

FUNCTIONAL CLASSIFICATION OF HYPERTENSIVE RETINOPATHY BASED ON THE RESULTS OF OPTICAL COHERENCE TOMOGRAPHY

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Abstract. Based on the results obtained, a special classification of hypertensive choroidopathy (HCP) was developed and proposed based on the central choroidal thickness (CCT) determined from OCT data. The peculiarity of this classification is that the CTC indicator should be determined using the appropriate method only when using OCT using Spectral technology domain (SDOCT) or Swep source (SSOCT), the resolution of which allows one to clearly visualize the boundaries of the choroid on sections and correctly set the “ruler” for measuring thickness.

The table shows the correspondence of the degree of HCP to the stages of HAR according to the Keith-Wagener-Barker classification. The main practical significance of the proposed classification is that stage 1 HCP, regarded as an increase in CTC within 230-245 μm , corresponds to the stage of the pathological process in which, against the background of stage 1 HD, there are no ophthalmoscopic signs of HAP. Detection of a pathological process at this stage is of high significance since it dictates the need for more active drug intervention, as there is a high risk of the rapid development of GAD.

Keywords: grade 2 HCP, in turn, is regarded as a CTC indicator in the range of 245-290 μm and corresponds to stages 1-2 of HAP.

In this case, there is both a manifestation of the main vascular symptoms of GAR and pronounced structural and functional changes in the choroid. Finally, grade 3 HCP is regarded as an increase in CTC > 290 μm and corresponds to stages 3-4 of GAR, in which there is a high probability of special ophthalmological treatment for patients in the form of laser exposure or administration of angiogenesis inhibitors, since grade 3 HCP is associated with a high risk of macular edema and neovascularization.

Classification of hypertensive choroidopathy based on the CTC indicator and the correspondence of its stages to the stages of HAR

Classification Keith-Wagener-Barker	Classification based on choroidal thickness indicators
There are no ophthalmoscopic signs of headache according to the classification in the presence of stage 1 hypertension	Hypertensive choroidopathy grade 1. (CTX 230-245 μm)
Stage 1. The pathological process extends only to the vessels of the inner lining of the eye, the changes are reversible. There is a violation of the ratio of the diameters of veins and arteries due to the narrowing of the latter.	Hypertensive choroidopathy grade 2. (CTX 245-290 μm)

<p>Single arteriovenous crossings are detected, the Salus I symptom is positive.</p>	<p>Hypertensive choroidopathy grade 3. (CTC > 290 μm)</p>
<p>Stage 2. Initial signs of organic damage to the retina are revealed. The walls of the retinal vessels are thickened, the light reflex is expanded. Due to the compaction of the vascular wall, the arteries resemble copper or silver wire during ophthalmoscopy. In limited areas, zones of partial or complete obliteration of arterioles are visible.</p>	
<p>Stage 3. The above-described manifestations are accompanied by symptoms of damage to nerve fibers. The ophthalmoscopic picture allows one to visualize plasmorrhages and hemorrhages that extend to the posterior parts of the vitreous. Accumulations of lipids appear as yellowish “solid” exudates. The protein transudate is “soft”, grayish in color. In the area of ischemic retinal infarction, “cotton wool-like” foci are formed.</p>	
<p>Stage 4. The changes are irreversible. A pronounced progression of sclerotic vascular lesions is characteristic. Ophthalmoscopically, swelling of the optic nerve head (OND) is visualized. Degenerative changes can be seen on the inner lining of the eyeball. The risk of developing macular edema and retinal detachment is extremely high.</p>	

Note: Central choroidal thickness (CCT) should be assessed using SDOCT or SSOCT.

Functional classification of HAR based on the OCTA indicator and the correspondence of its stages to the stages of HAR according to Keith-Wagener-Barker

Classification Keith-Wagener-Barker	Classification based on OCTA parameters
<p>There are no ophthalmoscopic signs of headache according to the classification in the presence of stage 1 hypertension</p>	<p>Stage 1. (initial retinal ischemia caused by headache) Total VD: 19.5-22; Overall PD: 36-38; CFA: 1.95-2.1 mm^2</p>
<p>Stage 1. The pathological process extends only to the vessels of the inner lining of the eye, the changes are reversible. There is a violation of the ratio of the diameters of veins and arteries due to the narrowing of the latter. Single arteriovenous crossings are detected, the Salus I symptom is positive.</p>	<p>Stage 2. (severe retinal ischemia caused by headache) Total VD: 17.5-19.5; Overall PD: 33-36; CFA: 1.8-1.95 mm^2</p>
<p>Stage 2. Initial signs of organic damage to the retina are revealed. The walls of the retinal vessels are thickened, the light reflex is expanded. Due to the compaction of the vascular wall, the arteries resemble copper or silver wire</p>	

