Brief Communication

Association of serum lipids with diabetic retinopathy in type 2 diabetes

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ABSTRACT

A total number of 140 type 2 diabetic patients with diabetic retinopathy (DR) were enrolled in the study from diabetic clinic during May 2011 till June 2012 to determine correlation between severity of DR with serum lipid and other modifiable risk factors in type 2 diabetic patients. Information including age, sex, height, body weight, body mass index (BMI), waist-hip ratio (WHR), and systolic and diastolic blood pressure was collected from each patient. Fasting plasma sugar, low density lipoprotein (LDL), triglyceride level (TG), high density lipoprotein (HDL), glycated hemoglobin ($HbA1_c$), creatinine, and 24 h urinary albumin excretion was done for each patient. Estimated glomerular filtration rate (eGFR) was measured by modification of diet in renal disease (MDRD) equation. Patients were divided in five groups according to retinopathy status based on early treatment DR study (ETDRS) disease severity level. Statistical analysis was performed with Statistical Packages for Social Sciences (SPSS) statistical software (version 17.0 for Windows). The alpha level was set at $P = 0.05$ for all tests. Statistically significant positive correlation between severity of DR with systolic blood pressure $P = 0.005$ (r = 0.974), diastolic blood pressure $P = 0.001$(r = 0.994), LDL $P = 0.005$ (r = 0.976), TG $P = 0.001$ (r = 0.990), and 24 h urinary albumin $P = 0.004$ (r = 0.977) was documented. DR was also strongly positively correlated with smoking $P = 0.017$ (r = 0.941) and duration of diabetes $P = 0.003$ (r = 0.981). There was strong inverse correlation of DR with HDL $P = 0.001$ (r = –0.994) and eGFR $P = 0.002$ (r = –0.987). Serum lipids were significantly correlated with severity of DR.

Key words: Diabetic retinopathy, fasting blood sugar, low density lipoprotein

Introduction

Diabetic retinopathy (DR) is a major microvascular complication of diabetes accounting for its leading cause of irreversible blindness worldwide. Assessing the risk factors of DR, particularly modified risk factors, is important for early intervention to reduce the onset and progression of DR. Several population-based epidemiological studies have investigated the risk factors of DR.[1] These studies consistently established that a longer diabetic duration, hyperglycemia, and hypertension were associated with increased risk of DR. High serum lipid levels have also been proposed as a risk factor for DR. High lipid levels are known to cause endothelial dysfunction due to a reduced bioavailability of nitric oxide and this endothelial dysfunction was suggested to play a role in retinal exudate formation in DR.[2] It was also reported that the peroxidation of lipids in lipoproteins in the vascular wall leads to local production of reactive carbonyl species that mediate recruitment of macrophages, cellular activation and proliferation, and also chemical modification of vascular proteins by advanced lipoxidation end-products which affect both the structure and function of the vascular wall.[3] Consequently, it was proposed that, hyperlipidemia might contribute to DR and macular edema (ME) by endothelial dysfunction and breakdown of the blood retinal barrier leading to exudation of serum lipids and lipoproteins.[4]

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Objective

To determine correlation between severity of DR with serum lipid and other modifiable risk factors in type 2 diabetic patients.

Materials and Methods

This was a retrospective study done in department of endocrinology and metabolism LLRM medical college. A total number of 140 type 2 diabetic patients with DR were recruited from diabetic clinic during May 2011 till June 2012. Information including age, sex, height, body weight (WT), body mass index (BMI), waist-hip ratio (WHR), and systolic and diastolic blood pressure was collected from each patient. Fasting plasma sugar, low density lipoprotein (LDL), triglyceride level (TG), high density lipoprotein (HDL), glycated hemoglobin ($HbA1_C$), creatinine, and 24 h urinary albumin excretion was done for each patient. Estimated glomerular filtration rate (eGFR) was measured by modification of diet in renal disease (MDRD). Patients were divided in five groups according to retinopathy status based on early treatment DR study (ETDRS) disease severity level.[5] Statistical analysis was performed with Statistical Packages for Social Sciences (SPSS) statistical software (version 17.0 for Windows). The alpha level was set at $P = 0.05$ for all tests.

