ORIGINAL RESEARCH

Diabetic retinopathy and it's relationship with lipid profile in Assam- a clinical study

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ABSTRACT

Background: Diabetes mellitus is a growing pandemic in modern times. Regular monitoring of the blood lipid profiles is necessary to determine the best course of treatment to prevent complications like diabetic retinopathy. This study aims to assess serum lipid profile in type 2 diabetes mellitus (T2DM) and their relationship with the severity of diabetic retinopathy. **Methods and Material:** A hospital based cross sectional study was conducted on seventy five patients. Their fasting lipid profile- HDL, LDL, VLDL, total cholesterol, TGL, HbA1c, renal function test, FBS, PPBS were calculated. Retinal findings for severity of diabetic retinopathy were correlated to serum lipids levels. **Results:** Of total patients, 78.6% had dyslipidaemia. The association between lipid profile parameters and severity of diabetic retinopathy showed that triglyceride and total cholesterol showed significant positive correlation while HDL showed negative correlation. **Conclusions:** Significant association of serum cholesterol, triglyceride, and HDL with the severity of diabetic retinopathy indicates the importance of correcting dyslipidemia to prevent the development and progression of diabetic retinopathy.

Key-words: Diabetic retinopathy, dyslipidaemia, type 2 diabetes mellitus.

INTRODUCTION

Diabetes mellitus describes a group of metabolic disorders characterized by the presence of hyperglycaemia due to defects in insulin secretion or action leading to microangiopathy and macroangiopathy. [1] Type 2 diabetes mellitus include those patients whose body fail to respond to insulin produced by the pancreas.[2]

India carried a burden of 77 million diabetics in 2019 which is expected to rise to 123.5 million by 2045. [2]

Diabetic retinopathy is one of the most common micro-vascular complications of diabetes mellitus. Chronically raised blood sugar levels increase reactive oxygen species, decrease nitric oxide and increase fatty acids leading to vascular complications. [3] Dyslipidaemia, characterised by raised serum total cholesterol (TC), triglyceride (TG), low density lipoprotein cholesterol (LDL-C) and reduced high density lipoprotein cholesterol (HDL-C) causes inactivation of nitric oxide by radicals and inhibition of nitric oxide formation leading to endothelial dysfunction. [4]

Various social and ethnicity factors like locality, education, awareness, lifestyle influence the lipid profile and diabetic retinopathy. Due to scarcity of data in local literature and variable data in different international studies, this study was conducted to explore the association of serum lipid levels and diabetic retinopathy in the local population.

MATERIALS AND METHODS

A hospital based cross sectional study was conducted on three hundred seventy five outpatients having diabetic retinopathy at a tertiary care hospital in Assam from January 2022 to June 2022. The study included Type 2 diabetes mellitus cases over the age of forty having diabetic retinopathy. Patients on lipid lowering agents like statin and fibrate, steroids, oral contraceptives,chronic kidney disease, severe media opacity and hypertension were excluded from the study.

All patients' written and informed consent in their vernacular language were taken before including them in the study. This study was conducted after due approval of the Institutional Ethical Committee.

Detailed ocular and systemic history using a standard questionnaire and a thorough ocular examination including best corrected visual acuity (worse eye was opted for analysis in the study) using Snellen chart, slit lamp biomicroscopy with 90 D lens, indirect ophthalmoscopy with 20 D lens and fundus fluoroscein angiography in selected cases. A 30 degree colour photograph was obtained using Carl Zeiss visucam 524 fundus camera after full dilatation of the pupil. OCT imaging was done using Primus 200 Spectre Spectral domain OCT with software version 4.0

Patients were divided into 4 groups based on severity of retinopathy using Early Treatment Diabetic Retinopathy Study (ETDRS) criteria.

5 ml of venous blood was obtained after overnight (10-12 hrs) fasting followed by assessment of fasting blood sugar and lipid levels using National Cholesterol Education Programme (NCEP-ATP III) categorisation. (using photometric enzymatic method VITROS 5600/XT 7600 Integrated Systems) FBS, PPBS, FLP (total cholesterol, HDL, LDL, VLDL, TGL), HbA1c, complete blood count, renal function test were performed on the blood sample.

SPSS Version 21 was used for data analysis. Categorical variables were assessed using frequency while numerical variables were expressed as . The finding was considered statistically significant when p value was less than 0.05.

RESULTS

There were seventy five patients included in the study of which two hundred sixty were male (69%) and one hundred fifteen (31%) female. The study population's age ranged from 42-80 years with mean age 61.20 (± 9.8) years. Majority (66%) of the patients were between the ages of 50 to 69. The mean duration of diabetes in the study population was 11.61± 3.564 years, longest being 21 years while the shortest was 4 years. The sociodemographic distribution of study population is shown in Table 1. The mean glycosylated haemoglobin of the study was found to be 7.17 ± 1.61. Based on HbA1c >7%, approximately two hundred eighty eight had poor glycemic control. Among diabetics, twenty (5.33%) patients were on diet and exercise alone, one hundred twenty (32%) were on oral hypoglycaemic agents (OHA), one hundred forty five (38.66%) were on insulin alone while ninety (24%) were on both insulin and OHA. The renal function test and routine urine were normal in all patients. Dyslipidaemia (any abnormal level of TC, LDL, VLDL, TG, HDL) was found in two hundred ninety five (78.6%) subjects.

