

CHARACTERISTICS OF RETINAL HEMODYNAMICS IN ELDERLY PATIENTS WITH VEGETATIVE DYSTONIA SYNDROME

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Abstract: This study examines the characteristics of retinal hemodynamics in elderly patients diagnosed with vegetative dystonia syndrome, with particular attention to quadrant-specific changes in retinal blood flow. All participants underwent retinal scanning in the upper, lower, temporal, and nasal quadrants under conditions of central gaze fixation. In cases where gaze fixation was impaired, additional scanning procedures were performed to obtain high-quality images free from motion-related artifacts. Quantitative analysis of retinal hemodynamic parameters revealed uneven distribution of circulatory changes across different retinal quadrants. The most pronounced alterations were observed in the upper, temporal, and lower quadrants, where a decrease in hemodynamic indices reached 8.9%. In contrast, the nasal quadrant demonstrated less significant changes, with a reduction of only 2.5%. These findings suggest that vegetative dystonia syndrome in elderly patients is associated with selective impairment of retinal microcirculation, predominantly affecting specific retinal regions. Assessment of quadrant-based retinal hemodynamics may therefore serve as a useful non-invasive tool for evaluating autonomic dysfunction and vascular regulation disorders in this patient population.

Keywords: retinal hemodynamics, elderly patients, vegetative dystonia syndrome, retinal quadrants, upper quadrant, lower quadrant, temporal quadrant, nasal quadrant, gaze fixation disorders, additional scanning, retinal microcirculation.

Introduction. The autonomic nervous system (ANS) plays a fundamental role in maintaining homeostasis by regulating cardiovascular activity, vascular tone, and microcirculation. Dysfunction of the ANS is widely распространено in the general population and is especially prevalent among elderly individuals, in whom age-related structural and functional changes of the nervous system contribute to impaired autonomic regulation. Autonomic disorders may develop as a result of organic lesions affecting the central or peripheral components of the ANS and are commonly manifested as vegetative dystonia syndrome.

The ANS is organized into suprasegmental and segmental levels, encompassing the sympathetic and parasympathetic divisions, which function in close coordination. The suprasegmental apparatus of the ANS includes the hypothalamus, thalamus, limbic system, brainstem structures (reticular formation, afferent and efferent pathways, and differentiated nuclear groups), as well as limited cortical areas responsible for autonomic regulation. Dysfunction of these structures leads to disturbances in vascular control and contributes to the development of autonomic imbalance.

Autonomic dysfunction may occur not only as a consequence of neurological disease but may also actively influence the course of cerebrovascular pathology by altering cerebral blood flow and vascular reactivity. In this regard, the assessment of microcirculatory changes is of particular clinical significance. The retinal vascular system, due to its anatomical and physiological similarities with cerebral circulation, provides a unique and accessible model for the non-invasive evaluation of microvascular function.

Visualization and quantitative assessment of retinal vessels allow early detection of hemodynamic disturbances that may precede clinically evident cerebrovascular disease. Studying retinal hemodynamics in elderly patients with vegetative dystonia syndrome therefore represents a promising approach for improving early diagnosis and risk stratification of vascular disorders of the central nervous system.

In light of the above, the present study aims to investigate the specific features of retinal hemodynamics in elderly patients with vegetative dystonia syndrome.

Materials and methods. We examined 147 patients aged 60-75 years who were hospitalized in the neurological department of the ACMI clinic in the period from 2019 to 2022 with a diagnosis of stage 2 chronic cerebral ischemia against the background of atherosclerosis and hypertension, confirmed by

magnetic resonance imaging of the brain, ultrasound examination of extracranial vessels, biochemical blood tests, including lipid profile.

The patients were divided into 2 groups. Group I consisted of 186 patients (63.1% of the total number of patients) with stage 2 chronic cerebral ischemia (CCI) with ADS (84 men (45.2%) and 102 (54.8%)), group II consisted of 109 patients (36.9%) with stage 2 CCI without ADS (38 men (34.9%) and 71 women (65.1%)).

The results of calibrometry of retinal vessels were obtained using a Topcon TRC-NW7SF fundus camera.

All the studied patients underwent spectral OCT on a Topcon DRI OCT Triton digital optical coherence tomograph with Swept Source technology. The Line and CrossLine modes were performed with activated tracking for 40–250 averaged scans. The sizes of the scanning zones during OCT

angiography were 2×2, 3×3 and 6×6 mm. All patients were scanned in the upper, lower, temporal, and nasal quadrants with central gaze fixation. In case of gaze fixation disorders, additional scanning was performed until optimal images were obtained without artifacts due to eye movement.

The research materials were subjected to statistical processing using the methods of parametric and non-parametric analysis. Accumulation, correction, systematization of initial information and visualization of the obtained results were carried out in Microsoft Office Excel 2016 spreadsheets. Statistical analysis was carried out using the IBM SPSS Statistics v.23 program (developed by IBM Corporation).

