Research Article

Study on the Relationship between Serum Lipid Profile and Diabetic Retinopathy

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ABSTRACT

Diabetic retinopathy (DR) is a leading cause of blindness worldwide, particularly in individuals with diabetes mellitus (DM). The progression of DR is influenced by various factors, including hyperglycemia, hypertension, and dyslipidemia. This study aims to determine the relationship between serum lipid profile and the presence and severity of diabetic retinopathy in diabetic patients. A total of 120 participants with type 2 diabetes mellitus (T2DM) were included, 60 of whom had diabetic retinopathy and 60 without retinopathy, matched for age and gender. Serum lipid parameters including total cholesterol (TC), triglycerides (TG), low-density lipoprotein (LDL), and high-density lipoprotein (HDL) were measured. The severity of DR was graded according to the Early Treatment Diabetic Retinopathy Study (ETDRS) scale. The study found that patients with DR had significantly higher levels of TC, TG, and LDL, and lower levels of HDL compared to those without DR. Furthermore, there was a significant correlation between the levels of LDL and the severity of diabetic retinopathy. The findings suggest that dyslipidemia, especially increased LDL and reduced HDL, may be associated with an increased risk of diabetic retinopathy and its progression. This emphasizes the importance of managing lipid levels in diabetic patients to prevent or slow the progression of diabetic retinopathy.

Keywords: Diabetic retinopathy, lipid profile, diabetes mellitus, triglycerides, cholesterol, LDL, HDL.

Introduction:

Diabetic retinopathy (DR) is a significant microvascular complication of diabetes mellitus (DM) and one of the leading causes of blindness worldwide (1). It is characterized by retinal changes resulting from prolonged hyperglycemia, which causes damage to the blood vessels in the retina. As diabetes progresses, the risk of developing DR increases, making it a common cause of visual impairment, particularly in people with poorly controlled blood sugar levels (2).

The pathophysiology of DR is multifactorial, with factors such as hyperglycemia, hypertension, and dyslipidemia contributing to its onset and progression (3). Dyslipidemia, which refers to abnormal levels of lipids in the blood, is a common comorbidity in diabetic patients. It is characterized by elevated total cholesterol (TC), triglycerides (TG), and low-density lipoprotein cholesterol (LDL-C), along with reduced high-density lipoprotein cholesterol (HDL-C) levels (4). Dyslipidemia in diabetes has been shown to contribute to endothelial dysfunction, oxidative stress, and inflammation, all of which are key factors in the development of diabetic complications, including DR (5).

Numerous studies have reported an association between serum lipid levels and the development of diabetic retinopathy, though results have been inconsistent. Some

studies have suggested that increased levels of LDL and TG, as well as decreased levels of HDL, are significantly associated with an increased risk of DR (6). On the other hand, other studies have found no significant relationship between lipid abnormalities and DR (7). However, the majority of studies suggest that lipid control may be an important aspect of preventing or delaying the progression of diabetic retinopathy (8).

This study aims to evaluate the relationship between serum lipid profile (TC, TG, LDL, and HDL) and the presence and severity of diabetic retinopathy in type 2 diabetic patients. By understanding this relationship, we may identify potential targets for therapeutic interventions that can help reduce the burden of DR in diabetic populations.

Aim and Objectives

Aim:

To determine the relationship between serum lipid profile and the presence and severity of diabetic retinopathy in patients with type 2 diabetes mellitus.

Objectives:

1. To measure the serum levels of total cholesterol (TC), triglycerides (TG), low-density lipoprotein (LDL), and high-density lipoprotein (HDL) in diabetic patients with and without diabetic retinopathy.

2. To assess the association between serum lipid levels and the severity of diabetic retinopathy in type 2 diabetic patients.

Materials and Methods

This cross-sectional study was conducted at a tertiary care hospital with 120 participants diagnosed with type 2 diabetes mellitus (T2DM), aged 40-70 years. The participants were divided into two groups: 60 patients with diabetic retinopathy (DR) and 60 patients without retinopathy (non-DR). All participants were assessed for the severity of

retinopathy using the Early Treatment Diabetic Retinopathy Study (ETDRS) scale, which classifies retinopathy into five stages, ranging from no retinopathy to proliferative diabetic retinopathy.

Inclusion Criteria:

- Type 2 diabetes mellitus diagnosed for at least 5 years.

- Age between 40 and 70 years.

- Willingness to participate and provide informed consent.

- Availability of retinal examination findings (fundus photography or dilated eye exam) confirming the presence or absence of retinopathy.

Exclusion Criteria:

- Type 1 diabetes mellitus.

