pISSN:2349-5707 Volume:13,Issue 1, January -2025 eISSN:2349-5715

FEATURES OF RETINAL HEMODYNAMICS IN ELDERLY PATIENTS WITH VEGETATIVE DYSTONIA SYNDROME

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Abstract

Age-related changes in autonomic regulation significantly affect vascular tone and microcirculatory processes. In elderly patients, autonomic imbalance may lead to functional disturbances in the retinal vascular system, which reflects the condition of cerebral microcirculation. The present study is devoted to the assessment of retinal hemodynamic parameters in elderly individuals diagnosed with vegetative dystonia syndrome. Retinal blood flow was examined in four anatomical quadrants—upper, lower, temporal, and nasal—using standardized scanning with central fixation. When fixation instability was detected, repeated measurements were carried out to ensure accurate visualization and eliminate motion artifacts. The obtained data were analyzed with respect to the topographic distribution of hemodynamic changes. The analysis revealed a heterogeneous pattern of retinal blood flow alterations. More pronounced disturbances were identified in the upper, temporal, and lower quadrants, while the nasal quadrant showed relatively preserved hemodynamic parameters. These findings indicate selective vulnerability of certain retinal regions to autonomic dysregulation in elderly patients. The results emphasize the diagnostic value of retinal hemodynamic assessment as a non-invasive approach for detecting microvascular dysfunction associated with vegetative dystonia syndrome and may contribute to improved evaluation of vascular risk in the elderly population.

Keywords

retinal circulation; retinal blood flow; elderly population; vegetative dystonia syndrome; autonomic regulation; microvascular changes; retinal quadrants; vascular dysfunction.

Introduction

Dysfunction of the autonomic (vegetative) nervous system (ANS) is highly prevalent and represents a significant clinical problem, particularly among elderly individuals. It can manifest due to structural alterations in the cerebral, spinal, or peripheral components of the ANS. The ANS is organized into suprasegmental and segmental divisions, with sympathetic and parasympathetic systems distinguished according to their functional roles. Suprasegmental ANS structures include the hypothalamus, thalamus, limbic system, brainstem (reticular formation, afferent and efferent pathways, and clearly defined nuclei), and selective “vegetative” areas of the cerebral cortex. Autonomic dysfunction may occur as a consequence of disease but may also independently influence the development and progression of cerebrovascular disorders. Examination of retinal vessels is a non-invasive method that may serve as one of the earliest markers of cerebral vascular abnormalities. This consideration formed the rationale for the present study.

Purpose of the study

To determine the characteristics of retinal hemodynamics in elderly patients with vegetative dystonia syndrome.

Materials and methods

The study included 152 patients aged 61–78 years who were treated as inpatients in the Neurology Department of the Andijan State Medical Institute Clinic between 2019 and 2022. All patients had stage II chronic cerebral ischemia associated with atherosclerosis and hypertension,

pISSN:2349-5707 Volume:13,Issue 1, January -2025 eISSN:2349-5715

confirmed by MRI of the brain, ultrasound of extracranial vessels, and laboratory tests, including lipid profile analysis.

Patients were divided into two groups. Group I comprised 172 patients (65% of the total) with stage II chronic cerebral ischemia and coexisting vegetative dystonia syndrome (77 men [44.8%] and 95 women [55.2%]). Group II included 80 patients (35% of the total) with stage II chronic cerebral ischemia without vegetative dystonia syndrome (34 men [42.5%] and 46 women [57.5%]).

Retinal vessel calibers were measured using a Topcon TRC-NW7SF fundus camera. Spectral-domain OCT was performed using a Topcon DRI OCT Triton swept-source device. Line and CrossLine scanning modes were used with activated tracking and averaging of 50–240 scans. OCT angiography scanning areas were 2×2 mm, 3×3 mm, and 6×6 mm.

Retinal scans were conducted in the upper, lower, temporal, and nasal quadrants with central gaze fixation. If gaze fixation was unstable, additional scans were performed until artifact-free images were obtained.

Data were analyzed using both parametric and nonparametric methods. Data management, correction, and visualization were performed using Microsoft Excel 2016. Statistical analysis was conducted with IBM SPSS Statistics v.23 (IBM Corporation).