Of 375 patients with retinopathy, 125 (33.33%) were found to have moderate non proliferative diabetic retinopathy(NPDR) followed by 105 (28%) with severe NPDR, 90 (24%) with mild NPDR, 55 (14.67%) with proliferative diabetic retinopathy (PDR). Table 2 shows the distribution of severity of diabetic retinopathy.

In the study, relationship between lipid profile with severity of diabetic retinopathy was found to be significantly positive for total cholesterol and triglyceride but a negative correlation with serum HDL. ($p < 0.05$ using Pearson's correlation test). Table 3 shows results of lipid profile with diabetic retinopathy severity.

Table 1- Sociodemography of study subjects

Variable	Category	Frequency	Percentage
Age	<50	50	13.3
	50-59	125	33.3
	60-69	125	33.3
	70-79	65	17.3
	>80	10	2.6
Gender	male	260	69
	female	115	31

Table 2- Distribution of diabetic retinopathy severity

DR grade	Frequency	Percent
MILD NPDR	90	24
MODERATE NPDR	125	33.33
SEVERE NPDR	105	28
PDR	55	14.67

Table 3- Correlation of lipid profile with severity of diabetic retinopathy

Biochemical parameter	statistical test	mild NPDR[a]	mod NPDR	sev NPDR	PDR[b]
TC	0.820 (p=0001)*	265.44+/-47.5	340.18+/- 35.2	358.92 +/- 21.5	364.61 +/- 29.7
HDL	-0.746 (p= 0.0001)*	35.83+/-7.1	28.09+/- 5.2	27.64+/-4.4	25+/-3.2
LDL	0.038 (p= 0.0648)	135.93+/-35.4	144.35+/-20.1	146.61+/-45	153.52+/-52.7
VLDL	0.017 (p=0.839)	32.45+/-17	33.42+/-6.2	36.14+/-16.5	38.14+/-20.4
Triglyceride	0.757 (p=0.0001)*	215.77+/-55.7	251.42+/-31.8	254.95+/-53.3	262.59+/-47.8

* correlation is significant when p value <0.05
[a] Non proliferative diabetic retinopathy
[b] Proliferative diabetic retinopathy

DISCUSSION

The target for good glycaemic control as recommended by American Diabetes Association (ADA) is HbA1c of <7 %. A controlled glycaemic status prevents or delays the progression of complications of diabetic mellitus. [5]

Hyperglycaemia is responsible for a biochemical cascade releasing cytokines and vasoactive substances that injures the vascular endothelium.[3,] [5] Dyslipidaemia on the other hand promotes peroxidation of lipids and lipoproteins releasing reactive carbonyl species that mediate recruitment of macrophages. This further cause endothelial disruption leading to breakdown of the blood retinal barrier and education of serum lipids and lipoproteins causing diabetic retinopathy.[4]

There are contradictory reports regarding effect of lipid profile on retinopathy.

Early Treatment Diabetic Retinopathy Study (ETDRS) Report 22 [6] and Miljanovic et al(2004) [7] showed elevated total serum cholesterol, triglyceride and LDL levels at baseline are associated with an increased risk of retinal hard exudate compared to those with normal lipid profile. Chew et al [6] also stated patients with raised serum total cholesterol, LDL or triglyceride who did not have hard exudates at first visit were at an increased risk of developing them at subsequent follow up. Our study is similar to Shan Y (2022), [8] and Ucgun et al(2007),[9] where positive correlation was found between serum cholesterol and progression of diabetic retinopathy.

R Raman et al(2010) [10] and Massin et al (2014) [11,] reported a positive correlation between high serum triglyceride (r=0.068) and LDL cholesterol with DR. On the contrary, although Ucgun et al(2007) [9] reported raised LDL levels with progression of DR, it showed triglycerides have no effect on the outcome of DR. Similarly, Shan Y (2022) [8] reported a strong association of triglyceride and HDL (r=0.142) with DR but a negative correlation (r= −0.016) of LDL with DR.

Chennai Urban Rural Epidemiology, Rema et al (2006) [12] showed that LDL has more association with diabetic macular edema than diabetic retinopathy. ACCORDION et al (2016)[13]stated that severity of retinopathy is influenced by low HDL cholesterol and raised triglyceride levels.

On the contrary, Nargis Parveen et al (2012) [14] showed that except total cholesterol all fractions of lipids are significantly related to the development and progression of retinopathy.

It was reported that intensive glycaemic control combined with treatment of dislipidaemia reduced the rate of progression of diabetic retinopathy and fenofibrate reduced the incidence of diabetic macular edema. [11]

The discrepancies in different studies might be due to the different ethnicities of the study population which affect the influence of established risk factors like duration of diabetes, severity of hyperglycaemia, insulin resistance, central obesity, hypertension and heredity. It may be hypothesised that serum lipid levels affect different populations at different levels, however this will require further studies.

CONCLUSION

Serum lipid levels play a salient role in the progression of diabetic retinopathy. Significant association was seen in the distribution of total serum cholesterol, HDL cholesterol and triglyceride in patients with diabetic retinopathy as well as its progression. Lipid lowering agents may be effective in delaying the onset and progression of diabetic retinopathy.

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Conflict of interest: None

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