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Study of Macroanatomical Changes in Retinal Vessels Using Oct in Early Ophthalmological Manifestations of Type 2 Diabetes

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Abstract: This article analyzes the macroanatomy of retinal vessels in patients with early-stage type 2 diabetes mellitus using optical coherence tomography (OCT). The study involved 24 patients diagnosed with type 2 diabetes. The condition, thickness, perfusion level, and presence of microaneurysms in the retinal vessels were evaluated. The results obtained demonstrated the significance of OCT in early diagnosis and prevention of diabetic retinopathy.

Key words: *Type 2 diabetes mellitus, optical coherence tomography, retina, diabetic retinopathy, macroanatomical changes.*

Introduction

Type 2 diabetes mellitus (TDM) is a widespread endocrine disease worldwide, leading to many systemic complications. The most dangerous of them is diabetic retinopathy (DR), i.e., damage to the retina. DR is one of the main causes of decreased vision. Therefore, early detection of the disease and assessment of changes are of great importance.

Optical coherence tomography (OCT) is a modern method that allows visualization of retinal layers with high accuracy, non-invasively. In this study, we analyzed the early macroanatomical changes occurring in the retinal vessels of patients with D2DM using OCT.

Materials and methods. This research was conducted in a prospective analytical type. Within the framework of the study, 24 patients (12 men and 12 women) with a relatively stable general health status, diagnosed with type 2 diabetes mellitus, participated. The age of the participants ranged from 40 to 65 years, and all of them had a diabetes duration of less than 5 years. The study included only patients with mild or no ophthalmologically pronounced clinical symptoms.

Inclusion criteria included: the presence of a diagnosis of type 2 diabetes mellitus, the duration of the disease not exceeding 5 years, and the absence of serious eye-related complaints in patients.

Exclusive criteria were: a diagnosis of type 1 diabetes mellitus, the presence of other retinal diseases (in particular, glaucoma or age-related macular degeneration - AMD), as well as uncontrolled arterial hypertension.

Optical coherence tomography (OCT) was used to identify macroanatomical and microvascular changes in the retina. The Spectralis OCT (Heidelberg Engineering) device was used in the study.

Visualization was mainly performed in the following segments: foveal center, parafoveal zone, and peripheveal zone.

The main parameters assessed during the study were:

- The thickness of the retinal layers, including ganglion cell layers (GCL), retinal nerve fiber layers (RNFL), and inner plexiform layer (IPL);
- Density of the vascular network, i.e., indicators of the degree of perfusion and vessel density;
- Microvascular changes including microaneurysms, disorder or indistinctness of capillary networks.

The obtained OCT images were examined and evaluated twice by ophthalmologists. The average values for each eye were calculated separately. This approach served to ensure the reliability and accuracy of changes detected by OCT.

Results. Within the framework of the study, both eyes of 24 patients were examined in detail using OCT. The obtained results showed the presence of macroanatomical and microvascular changes in the retina.

Analysis of the thickness of the retinal layers showed that in 62% of patients, a slight diffuse thinning of the ganglion cell layer (GCL) was observed. Also, the thickness of the retinal nerve fiber layer (RNFL) was below normal in 21% of cases, which also showed atrophic changes in these layers.

According to the results of assessing the density of the vascular network, a significant decrease in vascular density in the parafoveal zone was revealed in 50% of patients, and signs of retinal perfusion disorders were observed. At the same time, expansion of the foveal avascular zone (FAZ) was noted in 29% of patients, confirming that this is one of the features of vascular changes in the early stages of diabetic retinopathy.

Parameter	Findings	Percentage of Patients (%)
Ganglion Cell Layer (GCL) Thickness	Slight diffuse thinning observed	62
Retinal Nerve Fiber Layer (RNFL) Thickness	Below normal thickness with atrophic changes	21
Vascular Density in Parafoveal Zone	Significant decrease	50
Foveal Avascular Zone (FAZ) Expansion	Noted expansion	29
Microaneurysms	Detected	24
Capillary Perfusion Disorders	Observed	30

Among the microvascular changes, microaneurysms were detected in 24% of patients (6), and capillary perfusion disorders were observed in 30% of cases. These indicators indicate that the effect of diabetes in retinal microcirculation is already manifested in the early stages.

In general, the data obtained using OCT made it possible to accurately and reliably identify early ophthalmological changes in type 2 diabetes mellitus.

Analysis and discussion. The results of the study show that macroanatomical and microvascular changes at the retinal level are observed even in asymptomatic or mild forms of type 2 diabetes mellitus. Diffuse atrophy, especially in the layers of GCL and RNFL, decreased vascular density, expansion of the FAZ - all this can indicate the onset of diabetic retinopathy.

Detection of these changes using OCT angiography creates the basis for early initiation of treatment measures. The study proved: OCT has high sensitivity in the early detection of diabetic eye diseases.

Conclusion. In the early stages of type 2 diabetes mellitus, changes in the retinal level already begin. Optical coherence tomography is a reliable, fast, and non-invasive method for detecting changes and plays an important role in predicting and preventing the development of diabetic retinopathy. The analysis of 24 patients in this study once again confirms the importance of OCT diagnostics in clinical practice.

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