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RESEARCH ARTICLE

CORRELATION OF HBA1C AND NON-HDL CHOLESTEROL TO ASSESS DIABETIC DYSLIPIDEMIA

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ABSTRACT

Introduction

Diabetic dyslipidemia is a modifiable risk factor of cardiovascular disease, characterized by elevated triglycerides, presence of small dense LDL-C particles and decreased HDL-C. HbA1c can assess the glycemic status and is regarded as an independent risk factor for cardiovascular events. Non-HDL-C is considered to be a measure of cholesterol containing atherogenic lipoproteins and a better predictor of CVD in type 2 DM. The aim of this study is to estimate HbA1C and correlate with Non-HDL-C to assess Diabetic dyslipidemia.

Materials and Methods

The study was conducted among 120 subjects. Type 2 diabetes patients with duration more than 1 year and less than 5 years as the study group were further subdivided into group (A) with controlled DM patients with HbA1c < 6.5% and group (B) with uncontrolled DM patients with HbA1c ≥ 6.5%. . Fasting blood sample was analyzed for TC, TGL, LDLc and HDLc. Non-HDLc, TC/ HDLc and LDLc/ HDLc ratios were calculated.

Result

On comparison, LDLc and Non-HDLc were more highly statistically significant than TC, TC / HDLc and LDLc / HDLc ratios. HbA1c showed a positive correlation with Non-HDLc (r = 0.49) than the other cardiovascular risk ratios in Type 2 Diabetic individuals.

Conclusion

Thus, Non-HDL-C is considered to be a simple, cost-effective calculated tool and a better representative of diabetic dyslipidemia and considered to be a better predictor of adverse cardiovascular events.

INTRODUCTION

Type 2 Diabetes Mellitus is a metabolic disease and a more serious public health problem in a developing country like India. Death due to cardiovascular disease (CVD) has increased due to hyperglycemic status associated with atherogenic lipid profile.

GlycatedHemoglobin is the non-enzymatic irreversible condensation of glucose with N-terminal valine residues of beta chain of HbA. HbA1c concentration represents the glycemic status of diabetic patients over the preceding 8 to 12 weeks (Ram vinodMahato *et al*). A single measurement of increase in HbA1c predicts not only the glycemic status but also atherogenic environment that favours the risk of CVD (Syed IA *et al* 2011).

Hyperglycemia accelerates the formation of advanced glycation end products which modifies extracellular matrix molecules and causes cellular dysfunction. Results in release of inflammatory cytokines and causes vascular pathology.

Diabetes has a predisposition to dyslipidemia that predisposes to atherosclerosis (Frank Pistrosch *et al* 2011). National Cholesterol Education Program has highlighted the increased risk for CVD in hypertriglyceridemic patients. Studies have demonstrated that Non-HDL cholesterol as prime indicator and a strong predictor of CVD risk in individuals of all ages, males, females and patient with or without diabetes (Liu J *et al* 2005).Non-HDL-C is considered to be a measure of cholesterol containing atherogenic lipoproteins and a better predictor of CVD in type 2 DM. The aim of this study is to estimate HbA1C and correlate with Non-HDL-C to assess Diabetic dyslipidemia.

MATERIALS AND METHODS

The cross-sectional study was conducted among 120 subjects at SRM Medical College Hospital. Institutional ethical committee approved the study and informed consent was obtained from the individuals.

Inclusion criteria

Includes 60 male type 2 diabetes patients with duration more than 1 year and less than 5 years as the study group. They were further subdivided into group (A) with 28 controlled DM patients with HbA1c < 6.5% and group (B) with 32

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uncontrolled DM patients with HbA1c ≥ 6.5%. Age and sex matched 60 male subjects were taken as control group.

Exclusion criteria

The patients with type 1 Diabetes Mellitus, Chronic kidney disease stage 3 and above, recent major surgery, infection, diabetic foot were excluded.

Venous blood sample was collected after an overnight or 12 hours of fasting and analyzed in Olympus AU 400. Fasting blood glucose, total cholesterol, triglycerides were analyzed by enzymatic method. LDLc was measured by direct Immunoturbidimetric method. HbA1c was measured using turbidimetric method. Non-HDLc was calculated with the formula (TC – HDLc) and expressed in mg/dL.

Statistics

Data evaluation was done and the results were expressed as mean with standard deviation (S.D.); $p < 0.05$ was considered statistically significant. The biochemical parameters were correlated with Pearson's' correlation.

RESULTS

As depicted in table (1), the biochemical lipid profile parameters of type 2 Diabetic subjects were compared with control group. It was found that LDLc and Non-HDLcwere more highly statistically significant compared to TC, TC / HDLc and LDLc / HDLc ratios. The glycemic status of the diabetic subjects were assessed based on the value of HbA1c and further divided into group (A) n=28 with good glycemic control and group (B) n = 32 with poor glycemic control.

Table 1 Comparison of Biochemical Lipid profile parameters and cardiovascular risk ratios in type 2 DM with normal subjects

Biochemical Lipid profile parameters	Control group N = 60	Type 2 Diabetes Mellitus N = 60	P value
Total Cholesterol	163 ± 26.75	192± 48.35	< 0.05
Triglycerides	73.92 ± 32.29	179.77 ± 31. 39	< 0.05
LDLc	102 ±23.11	120 ± 40.55	0.001**
HDLc	39.43 ±7.47	35.78 ± 8.36	NS
TC / HDLc	4.0 ±0.99	6.3 ± 1.71	< 0.05
LDLc / HDLc	2.6 ± 0.81	5.5 ± 1.33	< 0.05
Non-HDLc	119.1 ± 9.24	155 ± 45.65	0.001***

Values are expressed in Mean ± Standard Deviation P value < 0.05 is considered significant. NS- Not significant ** Significant *** Highly significant

In table (2), the cardiovascular risk ratios TC / HDLc and LDLc / HDLc and Non-HDLc was also compared between the 2 groups and found to have a significant increase in poorly controlled diabetic individuals. Especially Non-HDLc was highly statistically significant with p value < 0.0001.

