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CORRELATION BETWEEN HYPERTENSION AND DIABETES WITH SERUM LIPID DISTURBANCES IN INDIAN POPULATION

Cardiology

Deepesh Agarwal Associate Professor, Department of Cardiology, Mahatma Gandhi Cardiac and Critical Care Center, Jaipur, Rajasthan, India

Ramanand P Sinha* Associate Professor, Department of Cardiology, Mahatma Gandhi Cardiac and Critical Care Center, Jaipur, Rajasthan, India *Corresponding Author

ABSTRACT

Background: Dyslipidaemia has been considered as the significant cause of mortality and morbidity in cardiovascular diseases. In the present study we sought to determine the connection of lipid disturbances in diabetic and hypertensive patients compared against non-diabetic and normotensive control patients.

Methods: A total of 310 patients were included in this retrospective, single-centre study conducted between February 2013 and January 2014. The patients were divided in two groups; case group, those who were suffering from comorbid diabetes and hypertension and control group, those who neither suffered from diabetes nor hypertension. Patients were evaluated diabetes and hypertension along with basic demography and lipid profile.

Results: Of total 310 patients, 164 patients diagnosed with diabetes and hypertension both (case group), and a control group of 146 patients who neither suffered from diabetes nor hypertension. Significant differences were observed in triglycerides (TG) (p value <0.001; CI = 1.53-3.88), high density lipoprotein (HDL) in males (p value <0.05; CI = 1.11-3.69), TG/non-HDL cholesterol (p value <0.05; CI = 1.12-2.75) and TG/HDL lipid parameters (p value <0.01; CI = 1.29-3.23).

Conclusion: The present study demonstrates that patients with hypertension and diabetes have disturbed lipid profile than the patients without hypertension and diabetes. Hypertensive and diabetic patients should be evaluated for lipid profile at regular intervals for better management and prevention of CVD.

KEYWORDS

cholesterol; diabetes mellitus; dyslipidaemia; hypertension

INTRODUCTION

The predominance of hypertension and diabetes mellitus is increasing globally with a major contribution from developing countries. In India, the prevalence of hypertension and diabetes mellitus was found to be 7.5% and 25.3%, respectively1. Hypertension and diabetes mellitus both are considered as the established major risk factors for cardiovascular diseases (CVD). Inflammation and oxidative stress play a crucial role in insulin resistance and CVD. Insulin resistance in diabetes disturbs the activity of various enzymes and pathways of lipid metabolism. Furthermore, various studies have proved that most of the hypertensive patients take inconsistence medications which may lead to irregular lipid profile in addition to the vascular endothelial damage2-6.

Dyslipidaemia [increased triglyceride (TG) and low density lipoprotein (LDL) and total cholesterol level and decreased high density lipoprotein (HDL) level] is the major mechanism by which diabetes promotes atherosclerosis. The normal physiology of vascular endothelium also gets disturbed by altered lipid profile which contribute to the initiation of atherosclerosis, . Thus, dyslipidaemia has been considered as the significant cause of mortality and morbidity in CVD patients. Evidence suggests that both diabetes mellitus and hypertension have been sturdily allied with higher mortality in CVD patients rather that diabetes mellitus and hypertension alone7. Thus, in the present study we sought to determine the connection of lipid disturbances in diabetic and hypertensive patients compared against non-diabetic and normotensive control patients.

METHODS

This was a retrospective, single-centre study conducted between February 2013 and January 2014. Patients were selected consecutively from the outpatient department by the attending physician. Patients who neither suffered from diabetes nor hypertension and those who suffered from both were included in this study. Patients who suffered from either only diabetes mellitus or only hypertension were excluded from this study. Patients with any major cardiac anomalies, renal or hepatic insufficiency, cancer, obstructive pulmonary disorders or having other major medical problems were excluded from the study. Patients that were on hypolipidemic drug were also excluded from this study. The patients were divided in two groups; case group, those who were suffering from comorbid diabetes and hypertension and control group, those who neither suffered from diabetes nor hypertension. The study protocol was approved by the Institutional Ethics Committee. As a part of associated hospital practice, a written consent and data release form was signed by each patient, irrespective of any study to be conducted in the future.

A total of 310 patients were included in this study during the specified inclusion period. All the evaluated patients were asked to report their basic details like age, gender, and smoking status. The patients were considered hypertensive if they were known cases of hypertensive or their systolic blood pressure exceeded 140 mmHg and/or diastolic blood pressure exceeded 90 mmHg as evaluated by physician. Patients with fasting blood glucose levels >126 mg/dl, glycated haemoglobin levels >6.5% or known cases of diabetes were considered as diabetic. Patients who managed their blood pressure or glucose levels with respective medications were also considered to suffer from hypertension and diabetes.