Research results. In the study of changes in the fundus of the eye in groups of patients, it was stated that in elderly patients with ADS there is a spasm of small-caliber vessels against the background of the predominance of sympathetic tone caused by arterial hypertension. These are the initial signs of transient disorders of the hemodynamics of the brain. Clinically, this was manifested by the appearance

of “flies” or colored spots before the eyes, periodic darkening or flickering, and other photopsies. Changes in the fundus often confirm cerebrovascular insufficiency.

Retinal manifestations of CCI with concomitant ADS include initial symptoms: moderate venous dilatation in 29.4% in CG and in 84.2% in the study group, reversible narrowing of the arteries, while maintaining the elasticity of the vessel wall, or irreversible angiospasm in 25% of somatically healthy

people and in 74.1% of patients with osteochondrosis of the cervical spine, in the control group, in 27.2% of cases there were single arterio-venous decussations of the first degree, while the symptoms of arterio-venous decussations of the first degree were present in 68.2% of the subjects; tortuosity of vessels was found in the same proportions, and division of vessels at a right angle was detected only in

35.9% of patients. The analysis showed that the identified differences are significant ($p \leq 0.05$) and the results obtained are due to the development of this pathology in patients with VCD.

In ADS in elderly patients with stage 2 CCI, in addition to photopsies, the examination revealed loss of visual fields and the appearance of scotomas, which was due to arterial spasm or their extravasal compression by dilated veins in the fundus.

There was also an increase in angioretinopathy: all the subjects had pronounced venous plethora and arterial spasm, angiosclerosis. Sclerosis of the vascular wall is caused by dystrophic processes in it against the background of secondary retinal ischemia, and turbulent blood flow leads to

the appearance of a symptom of intermittent, “bead-shaped” vessels, the wall of which is

partially covered by edematous retina, this symptom was found in 38.9% of patients. In 61.4% of patients, a symptom of arteriovenous decussation of II–III degree was detected.

Significant disorders of cerebral hemodynamics were observed, in this group transient attacks of vision loss were also detected, this is due to the onset of spasm of the retinal vessels. The study of the

fundus revealed signs of angioretinopathy, retinal ischemia, which can be characterized as a syndrome of ischemic neuro-opticopathy. Signs of thickening due to retinal edema were observed in 67.4% of patients in this group, an increase in the diameter of physiological excavation was observed in 61.9% of the subjects.

When examining patients with ICA stenosis in combination with circulatory disorders in the VBB, similar changes in retinal vessels were revealed, as well as simple sclerotic symmetrical atrophy with contours of pseudoglaucomatous excavation. The data of calibrometry of retinal vessels of other authors confirm the results obtained by A.N. Samoilov (1998, pp. 37-39), using calibrometry of the

retinal vessels in VCD, revealed narrowing and sclerosis of the arteries, dilation of the retinal veins, symptoms of decussation and division at a right angle. These manifestations are caused by retinal ischemia due to impaired blood flow in the ICA and VA in CCI.

The data obtained indicate that the arteriovenous ratio (AVR) in elderly patients with stage 2 CCI with ADS and without ADS was below normal values, which explained the presence of angiopathy in all examined patients. Changes in the lumen of the retinal vessels and pronounced angiospasm were significantly more often observed in patients with ADS.

According to OCT-angiography, the blood flow density in the retinal arteries was studied in the AngioRetina mode with a scanning area of 3x3 mm. The study found that elderly patients with ADS had a 5.9% decrease in this indicator compared with the group of patients without ADS. When analyzing the data by quadrants, it was noted that the maximum changes are observed in the upper, temporal and

lower quadrants - 8.9%, while in the nasal quadrant the decrease was less pronounced and amounted to 2.5%.

In patients with ADS, changes in the fundus were more significant: the decrease in blood flow density was 16.3% and 18.1%, respectively; in these groups, a uniform decrease in blood flow density in all quadrants was already noted. The manifestation of the initial symptoms of changes in the fundus reflects the early stage of the formation of venous cerebral insufficiency against the background of CCI

and they should be regarded as early diagnostic signs, and it is worth evaluating their use by a practical healthcare doctor in the diagnosis and treatment of this disease.

Conclusion. Thus, given the presence of clinical symptoms and characteristic changes in the fundus of the eye in elderly patients with ADS, the degree of insufficiency of cerebral venous hemodynamics should be assessed by pathological changes in the retina and the severity of visual impairment. It is necessary

to use functional methods of research, such as ophthalmoscopy, visometry, perimetry, biomicroscopy and a modern method of studying the retina - optical coherence tomography. This is important for the differential diagnosis of venous cerebral dysfunction, for correcting tactics and correctly assessing the

results of drug therapy, and for predicting the course of the disease.

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