RELEVANCE OF THE PROBLEM OF FUNDUS CHANGES IN ARTERIAL HYPERTENSION

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Abstract. *Hypertension is a risk factor for many systemic pathological processes that cause serious morbidity and high mortality. The World Health Organization (WHO) defines hypertension as a systolic blood pressure greater than 140 mmHg and/or a diastolic blood pressure greater than 90 mmHg. According to statistics, approximately 1.15 billion people worldwide suffer from this condition. Hypertension can affect the eyes in several ways, including the development of retinopathy, chorioretinopathy, and optic neuropathy. It is also a risk factor for other vision-threatening conditions, including retinal artery occlusions, retinal vein occlusions, retinal artery microaneurysms, and anterior ischemic optic neuropathy.*
Keywords: *the epidemiology of hypertensive retinopathy (HR) is difficult to determine because retinal vascular changes are often masked by the presence of other retinal vascular diseases such as diabetes mellitus.*

Hypertension increases the risk of development and progression of diabetic retinopathy, glaucoma and age-related macular degeneration. Hypertension is also a risk factor for the development of subchoroidal hemorrhage during ophthalmological surgery. The eye is the only organ in the body where intravascular changes caused by systemic hypertension can be observed directly in a living organism. The most common ophthalmic manifestation of hypertension is hypertensive retinopathy (HR). There are several scoring systems for GH proposed to classify its severity. The most widely used classification is the Keith-Wagener-Barker classification, proposed in 1939. Recently, Wang and Mitchell proposed a simplified scoring system in 2004. GH may be the first sign of a hypertensive crisis, an acute, life-threatening condition caused by a significant increase in blood pressure that leads to acute organ dysfunction. High blood pressure with signs of mild GH is called "accelerated hypertension", while high blood pressure with signs of severe GH, including swelling of the brain, is called "malignant hypertension". GH is an eye disease caused by a long-term increase in blood pressure (BP), which can lead to decreased vision. Millions of people around the world suffer from medical problems associated with high blood pressure. The prevalence rate of GH is approximately 75% among individuals with essential hypertension (HTN).

The epidemiology of hypertensive retinopathy (HR) is difficult to determine because retinal vascular changes are often masked by the presence of other retinal vascular diseases such as diabetes mellitus. Studies by Erden et al5 have shown that the degree and duration of hypertension increases the incidence of GH. In their study, the incidence of retinal vascular changes in patients undergoing outpatient treatment for hypertension was 66.3%. In the Cardiovascular Health Study, which included 2050 people aged 69 to 97 years without diabetes, it was found that 8.3% had retinopathy, 9.6% had focal arteriolar narrowing, and 7.7% had narrowing of arteriovenous junctions, and all reticular changes were associated with systemic hypertension. 6 Data from the Beaver Dam Eye Studio study, which evaluated patients with