All the patients were evaluated for total cholesterol, HDL, LDL, very low density lipoprotein (VLDL), TG, non-HDL cholesterol, TG/HDL cholesterol and TG/non-HDL cholesterol.

STATISTICAL ANALYSIS

Data were entered and analysed using SPSS version 15.0 (IBM, USA). Data were reported as mean and standard deviation for continuous variables and percentages for categorical variables. Variables were compared using independent sample t-test for normally distributed data and Mann-Whitney U test for non-normally distributed data. P-value <0.05 was considered statistically significant.

RESULTS

A total of 310 patients were included in this study, 164 patients diagnosed with diabetes and hypertension both (case group), and a control group of 146 patients who neither suffered from diabetes nor hypertension. The mean age of the population in case group was 56.7 ± 10.2 years and 55.9 ± 10.2 years in control group. Majority of patients in both the groups were male, 79.3% and 75.3% in case group and control group, respectively. Significantly more numbers of patient were smokers in case group than control group (p value, 0.001). Other laboratory and demographic details are depicted in Table 1.

A differential diagnosis of females between the groups showed no significant difference, while differential diagnosis of male population showed significant difference in various parameters like total cholesterol, TG, HDL, VLDL, non-HDL cholesterol and TG/non-HDL cholesterol between the groups, as shown in Table 2. The total cholesterol, TG, HDL, LDL, TG/HDL cholesterol concentration were

compared between the Groups, as shown in Table 3. There were no significant differences in total cholesterol and LDL levels between the groups (p values = 0.11 & 0.63; CI = 0.91-2.39 & 0.7-1.80, respectively). Significant differences were observed in TG (p value <0.001; CI = 1.53-3.88), HDL in males (p value <0.05; CI = 1.11-3.69), TG/non-HDL cholesterol (p value <0.05; CI = 1.12-2.75) and TG/HDL lipid parameters (p value <0.01; CI = 1.29-3.23).

DISCUSSION

Hypertension and diabetes are recognised globally as major risk factors for CVD, stroke, and renal diseases. According to studies, about 80% of hypertensive and 97% of diabetic patients have comorbidities such as obesity and one or more abnormalities in lipid metabolism , . In this study, the control group had significantly less BMI values than the case group. The present study investigates link between lipid levels and hypertension and diabetes among Indian population. The present study showed significant difference between the control group and case group in lipid parameters like TG, HDL, VLDL, non-HDL cholesterol, TG/HDL and TG/non-HDL cholesterol levels. A significantly more number of smokers (p value=0.001) were present in the case group than the control group.

Our study showed no significant difference in any of the parameters between the groups of females. Female patients with diabetes and hypertension and without diabetes and hypertension had p values ≥0.3 for all the lipid parameters. Contrary to female patients, male patients had significant difference between the groups for several lipid parameters. In male patients group, patients with both diabetes and hypertension had significantly higher values of total cholesterol, TG, HDL, VLDL. Major lipid parameter disorder in the present study was hypertriacylglycerolemia, more than half of patients (53.7%) in case group and almost one third patients in control group had TG values >150 mg/dl. A fasting TG level >150 mg/dl is considered one of the criteria for high risk of CVD 11. Several such studies showed higher proportion of female patients than the males, while in our study male population was high 12-14.

Studies round the globe had found that the chronicity of diabetes and hypertension bothered lipid levels 15-17; our study showed similar data where low HDL levels and high TG/HDL levels were observed in diabetic and hypertensive group. Diabetes, hypertension and lipid profiles play a pivotal role in development of CVD, some studies have shown high rate of mortality in Asian countries due to CVD than the rest of the world 18-20. The present study provides a hint of link between these culprit comorbidities.

CONCLUSION

The present study demonstrates that patients with hypertension and diabetes have disturbed lipid profile than the patients without hypertension and diabetes. Hypertensive and diabetic patients should be evaluated for lipid profile at regular intervals for better management and prevention of CVD.