Results

As shown in Table 1 there was statistically significant positive correlation between severity of DR and systolic blood pressure $P = 0.005$ (r = 0.974), diastolic blood pressure $P = 0.001$ (r = 0.994), LDL $P = 0.005$ (r = 0.976), TG $P = 0.001$ (r = 0.990), and 24 h urinary albumin $P = 0.004$ (r = 0.977). DR was also strongly positively correlated with smoking $P = 0.017$ (r = 0.941) and duration of diabetes $P = 0.003$ (r = 0.981). There was strong negative correlation of DR with HDL $P = 0.001$ (r = -0.994) and eGFR $P = 0.002$ (r = -0.987).

Discussion

Endothelial dysfunction is a well-known finding in hypercholesterolemic patients and it was proposed that, hyperlipidemia might contribute to DR and ME by endothelial dysfunction and breakdown of the blood retinal barrier leading to exudation of serum lipids and lipoproteins.[4] In this study we have evaluated the modifiable risk factor of DR and there correlation with severity of DR. There are conflicting reports in the literature regarding the effect of lipid profile on retinopathy or maculopathy. In ETDRS it was shown that patients with high total cholesterol and LDL levels were more likely to have retinal hard exudates compared to patients with normal lipid profile.[6] In our study, we found a significant correlation between serum lipids and DR, but there was no association between HbA1c and DR. Similarly, Chennai Urban Rural Epidemiology Study showed that mean cholesterol, triglyceride, and non-HDL levels were higher in patients with DR compared to those without DR.[7]

Conclusion

Hypercholesterolemia, systolic and diastolic blood pressure, renal function, and urine albumin excretion is significantly associated with progression of DR.

Table 1: Clinical characteristic of different groups of DR

	Mild NPDR *N*=39	Moderate NPDR *N*=30	Severe NPDR *N*=23	Mild PDR N=29	High risk PDR *N*=19	*r*	*P* value
Age (years)	43.21±7.4	44.32±6.8	45.13±7.1	45.89±7.4	48.46±4.4	*r*=0.965	0.008
Smoker	11 (28%)	10 (33%)	10 (43%)	12 (41%)	9 (47%)	*r*=0.941	0.017
Duration of DM (years)	12.05±6.82	13.41±6.43	14.97±7.24	15.32±7.81	17.69±6.87	*r*=0.981	0.003
BMI (kg/m^2)	26.43±6.32	27.16±7.24	26.98±6.71	25.78±5.42	25.83±8.54	*r*=-0.641	0.243
WHR	1.01±0.13	1.02±0.14	1.01±0.11	1.02±0.11	1.04±0.11	*r*=0.775	0.124
Systolic BP (mmHg)	122.4±12.6	130.2±14.2	132.4±15.6	135±16.7	139.81±17.9	*r*=0.974	0.005
Diastolic BP (mmHg)	82.08±4.2	83.78±5.3	85.77±5.7	86.74±6.1	88.18±8.2	*r*=0.994	0.001
FBS (mg/dl)	158.87±93.24	161.22±94.47	149.89±91.47	159.72±89.27	146.23±87.23	*r*=-0.663	0.251
HbA1c (%)	8.4±5.3	9.1±3.4	8.7±2.7	9.8±2.9	8.4±2.2	*r*=0.188	0.762
Urinary albumin (mg/day)	12.42±6.24	18.46±8.58	46.82±11.4	52.44±18.23	78.46±28.31	*r*=0.977	0.004
LDL (mg/dl)	152.34±57.43	155.67±54.37	159.28±53.86	160.26±55.86	166.84±48.79	*r*=0.976	0.005
TG (mg/dl)	162.24±59.43	167.78±62.87	172.27±64.52	175.79±62.19	178.43±58.48	*r*=0.990	0.001
HDL (mg/dl)	48.13±8.15	47.19±9.42	44.87±7.56	43.23±8.38	41.26±6.61	*r*=-0.994	0.001
Creatinine (mg/dl)	97.02±0.94	1.02±1.08	1.12±1.21	1.32±1.44	2.34±2.56	*r*=0.847	0.070
eGFR (ml/min/1.73m^2 BSA)	94.23±20.56	88.52±24.46	72.98±32.47	68.24±32.12	58.54±42.66	*r*=-0.987	0.002

DM: Diabetes mellitus, BMI: body mass index, WHR: Waist-hip ratio, BP: Blood pressure, FBS: Fasting blood sugar, LDL: Low density lipoprotein, TG: Triglyceride, HDL: High density lipoprotein, eGFR: Estimated glomerular filtration rate, DR: Diabetic retinopathy, NPDR: Nonprolifreative DR, PDR: Proliferative DR

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