systemic hypertension in a nondiabetic setting population over a five-year period showed that the incidence of retinal vascular changes was about 15%; specifically, 6% had retinopathy, 9.9% arteriolar narrowing, and 6.5% arteriovenous junction narrowing7. Also, Yu et al8 reported similar results in this population of 3654 individuals aged 49 years and older and demonstrated a direct correlation between age and severity of hypertension. In contrast to the study by Erden et al5, this study did not find a correlation with the duration of systemic hypertension. Several studies have shown that GH may be considered an independent factor associated with overall morbidity and mortality. The study by VRRM Rao and colleagues covered the analysis of the prevalence of GH, risk factors, comorbidities, taking into account the influence of gender, systolic blood pressure, duration of hypertension, body mass index (BMI) and blood lipids. This study established the prevalence of GH among patients with hypertension at 40%. Risk factors for GH include age, female gender, high systolic blood pressure, and duration of hypertension. Associations have also been found between GH and increased levels of total cholesterol, low-density cholesterol and triglycerides. It should be noted that the presence of GH is often accompanied by ischemic heart disease and acute cerebrovascular accidents (ACVA) against the background of hypertension. The degree and duration of hypertension is directly proportional to the incidence of GH, as described by Erden and his colleagues. In their study, the incidence of GH was 65%. Kabedi et al stated that the incidence of GH was 85% among the total number of patients with hypertension and found that chronic kidney disease was the most significant predictor of the development of severe GH. According to a study conducted by Del Brutto et al, grade 1 GR was detected in 40% of patients with hypertension, and grade 2 GR was observed in 20% of patients with hypertension. Changes in the retina indicating significant progression of retinopathy have been shown to be strongly associated with the occurrence of cardiac -vascular diseases. Advanced lesions may predict heart failure and cardiovascular mortality, independent of blood pressure and other risk factors. Wang et al analyzed the results of two large cohort studies: the Beaver Dam Eye Study and the Blue Mountains Eye Study, both of which examined retinal vessel diameter. These studies established a relationship between retinal vessel diameter and the risk of coronary artery disease and stroke in middle-aged individuals. Another meta-analysis of more than 21,000 patients indicates that both narrower retinal arterioles and wider retinal veins correlate with a higher risk of CAD in women, but not in men. The above results may support the thesis that coronary microvascular dysfunction plays an important role in the pathogenesis of CAD. Hypertension, especially when poorly controlled or untreated, leads to the development of left ventricular (LV) hypertrophy. Previous studies have shown a close association between advanced hypertensive retinopathy and LVH and that hypertensive retinopathy doubles the risk of LVH. Recent research suggests that retinal arteriolar constriction may be as accurate as BP measurement in predicting LVH. The coincidence of changes in retinal vascular diameter with myocardial hypertrophy (MH) and ventricular remodeling was also studied. Based on digital retinography images performed in hypertensive patients, it was shown that the retinal vessel diameter ratio (AVR) was correlated with the presence of GM in the form of LVH. The assessment of retinal arterioles serves as a model for assessing cerebral microcirculation due to their close proximity, anatomical similarity and common vascularity system (the internal carotid artery supplies blood to both the forebrain and the retina). Hypertensive retinopathy has been shown to predict long-term risk of stroke, even in patients with well-controlled blood pressure. This suggests that precise control of retinal microcirculation has added value in predicting vascular risk. There is also evidence, based on

cohort studies, that changes in retinal microcirculation are associated with dementia, cognitive impairment, and brain imaging abnormalities. Stronger correlations are observed with more severe abnormalities of the retinal microcirculation. Poorly controlled systemic hypertension leads to damage to the retinal microcirculation, so recognition of hypertensive retinopathy may be an important element in cardiovascular risk stratification in patients with hypertension. However, there is no widely accepted classification or definition of hypertensive retinopathy. Various international recommendations are not consistent in this regard. For example, the risk stratification table (Table 1) from the European Society of Hypertension-European Society of Cardiology guidelines (ESH-ESC 2003)12 indicates that degrees III and IV hypertensive retinopathy (as defined in Table 2) are associated with clinical conditions, while The Joint National Committee on the Prevention, Detection, Evaluation, and Treatment of Hypertension (JNC VII) in the United States lists retinopathy generically (without specification of grade) as a target organ lesion13. Additionally, the World Organization for Hypertension Health Organization (WHO-ISH) in 200314 and the British Hypertension Society in 2004 (BHS IV)15 consider retinopathy as end-organ damage, although again only for grades III and IV. There are several considerations which may interfere with systemic examination of the retina in patients with hypertension. These include unclear definitions and heterogeneous classifications of hypertensive retinopathy, making grading a largely arbitrary process, and a lack of clearly defined predictive value for both systemic outcome and visual impairment. Several recent studies have shown that retinal microvascular changes can be reliably captured on retinal films16–23. Overall, image reproduction was excellent for well-defined signs of retinopathy (kappa values ranged from 0.80 to 0.99 for microaneurysms and retinal hemorrhages) and moderate for other more subtle retinal arteriolar changes (0.40 to 0.79 for arteriolar narrowing and reticular intersections of arteriovenous). Additionally, these studies suggest that generalized arteriolar narrowing can be assessed by measuring reticular vessel diameters on images using imaging software. The development of specialized software packages has made it possible to objectively measure the arteriolar to venular ratio (AVR) in selected standardized retinal regions. This technique appears to have substantial replicability (intraclass correlation coefficients ranged from 0.80 to 0.99).

Conclusion

In conclusion, the relevance of the problem of fundus changes in arterial hypertension lies in its significant clinical implications. The examination of the fundus allows for the direct visualization of the retinal blood vessels, providing valuable information about the impact of arterial hypertension on the microvasculature. Fundus changes in arterial hypertension, such as hypertensive retinopathy, serve as important markers of end-organ damage and are associated with an increased risk of cardiovascular events, including stroke and heart disease. Early detection and monitoring of fundus changes can aid in the timely implementation of interventions to manage hypertension and prevent further complications, underscoring the relevance of addressing this problem in clinical practice.

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