Table 2 Comparison of Non-HDLc and other cardiovascular risk markers in Type 2 DM patients with and without glycemic control

Parameters	Group A Type 2 DM HbA1c < 6.5%	Group B Type 2 DM HbA1c > 6.5%	P value
Non-HDLcmg/dL	117.5 ± 13.72	178 ± 24.37	< 0.0001***
TC/ HDLc	4.4 ± 1.57	6.83 ± 1.28	< 0.001**
LDLc/ HDLc	2.64 ± 1.16	5.70 ± 1.01	< 0.001**

As shown in table (3), HbA1c showed a highly significant positive correlation with Non-HDLc (r = 0.49) than the other cardiovascular risk ratios.

Graph 1:

DISCUSSION

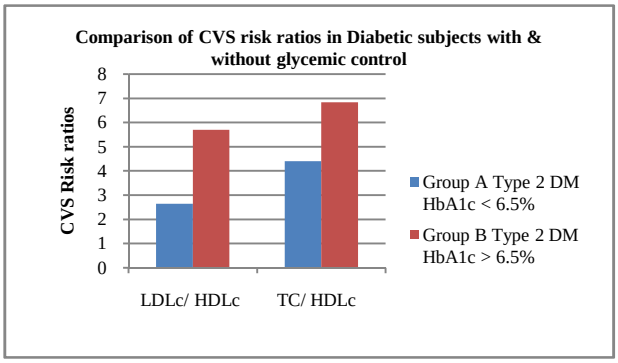
Diabetic patients exhibit an atherogenic lipid profile and the laboratory diagnosis of diabetic dyslipidemia is assessed with the routine lipid profile parameters. Type 2 DM is more commonly associated with abnormal lipoprotein phenotype which is characterized by increased triglycerides, decreased HDLc and accumulation of small dense LDLc particles. Non-HDLc is considered as a better predictor of atherogenicity, since it is the difference between TC and HDLc. It also provides a single index of all atherogenic lipoproteins (LDLc, VLDL, IDL and lipoprotein (a) (Stanley H. Hsia 2003). Though apo B is a direct measure of atherogenic particles, measurement of Non-HDLc is more simple, practical and inexpensive.

Table 3 Correlation between HbA1c with TG, Cardiovascular risk ratios, Non-HDL-C and AIP.

Parameters	r - value	Correlation
HbA1c & Fasting blood glucose	0.71	'+'
HbA1c &HDLc	-0.22	'-'
HbA1C &LDLc	0.59	'+'
HbA1c & TC/HDLc	0.51	'+'
HbA1c &LDLc/HDLc	0.61	'+'
HbA1c & Non-HDLc	0.49	'+'

Correlation	Negative	Positive
Small	-0.03 to 0.1	0.1 to 0.3
Medium	-0.5 to 0.3	0.3 to 0.5
Strong	-1.0 to 0.5	0.5 to 1.0

Our study revealed that non-HDLc is high in Diabetic patients with poor glycemic control. This is further statistically proved by the significant positive correlation of HbA1c with non-HDLc.



We also showed that HbA1c had statistically significant positive correlation with cardiovascular risk ratios TC / HDLc and LDLc / HDLc. Type 2 Diabetes have a typical pattern of dyslipidemia, which enhances the atherogenic environment within the circulation. SeemaSingla *et al* 2009 study had results similar to our study with Lp(a) and LDLc/HDLc ratio correlated with glycemic status. It was suggested that the metabolic reason for diabetic dyslipidemia as impairment of LDL uptake by fibroblast and decreases synthesis of HDLc which leads to increase in LDLc / HDLc ratio in type 2 Diabetes (Stanley H. Hsia 2003).

Our study revealed a better statistical correlation of TC / HDLc with HbA1c. Studies have showed the predictive power of TC / HDLc ratio, which can be used as a treatment guide for diabetic dyslipidemia. SeemaSingla *et al* demonstrated that total number of apo B containing particles and small LDLc particles are better reflected by TC / HDLc ratio and non-HDLc than LDLc alone.American Diabetes Association has considered the reduction of Non- HDL-C as target goal for diabetic patients (< 130 mg/dL) in addition to lowering LDL-C (Brunzell JD *et al* 2008). Currently India has the largest population of Diabetic subjects which is influenced by many factors; one of which is the protein Adiponectin produced by

the adipose tissue and polymorphism of Adiponectin gene is associated with Type 2 DM (Prithiviraj *et al* 2012).

HbA1c is established as the gold standard to assess glycemic control bythe Diabetes Complication and Control trial. Although HbA1c and dyslipidemia are independent risk factors of cardiovascular disease, they both can be considered as a very high risk for CVD. In European Prospective Investigation Into Cancer and Nutrition (EPIC – Norfolk), an increase of HbA1c was associated with increase in the risk of Cardiovascular Mortality (Kay-Tee Khaw *et al* 2004). Thus our study highlighted the correlation of HbA1c and non-HDLc which emphasis the relation between glycemic control and diabetic dyslipidemia that goes hand in hand.

CONCLUSION

Non-HDL-C is more representative of all atherogenic lipoprotein which positively correlated with HbA1c can be considered as a measure of Diabetic dyslipidemia. Easily measurable non-HDLc, also adds significant value to assess CVS risk. Thus, HbA1C and non-HDLc can be considered as the dual markers useful to clinicians and appropriate attention is necessary in lowering, thereby reduces the incidence of future cardiovascular events in Diabetic patients.

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