagnostic significance of macular ganglion cell complex thickness (GCIPL) and circumpapillary retinal nerve fiber layer thickness (cpRNFL) in early glaucoma, taking into account the localization of visual field defects.

Materials and Methods. A retrospective observational study was conducted including 47 patients with early-stage glaucoma and 21 healthy volunteers. Depending on the topography of visual field defects, glaucoma patients were divided into two subgroups:

1. Patients with isolated parafoveal defects (PFD) located within the central 10°;

2. Patients with isolated peripheral nasal defects (PND) located outside the central 10° fixation area.

All participants underwent optical coherence tomography of the macular region and optic nerve head using a spectral-domain Cirrus HD-OCT device. The following parameters were analyzed: mean and minimum GCIPL thickness, as well as mean cpRNFL thickness.

Diagnostic performance was evaluated using receiver operating characteristic (ROC) analysis with calculation of the area under the curve (AUC).

Results. In patients with parafoveal involvement, a significant reduction in both mean and minimum GCIPL thickness was observed compared to patients with peripheral defects, while cpRNFL parameters did not differ significantly between the subgroups.

In the overall glaucoma group, no significant differences in diagnostic accuracy between GCIPL and cpRNFL were found: AUC values for mean GCIPL (≈0.96), minimum GCIPL (≈0.97), and cpRNFL (≈0.97) were comparable ($p>0.05$).

In the subgroup with parafoveal defects, GCIPL parameters demonstrated higher diagnostic performance (AUC up to 0.99) compared to cpRNFL (≈0.96).

Conversely, in patients with peripheral defects, cpRNFL showed superior diagnostic accuracy (AUC≈0.98), while GCIPL parameters were less accurate (AUC≈0.94–0.95), with some differences reaching statistical significance.

Conclusion. The diagnostic performance of retinal morphometric parameters in early glaucoma depends on the topography of functional impairment. GCIPL parameters are more sensitive in detecting central visual field damage, whereas cpRNFL demonstrates superiority in peripheral defects.

Taking into account the localization of visual field damage improves the accuracy of early glaucoma diagnosis and optimizes the interpretation of OCT data

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