Table 1 – Basic characteristic of patients

	No DM and HT (n = 146)	DM and HT (n = 164)	P value
Age, mean ± SD, years	55.9±10.2	56.7±10.2	0.8
Males, n (%)	110(75.3%)	130(79.3%)	0.41
BMI, kg/m2	21.6±2.3	22.8±2.8	0.001
Smoking, n (%)	57(39.0%)	141(86.0%)	0.001
Total cholesterol, mg/dl	175.6±51.5	192.8±59.9	0.014
Triglycerides, mg/dl	138.3±78.3	175.8±88.5	0.001
HDL cholesterol, mg/dl	34.5±10.4	37.2±9.1	0.002
LDL cholesterol, mg/dl	111.8±43.4	120.6±52.1	0.24
VLDL cholesterol, mg/dl	27.8±16.5	33.3±14.7	0.001
Non-HDL cholesterol, mg/dl	141.2±47.5	155.7±56.6	0.03
TG/HDL cholesterol	4.2±2.5	5.7±7.7	0.007
TG/non-HDL cholesterol	1.0±0.6	1.2±0.7	0.001

DM – Diabetes mellitus, HT – hypertension, BMI - body mass index, HDL – high density lipoprotein, LDL – low density lipoprotein, VLDL – very low density lipoprotein, TG - triglyceride

Table 2 – Comparison of lipid profile of genders between the groups

	Female n = 70			Male n = 240		
	No DM and HT (n=36)	DM and HT (n=34)	P value	No DM and HT (n=110)	DM and HT (n=130)	P value
Age, mean ± SD, years	57.3±10.1	57.5±10.9	0.92	55.5±10.3	56.5±10.1	0.42
Total cholesterol, mg/dl	182.9±53.9	192.8±50.2	0.43	173.3±50.7	192.8±62.4	<0.01
Triglycerides, mg/dl	151.4±97.7	159.1±56.7	0.69	134.1±70.8	180.2±94.8	<0.001
HDL cholesterol, mg/dl	38.8±12.7	37.8±9.4	0.7	33.1±9.2	37.0±9.0	<0.01
LDL cholesterol, mg/dl	114.6±41.0	121.8±46.3	0.49	110.9±44.4	120.3±53.8	0.14
VLDL cholesterol, mg/dl	29.9±19.5	31.3±11.4	0.70	27.2±15.5	33.8±15.4	<0.01
Non-HDL cholesterol, mg/dl	144.0±51.2	155.0±46.6	0.35	140.2±46.5	155.8±59.0	<0.05
TG/HDL cholesterol	4.0±2.3	6.2±12.4	0.30	4.3±2.4	5.3±6.0	0.1
TG/non-HDL cholesterol	1.0±0.5	1.0±0.4	0.77	1.0±0.6	1.2±0.8	<0.05

DM – Diabetes mellitus, HT – hypertension, BMI - body mass index, HDL – high density lipoprotein, LDL – low density lipoprotein, VLDL – very low density lipoprotein, TG - triglyceride

Table 3 – Analysis of various lipid components with cut-off values

	No DM and HT (n = 146), n (%)	DM and HT (n = 164), n (%)	Odd Ratio	CI	P value
Total cholesterol, mg/dl			1.48	0.91-2.39	0.11
≤ 200	105 (71.9%)	104 (63.4%)			
> 200	41 (28.1%)	60 (36.6%)			
Triglycerides, mg/dl			2.44	1.53-3.88	<0.001
≤ 150	99 (67.8%)	76 (46.3%)			
> 150	47 (32.2%)	88 (53.7%)			
HDL cholesterol, mg/dl					
Male			2.02	1.11-3.69	<0.05
< 40 Male	89 (61.0%)	88 (53.7%)			
≥ 40 Male	21 (14.4%)	42 (25.6%)			
Female			0.15	0.02-1.33	0.06
< 50 Female	30 (20.5%)	33 (20.1%)			
≥ 50 Female	6 (4.1%)	1 (0.6%)			
LDL cholesterol, mg/dl			1.12	0.70-1.80	0.63
≤ 130	99 (67.8%)	107 (65.2%)			
> 130	47 (32.2%)	57 (34.8%)			

TG/HDL cholesterol			1.75	1.12-2.75	<0.05
TG/HDL-c ≤ 4	79 (54.1%)	66 (40.2%)			
TG/HDL-c > 4	67 (45.9%)	98 (59.8%)			
TG/non HDL cholesterol			2.04	1.29-3.23	<0.01
TG/ non-HDL-c ≤ 0.9	73 (57.5%)	54 (42.5%)			
TG/non-HDL-c > 0.9	73 (39.9%)	110 (60.1%)			

DM – Diabetes mellitus, HT – hypertension, BMI - body mass index, HDL – high density lipoprotein, LDL – low density lipoprotein, VLDL – very low density lipoprotein, TG - triglyceride

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