during ophthalmoscopy. In limited areas, zones of partial or complete obliteration of arterioles are visible.	
Stage 3. The above-described manifestations are accompanied by symptoms of damage to nerve fibers. The ophthalmoscopic picture allows one to visualize plasmorrhages and hemorrhages that extend to the posterior parts of the vitreous. Accumulations of lipids appear as yellowish “solid” exudates. The protein transudate is “soft”, grayish in color. In the area of ischemic retinal infarction, “cotton wool-like” foci are formed.	Stage 3. (severe retinal ischemia caused by headache) Total VD: <17.5; Overall PD: <33; CFA: <1.8 mm ²
Stage 4. The changes are irreversible. A pronounced progression of sclerotic vascular lesions is characteristic. Ophthalmoscopically, swelling of the optic nerve head (OND) is visualized. Degenerative changes can be seen on the inner lining of the eyeball. The risk of developing macular edema and retinal detachment is extremely high.	

The table shows the functional classification of retinal ischemia caused by headache based on OCTA parameters. The classification is based on the values of the total vascular density and retinal perfusion, as well as the blood flow area in the choriocapillaris or CFA (Choriocapillaris flow area). According to the classification, there are 3 stages of ischemia, stage 1 corresponds to hypertension without manifestation of ophthalmoscopic signs in the fundus, stage 2 corresponds to stages 1-2 of GAR, and stage 3 corresponds to stages 3-4 of GAR and reflects severe retinal ischemia associated with the development of neovascularization. In connection with the above, the proposed classifications can be considered as a criterion when prescribing laser treatment and intravitreal administration of angiogenesis inhibitors for hypertensive retinopathy.

Conclusion

In conclusion, the functional classification of hypertensive retinopathy based on the results of optical coherence tomography (OCT) provides valuable insights into the structural changes and functional implications of this condition. OCT imaging allows for a detailed assessment of retinal layers, thickness measurements, and identification of pathological features, enabling a more precise classification of hypertensive retinopathy.

Through OCT, hypertensive retinopathy can be classified into distinct stages based on retinal changes. In the early stages, OCT reveals mild thickening of the retinal layers, particularly the inner retinal layers, indicating early microvascular alterations. As the condition progresses, OCT may identify the presence of retinal edema, intraretinal hemorrhages, and exudates, suggesting increased vascular permeability and compromised blood-retinal barrier.

REFERENCES

1. Zhalalova D.Z. , Makhkamova D.K. Multicomponent approach to the diagnosis of retinal changes in arterial hypertension Journal “ Problems of biology and medicine” - 2021. No. 5 C - 205-211.
2. Zhalalova D.Z. , Makhkamova D.K. OCT angiography in assessing the vascular bed of the retina and choroid Journal “ Problems of biology and medicine” - 2021. No. 6 C - 211-216.

3. Zhalalova DZ .The content of endothelin and homocysteine in blood and lacrimal fluid in patients with hypertensive retinopathy Web of Scientist:International Scientific Research Journal Volume 3,ISSUE 2,February-2022,C. 958-963
4. Zhalalova DZ Modern aspects of neuroprotective treatment in hypertensive retinopathy Web of Scientist:International Scientific Research JournalVolume 3,ISSUE 2,February-2022,C. 949-952
5. Zhalalova DZDevelopment of classification criteria for neuroretinal ischemia in hypertension Web of Scientist:International Scientific Research Journal Volume 3,ISSUE 2,February-2022,C. 972-978
6. Jalalova D.Z. Classification criteria for changes in retinal vessels in arterial hypertension Journal “ Problems of biology and medicine” - 2022. No. 1 C - 50-53.
7. Zhalalova D.Z. Diagnostic criteria for optical coherence tomography with angiography function for ischemic diseases of the organ of vision against the background of arterial hypertension Journal “ Problems of biology and medicine” - 2022. No. 5 C –73-78
8. Zhalalova D.Z. Evaluation of markers of endothelial dysfunction in tear fluid in patients with arterial hypertension . Journal of Biomedicine in Amaliet. Tashkent - 2022, Volume No., No. WITH.
9. Zhalalova D.Z. OCT angiography in the assessment of retinal and choreoretinal microcirculation in patients with uncomplicated arterial hypertension International Ophthalmological Congress IOC Tashkent 2021, P 95-96
10. Zhalalova D.Z. Modern aspects of neuroprotective treatment for hypertensive retinopathy Journal TMA - 2022. No. 4 P 84-87
11. Shernazarov Farrukh ORGANIZATION OF DIGITALIZED MEDICINE AND HEALTH ACADEMY AND ITS SIGNIFICANCE IN MEDICINE // SAI. 2023. №Special Issue 8. URL: <https://cyberleninka.ru/article/n/organization-of-digitalized-medicine-and-health-academy-and-its-significance-in-medicine> (дата обращения: 20.11.2023).