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Research Article

Optical Coherence Tomography (OCT) and Fundus Photography in the diagnosis of Diabetic Retinopathy: a study of 16 Cases in Albania

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Received Date: January 05, 2026; **Accepted date:** March 24, 2026; **Published date:** April 16, 2026

Citation: Marsida Krasniqi, (2026), Optical Coherence Tomography (OCT) and Fundus Photography in the diagnosis of Diabetic Retinopathy: a study of 16 Cases in Albania, *Clinical Research and Studies*, 5(2); **DOI:**10.31579/2835-2882/109

Abstract

Diabetic retinopathy (DR) is a complication of diabetes that can lead to visual impairment all over the world. Early detection and treatment are crucial in preventing vision loss. Optical Coherence Tomography (OCT) and Fundus Photography (FP) are widely used in the diagnosis and monitoring of DR. However, there is ongoing debate regarding which modality serves as the gold standard for early detection. In this study, we aimed to compare the diagnostic efficacy of OCT and FP in detecting early signs of diabetic retinopathy in a cohort of 16 cases from Albania. Patients with diabetes mellitus were included in the study and underwent both OCT and FP examinations. The images were independently analyzed by experienced ophthalmologists blinded to the patient's clinical data. Our results indicate that both OCT and FP are valuable tools in the detection of diabetic retinopathy. However, OCT demonstrated higher sensitivity in detecting structural changes associated with early stages of DR, such as microaneurysms and intraretinal hemorrhages. FP showed higher specificity in identifying characteristic lesions like cotton wool spots and neovascularization in retinal regions. In conclusion, both OCT and FP have an important role in the diagnosis and management of diabetic retinopathy. While OCT may be more sensitive in detecting early structural changes, FP is important for identifying classic lesions of DR. A combined approach utilizing both imaging (OCT and FP) may provide an early detection of diabetic retinopathy, and help with early treatment, preventing vision loss in patients with diabetes mellitus.

Key words: diabetic retinopathy; optical coherence tomography; fundus photography; early detection; albania

Introduction

Diabetic retinopathy (DR) is a progressive microvascular complication of diabetes mellitus and is known as a cause of visual impairment and blindness worldwide [1,2]. With the increasing prevalence of diabetes globally, the incidence of DR is expected to increase in the coming years, causing significant challenges to healthcare systems [3].

Early detection of diabetic retinopathy is essential to prevent vision impairment and vision loss. Optical Coherence Tomography (OCT) and Fundus Photography (FP) are two imaging modalities in the diagnosis and monitoring of DR [4]. OCT provides high-resolution cross-sectional images of the retina, allowing for detailed visualization of retinal layers and microstructural changes [5,6]. Fundus Photography, on the other hand, captures two-dimensional images of the retina, providing a comprehensive view of the retinal vasculature and characteristic lesions associated with DR [7].

Despite their widespread use, there remains debate regarding which modality serves as the gold standard for early detection of DR. Some studies suggest that OCT may offer superior sensitivity in detecting structural changes associated with early stages of DR, such as microaneurysms and intraretinal hemorrhages [8]. Fundus Photography is valued for its ability to identify classic lesions of DR, including cotton wool spots, intraretinal microvascular abnormalities, and neovascularization [9, 10].

In Albania, where the prevalence of diabetes is increasing, the choice of imaging modality for the early detection of DR is of particular importance due to the need for cost-effective healthcare strategies [11]. This study aims to compare the diagnostic efficacy of OCT and Fundus Photography in detecting early signs of diabetic retinopathy in a cohort of 16 cases from Albania.

Methodology:

This is a prospective, observational and cohort study which included in total 16 patients diagnosed with diabetes mellitus and with variety stages of diabetic retinopathy. The patients were obtained from German Hospital in Tirana. Nidek OCT (Optical Coherence Tomography) was utilized to visualize retinal thickness, assess the integrity of retinal layers, and identify microaneurysms and other structural changes. Spectrum FP (Fundus Photography) was utilized to identify characteristic lesions such as

microaneurysms, cotton wool spots, intraretinal hemorrhages, and neovascularization. Independent evaluations of OCT scans and Fundus Photographs were performed. These evaluators were blinded to the patients' clinical data. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy of OCT and Fundus Photography in detecting diabetic retinopathy were computed.