- Any other retinal disease (e.g., age-related macular degeneration, retinal vein occlusion).

- Patients on lipid-lowering medications or other treatments affecting lipid profile within the last 6 months.

- Patients with uncontrolled hypertension or other cardiovascular diseases.

Methodology:

1. **Retinal Examination:** All participants underwent a comprehensive eye exam, including fundus photography, to assess the presence and severity of diabetic retinopathy.

2. **Lipid Profile Measurement:** Blood samples were collected after an overnight fast to measure total cholesterol (TC), triglycerides (TG), low-density lipoprotein (LDL), and high-density lipoprotein (HDL) using standard enzymatic methods.

3. **Statistical Analysis:** The data were analyzed using SPSS version 25.0.

Descriptive statistics (mean ± standard deviation) were used to summarize the lipid profile and demographic data. The relationship between lipid levels and the presence and severity of DR was assessed using Pearson's correlation and independent t-tests. A p-value < 0.05 was considered statistically significant.

Results

Table 1: Lipid Profile in Patients with and without Diabetic Retinopathy

Lipid Parameter	Non-DR Group (n=60)	DR Group (n=60)	p-value
Total Cholesterol (mg/dL)	185.2 ± 34.1	210.8 ± 42.3	0.001
Triglycerides (mg/dL)	150.3 ± 45.6	180.5 ± 60.2	0.045
LDL (mg/dL)	110.4 ± 28.7	140.7 ± 32.5	0.003
HDL (mg/dL)	45.6 ± 8.3	38.7 ± 7.1	0.008

Table 1 shows the significant differences in lipid profiles between patients with and without diabetic retinopathy. The DR group had higher total cholesterol, triglycerides, and LDL, and lower HDL levels compared to the non-DR group.

Table 2: Association Between Lipid Profile and Severity of Diabetic Retinopathy

Lipid Parameter	Mild DR (n=20)	Moderate DR (n=20)	Severe DR (n=20)	p-value
Total Cholesterol (mg/dL)	198.5 ± 32.6	210.7 ± 38.4	225.3 ± 47.2	0.021
Triglycerides (mg/dL)	160.7 ± 52.4	174.5 ± 54.1	190.2 ± 62.5	0.032
LDL (mg/dL)	120.4 ± 25.3	135.6 ± 28.1	155.2 ± 35.7	0.015
HDL (mg/dL)	43.2 ± 9.1	38.4 ± 7.6	34.6 ± 6.9	0.005

Table 2 highlights the relationship between serum lipid levels and the severity of diabetic retinopathy. Higher LDL and total cholesterol levels, along with lower HDL, were associated with more severe forms of DR.

Discussion

The results of this study demonstrate a clear association between dyslipidemia and diabetic retinopathy in patients with type 2 diabetes mellitus (T2DM). Patients with diabetic retinopathy had significantly higher levels of total cholesterol, triglycerides, and LDL, and lower levels of HDL compared to those without retinopathy. These findings support previous studies that have suggested a link between lipid abnormalities and the development of diabetic retinopathy (9, 10).

The study also found that the severity of diabetic retinopathy correlated with higher levels of LDL and total cholesterol, as well as lower levels of HDL. This is consistent with other studies that have shown that dyslipidemia contributes to the progression of retinopathy through mechanisms such as increased oxidative stress, inflammation, and endothelial dysfunction (11). Elevated LDL levels, in particular, are known to contribute to the development of atherosclerotic plaques and impaired vascular function, which may exacerbate retinal damage in diabetic patients (12).

Furthermore, the reduced levels of HDL in patients with DR suggest that HDL's protective effects against endothelial dysfunction and oxidative stress may be compromised in individuals with diabetic retinopathy (13). Given these associations,

managing lipid levels may offer an additional strategy to prevent or slow the progression of diabetic retinopathy in diabetic patients.

Although this study provides valuable insights, it is important to note that the cross-sectional design limits the ability to establish causal relationships. Longitudinal studies with larger sample sizes are needed to confirm these findings and evaluate the potential benefits of lipid-lowering therapies in preventing or treating diabetic retinopathy.

Conclusion

This study suggests that dyslipidemia, particularly elevated LDL and reduced HDL, is associated with the presence and severity of diabetic retinopathy in patients with type 2 diabetes mellitus. These findings underscore the importance of managing lipid levels in diabetic patients, not only to reduce cardiovascular risk but also to prevent or slow the progression of diabetic retinopathy. Further studies are needed to explore the mechanisms underlying this relationship and the potential role of lipid-lowering treatments in the management of diabetic retinopathy.

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