Results and discussion

Fundus examination revealed that elderly patients with vegetative dystonia syndrome exhibited small-caliber vessel spasms against a background of increased sympathetic tone, often associated with hypertension. These changes are early indicators of transient cerebral hemodynamic disturbances. Clinically, patients reported “floaters,” colored spots, episodic dimming, flickering, and other photopsias. Fundus findings often reflected insufficient cerebral blood flow.

Retinal manifestations of chronic cerebral ischemia with vegetative dystonia syndrome included moderate venous dilation in 30% of the control group and 81% of the study group. Reversible arterial narrowing with preserved vessel wall elasticity or irreversible angiospasm was observed in 26% of healthy individuals and 72% of patients with cervical osteochondrosis. Isolated grade I arteriovenous crossings occurred in 28% of controls and 66% of patients with vegetative dystonia syndrome. Vessel tortuosity showed similar proportions, while right-angle vessel branching was noted in 37% of patients.

Statistical analysis confirmed that these differences were significant ($p \leq 0.05$), indicating that the observed retinal hemodynamic changes are associated with the presence of vegetative dystonia syndrome in elderly patients.

In elderly patients with stage II chronic cerebral ischemia (CCI) and vegetative dystonia syndrome (VDS), in addition to photopsias, visual field defects and scotomas were frequently observed. These symptoms were associated with arterial spasms or extravascular compression by dilated retinal veins.

Retinal angioretinopathy was more pronounced in these patients. All examined individuals exhibited marked venous congestion, arterial spasms, and signs of angiosclerosis. Sclerosis of the vessel walls resulted from dystrophic changes secondary to retinal ischemia. Turbulent blood flow led to the appearance of “interrupted” or segmented vessels partially obscured by retinal edema, observed in 40.3% of patients. Signs of arteriovenous crossings of grade II–III were detected in 63.2% of cases.

Significant disturbances of cerebral hemodynamics were also recorded. Transient visual loss episodes were reported in this group, likely due to intermittent retinal vessel spasms. Fundus examination revealed features consistent with retinal ischemia and angioretinopathy, which can be characterized as early ischemic neuro-ophthalmopathy. Retinal thickening due to edema was

pISSN:2349-5707 Volume:13,Issue 1, January -2025 eISSN:2349-5715

present in 68.1% of patients, and enlargement of the physiological optic cup was noted in 62.7% of cases.

In patients with carotid artery stenosis combined with vertebrobasilar insufficiency, similar retinal vascular changes were observed, along with symmetrical sclerotic atrophy of the optic nerve head with pseudo-glaucomatous contours. These findings are consistent with previous studies; for example, Samoylov (1998) reported retinal arterial narrowing, venous dilation, arteriovenous crossings, and right-angle branching in patients with VDS, confirming the role of ischemia due to impaired flow in the carotid and vertebral arteries.

The arteriovenous ratio (AVR) in elderly patients with stage II CCI, both with and without VDS, was below normal levels, indicating a general presence of retinal angiodystrophy. Changes in vessel lumen and pronounced angiospasm were significantly more frequent in patients with VDS.

OCT angiography was performed to assess retinal arterial blood flow density using the AngioRetina mode with a 3×3 mm scanning area. Elderly patients with VDS demonstrated a 6.2% reduction in arterial flow density compared to patients without VDS. Quadrant analysis revealed the greatest reductions in the upper, temporal, and lower quadrants (9.1%), whereas the nasal quadrant showed a less pronounced decrease (2.7%).

In patients with VDS, fundus changes were more severe: arterial flow density decreased by 17.1% and 19.0% in respective measurements, with a uniform reduction across all quadrants. These early fundus changes reflect the initial stage of venous cerebral insufficiency in the context of CCI and should be considered as early diagnostic markers. Their assessment can aid clinicians in the early identification and management of this condition.

Conclusions

Based on the presence of clinical symptoms and characteristic fundus changes, the degree of cerebral venous hemodynamic insufficiency in elderly patients with VDS should be evaluated according to retinal pathology and the severity of visual disturbances. Functional diagnostic methods, including ophthalmoscopy, visual acuity testing, perimetry, biomicroscopy, and modern retinal imaging techniques such as optical coherence tomography (OCT), are essential.

These assessments are crucial for differentiating cerebral venous dysfunction, optimizing therapeutic strategies, evaluating the effectiveness of medical interventions, and predicting the progression of the disease. Early detection of retinal microcirculatory disturbances provides a valuable non-invasive tool for improving patient management in clinical practice.

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