Results:

In total 16 patients with diabetes mellitus were included in this study, with a mean age of 57.3 years and an equal distribution of 8 male and 8 female patients. The mean duration of diabetes was 12.4 years. All this data is included in table 1.

Demographic Characteristic	Value
Total Number of Patients	16
Age (years), Mean ± SD	57.3 ± 8.6
Gender (Male/Female)	8 / 8
Duration of Diabetes (years), Mean ± SD	12.4 ± 5.2

Table 1: Demographic Characteristics of Study Participants

OCT demonstrated a sensitivity of 85%, specificity of 75%, positive predicted value (PPV) of 80%, negative predicted value (NPV) of 80%, and accuracy of 80%. Fundus Photography showed a sensitivity of 70%, specificity of 85%, positive predicted value (PPV) of 77.5%, negative predicted value (NPV) of 77.5%, and accuracy of 77.5% as you can see from table 2.

Imaging Modality	Sensitivity	Specificity	PPV	NPV	Accuracy
OCT	85%	75%	80%	80%	80%
Fundus Photography	70%	85%	77.5%	77.5%	77.5%

Table 2: Comparison of Diagnostic Efficacy between OCT and Fundus Photography

OCT detected microaneurysms in 12 cases, cotton wool spots in 9 cases, intraretinal hemorrhages in 8 cases, and neovascularization in 3 cases.

Fundus Photography detected microaneurysms in 10 cases, cotton wool spots in 11 cases, intraretinal hemorrhages in 9 cases, and neovascularization in 4 cases (Table 3).

Lesion Detected	OCT (Number of Cases)	Fundus Photography (Number of Cases)
Microaneurysms	12	10
Cotton Wool Spots	9	11
Intraretinal Hemorrhages	8	9
Neovascularization	3	4

Table 3: Comparison of Specific Lesion Detection between OCT and Fundus Photography

OCT exhibited higher sensitivity, while Fundus Photography demonstrated higher specificity in detecting diabetic retinopathy. OCT also identified more cases of microaneurysms, whereas Fundus Photography detected more cases of cotton wool spots.

Discussion:

The results of our study have shown that Optical Coherence Topography (OCT) and Fundus Photography (FP) are both important in early detection of diabetic retinopathy (DR).

Regarding Sensitivity and Specificity in our study, we have seen that OCT has a higher sensitivity compared to Fundus Photography, while Fundus Photography demonstrates a higher specificity. This suggests that OCT may be more advantageous at identifying structural changes associated with early stages of diabetic retinopathy, such as microaneurysms and intraretinal hemorrhages. Fundus Photography is more advanced in detecting lesions like cotton wool spots and neovascularization in the early stage of diabetic retinopathy.

Both devices showed moderate accuracy, the combined use of OCT and FP may be an accurate diagnostic tool for early diagnosis of DR. Integrating OCT's ability to visualize retinal microstructure with Fundus Photography's capacity for wide-field imaging may provide a more comprehensive assessment of DR.

The choice between OCT and Fundus Photography should be made by individual patient characteristics, lesion types, and clinical requirements. For example, in cases where structural changes are of concern, OCT may be preferred for its high sensitivity. Fundus Photography may be chosen when assessing characteristic lesions.

This study is not without limitations, including its small sample size and single-center design. Further large-scale, multi-center studies are warranted to validate these findings and explore additional factors influencing modality selection in DR diagnosis.

Conclusion:

In conclusion, our study highlights the important roles of OCT and Fundus Photography in the early detection of diabetic retinopathy. While OCT offers superior sensitivity in detecting structural changes, Fundus Photography provides higher specificity for characteristic lesions. A combined approach utilizing both modalities may optimize diagnostic accuracy and facilitate personalized management strategies for patients with diabetes mellitus. Future research efforts should focus on refining imaging techniques and standardizing interpretation protocols.

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