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PREVALENCE OF RETINOPATHY IN PATIENTS WITH TYPE 2 DIABETES MELLITUS

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Abstract. This scientific study provides a comprehensive analysis of the mechanisms of development, clinical course, stages, and effects of diabetic retinopathy on the visual system in patients with type 2 diabetes mellitus. It was observed that the frequency of retinopathy increases progressively with the duration of the disease. Initially, retinopathy is asymptomatic and is often detected incidentally during routine ophthalmological examinations. In later stages, a decrease in visual acuity, microaneurysms in the fundus, dot and blot hemorrhages, exudates, macular edema, and signs of neovascularization were identified. Certain differences in the course of retinopathy between males and females were also observed. In females, earlier onset of the disease was associated with pregnancy, hormonal changes, and metabolic disturbances, whereas in males, retinopathy was more commonly associated with long-standing diabetes, harmful habits, and elevated arterial blood pressure.

The study results demonstrated that maintaining strict glycemic control, keeping glycated hemoglobin levels within normal limits, stabilizing blood pressure, and regulating lipid metabolism significantly reduce the risk of developing diabetic retinopathy. Regular ophthalmological examinations enable early detection and timely treatment, which are crucial for preserving vision.

Based on the findings, practical recommendations were proposed for early diagnosis, prevention, and individualized treatment strategies for diabetic retinopathy in patients with type 2 diabetes mellitus.

Keywords: Diabetic retinopathy (DR), Non-proliferative diabetic retinopathy (NPDR), Optical coherence tomography (OCT), Diabetic macular edema (DME), Proliferative diabetic retinopathy (PDR), Ophthalmoscopy (fundus examination), Glycated hemoglobin (HbA1c), Vitrectomy

Introduction. Diabetes mellitus is characterized by its widespread prevalence, its impact on all types of metabolic processes in the body, its influence on multiple organ systems, and the development of complications. One of the less studied yet highly relevant aspects of diabetes is its effect on vision, with several issues still remaining unresolved.

The development of diabetic retinopathy is significantly influenced by factors such as age, onset, and duration of diabetes. In patients whose diabetes begins before the age of 30, the prevalence of retinopathy increases to 50% after 10–12 years and up to 75% after 20 years. In patients diagnosed at an older age, retinopathy may develop more rapidly and can be observed in 80% of cases after 8 years.

The primary factor in the development of diabetic retinopathy is insulin deficiency, leading to the accumulation of sorbitol and fructose in cells. This increases osmotic pressure, contributes to intracellular edema, thickening of capillary endothelium, and narrowing of their lumen.

There is also evidence suggesting immunological changes in diabetic retinopathy, which negatively affect the function of other organs and systems. In patients with type 2 diabetes,

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visual impairment may lead to serious depressive conditions and is most commonly observed in individuals aged 20–65 years.

According to literature data, diabetic retinopathy occurs in 60–80% of diabetic patients, with approximately 30% experiencing decreased visual acuity. Currently, 422 million people worldwide are affected by diabetes mellitus. However, retinopathy associated with type 2 diabetes remains insufficiently studied.

Pathogenesis of Retinopathy in Type 2 Diabetes.

The primary cause of diabetic retinopathy is chronic hyperglycemia, which induces complex biochemical and morphological changes in retinal microvasculature.

In the initial stage, hyperglycemia damages capillary wall cells, particularly pericytes, leading to their gradual loss. This results in weakening of the vessel wall and formation of microaneurysms. The basement membrane thickens and vascular permeability increases.

In subsequent stages, blood flow is impaired, and some capillaries become occluded, causing retinal hypoxia. This stimulates neovascularization as a compensatory mechanism.

Newly formed vessels are structurally immature, fragile, and prone to rupture, leading to intraocular hemorrhages. Fibrosis may also develop, causing retinal traction and detachment.

Metabolic disturbances also play a key role. Activation of the polyol pathway leads to sorbitol accumulation, increased osmotic pressure, and cellular damage. Protein glycation further disrupts vascular function.

Oxidative stress contributes to endothelial dysfunction through increased free radical formation, exacerbating vascular damage.

Diagnosis of Diabetic Retinopathy

Early detection is crucial for preserving vision. Since early stages are often asymptomatic, all patients with type 2 diabetes should undergo regular ophthalmological examinations.

Ophthalmoscopy is the most common method, allowing direct visualization of retinal changes such as microaneurysms and hemorrhages.

Fundus photography enables documentation and monitoring of disease progression over time.

Fluorescein angiography assesses vascular permeability and circulation, detecting even subclinical changes.

Optical coherence tomography (OCT) provides high-resolution imaging of retinal layers and is highly effective in detecting macular edema.

Ultrasound examination is used when visualization is impaired due to hemorrhage.

Systemic parameters such as blood glucose, HbA1c, blood pressure, and lipid profile are also evaluated. Screening is essential: patients should undergo examination at diagnosis and at least annually thereafter.

Prevalence of Retinopathy in Type 2 Diabetes

Diabetic retinopathy is one of the most common microangiopathic complications of type 2 diabetes. Its prevalence depends on age, disease duration, glycemic control, and comorbidities.

Epidemiological studies show that retinopathy occurs in approximately 30–40% of patients, reaching up to 50% in some populations. The risk increases significantly with disease duration.

Type 2 diabetes often develops asymptomatically, and 20–25% of newly diagnosed patients already have signs of retinopathy.

Regional differences are also significant. Developed countries have effective screening programs, resulting in earlier detection and fewer severe cases. In developing countries, including Central Asia and Uzbekistan, prevalence is increasing due to insufficient diagnostic and control measures.

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Risk factors include poor glycemic control, hypertension (increasing risk 1.5–2 times), dyslipidemia, obesity, and smoking. Aging also contributes to higher risk, although incidence among younger populations is rising.

Clinical Features of Diabetic Retinopathy in Type 2 Diabetes

Diabetic retinopathy in type 2 diabetes progresses slowly, often remains asymptomatic for a long time, and develops in stages.

Early symptoms are minimal and may include eye fatigue, delayed light adaptation, and reduced contrast sensitivity.

Non-proliferative stage (NPDR): characterized by microaneurysms, hemorrhages, and exudates, often with minimal complaints.

Diabetic macular edema (DME): a leading cause of vision loss, presenting with blurred vision and distortion (metamorphopsia).

Proliferative stage (PDR): the most severe stage, involving neovascularization, hemorrhages, and risk of retinal detachment.

Key influencing factors include duration of diabetes, HbA1c levels, hypertension, dyslipidemia, and renal dysfunction. Each 1% increase in HbA1c significantly raises the risk of progression.

Regular monitoring using OCT and fundus photography is essential. Telemedicine and AI-based screening systems are increasingly important, especially in underserved regions.

Treatment and Prevention

Treatment is complex and aims to prevent progression and preserve vision.

Glycemic control is the most critical factor (HbA1c <7%).

Blood pressure and lipid management are essential.

Laser photocoagulation reduces progression by destroying ischemic retinal areas.

Intravitreal injections (anti-VEGF) inhibit neovascularization and reduce macular edema.

Vitrectomy is used in advanced cases.

Prevention includes early diagnosis, healthy lifestyle, weight control, physical activity, and smoking cessation. Regular ophthalmological check-ups are mandatory.

Conclusion. Diabetic retinopathy in patients with type 2 diabetes is a slowly progressive, often asymptomatic disease influenced by multiple metabolic and hemodynamic factors. Understanding its clinical features is essential for early diagnosis, effective monitoring, and development of individualized treatment strategies.

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