Original Article

Coronary Artery Disease Risk Factors in Type 2 Diabetes Mellitus with Metabolic Syndrome in the Urban South Indian Population

Biochemistry Section

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ABSTRACT

Introduction: Insulin resistance increases the risk of developing metabolic syndrome, a major cause of dyslipidaemia and heart disease. Metabolic syndrome is a cluster of metabolic risk factors that come together in a single individual. Hence, in the present study, the occurrence of metabolic syndrome among type 2 diabetes mellitus patients by the WHO criteria has been carried out. The risk factors were compared between patients with type 2 diabetes mellitus, with and without metabolic syndrome.

Materials and Methods: Eighty seven, age matched, type 2 diabetic patients who attended a diabetic clinic were included in this study. They were grouped as diabetic patients with metabolic syndrome and diabetic patients without metabolic syndrome, based on the WHO criteria. The biochemical parameters like fasting blood sugar (FBS), post prandial blood sugar (PPBS) and lipid profile were estimated by using diagnostic kits. The blood pressure (BP) was measured and the body mass index (BMI) and the atherogenic index of plasma (AIP) were calculated. Statistical analysis was done by the Student's t test.

Results: The occurrence of metabolic syndrome among the type 2 diabetic patients was 33%. A significant increase was seen in triglycerides (TGLs), very low density lipoproteins (VLDLs), the TGL/HDL ratio, AIP, BP and BMI and a decrease was observed in the high density lipoproteins (HDLs) of type 2 diabetic patients with metabolic syndrome when compared with the type 2 diabetic patients without metabolic syndrome.

Conclusion: The significant increase in the TGLs, the TGL/HDL ratio, AIP, BP and the BMI of diabetic patients with metabolic syndrome when compared to the type 2 diabetic patients without metabolic syndrome, predicts that patients with type 2 diabetes mellitus with metabolic syndrome are at a higher risk level for coronary heart disease (CHD).

Key Words: Metabolic syndrome, atherogenic index of plasma, coronary heart disease

KEY MESSAGE

- Patients suffering from type 2 diabetes mellitus with metabolic syndrome are more prone to cardiovascular disease. The atherogenic index of plasma (log TGL/HDL) is a good marker for cardiovascular risk.

INTRODUCTION

The incidence of type 2 diabetes mellitus is rising worldwide, mostly due to the increasing prevalence of obesity and a longer life expectancy [1]. Insulin resistant patients are at an increased risk of developing metabolic syndrome, a major cause of heart disease and dyslipidaemia [2].Metabolic syndrome is a combination of medical disorders that increase the risk of developing cardiovascular disease and diabetes. The factors which are characteristic of metabolic syndrome, which is also known as dysmetabolic syndrome X, are abdominal obesity, atherogenic dyslipidaemia, raised blood pressure, insulin resistance with or without glucose tolerance and the proinflammatory and the prothrombotic states[3], [4]. Several organizations have proposed a slightly different criteria for metabolic syndrome[5],[6],[7],[8]. Insulin resistance is considered as the underlying abnormality in this syndrome. The pathogenesis is still unclear, although environmental factors such as diet and physical activity, coupled with still largely unknown genetic factors, clearly interact to produce this syndrome [9]. Central obesity is the key feature of this syndrome, reflecting the fact that the syndrome's prevalence is driven by the strong relationship between waist circumference and increasing adiposity [10]. Reports suggest that BP levels are strongly associated with the degree of insulin resistance [11]. It has been reported that insulin resistance might be involved in the pathogenesis of primary hypertension, in up to 40-50% of the cases [12]. Hence, in the present study, type 2 diabetes mellitus patients were grouped as those with metabolic syndrome and those without metabolic syndrome, based on the WHO criteria. The risk factors were compared between patients with type 2 diabetes mellitus, with and without metabolic syndrome.

MATERIALS AND METHODS

Eighty seven, age matched, type 2 diabetic patients who attended a diabetic clinic were included in this study. The biochemical parameters like FBS, PPBS and lipid profile were estimated using Bayer's diagnostic kits.

- FBS and PPBS - Glucose oxidase Peroxidase method
- Total Cholesterol – Cholesterol oxidase peroxidase method
- Triglycerides – Glycerol 3 phosphate oxidase method
- HDL cholesterol – Phosphotungstate method
- LDL and VLDL – Friedewald's formula. VLDL = TGL/5, LDL = Total cholesterol – (HDL+VLDL).

The blood pressure was measured by using a standard sphygmomanometer. The BMI was calculated as the weight (kg) divided by the height squared (m2) and AIP was calculated by using the Czech online calculator of atherogenic risk.

The patients were grouped as diabetic patients with metabolic syndrome and diabetic patients without metabolic syndrome, based on the WHO criteria. Metabolic syndrome was defined clinically, based on the presence of impaired fasting blood glucose and any two of the following

a. Blood Pressure: ≥ 140/90mmHg
b. Dyslipidaemia : TGL >150mg/dl and HDL < 35 mg/dl
c. Central obesity: BM I >30kg/m2

Inclusion criteria: Age between 40-60 yrs, type 2 diabetes mellitus
Exclusion criteria: Smokers, Alcoholics, Liver disease, kidney disease.

STATISTICAL ANALYSIS

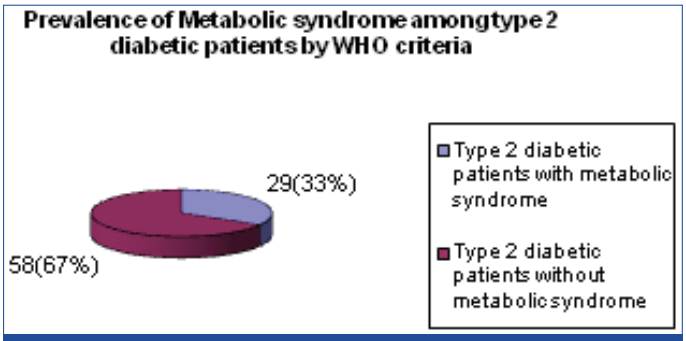
The data were analyzed by using the SPSS version 11.0. Student's t test was used to find the significant difference between the various parameters among the groups.

Ethical issues: The purpose of the study was explained to all the participants and their consent was obtained. The requisite clearance of the institutional human ethics committee was obtained.

RESULTS

Our report revealed that 33% of the type 2 diabetic patients had metabolic syndrome, as shown in [Table/Fig-1].

As shown in [Table/Fig-2], a significant increase was seen in TGL and VLDL and a decrease was observed in HDL in the type 2 diabetic patients with metabolic syndrome when compared with the type 2 diabetic patients without metabolic syndrome. No significant change was observed in the fasting and post prandial blood sugar and the cholesterol levels among the study groups.



[Table/Fig-1]: Type 2 diabetes mellitus with metabolic syndrome – 29
Type 2 diabetes mellitus without metabolic syndrome – 58

Parameters (mg/dl)	Type 2 DM without metabolic syndrome	Type 2 DM with metabolic syndrome	p value
FBS	163 ± 63.3	184 ± 70.2	0.08
PPBS	267 ± 112.8	297 ± 89	0.230
Cholesterol	185 ± 34.7	193 ± 30.7	0.285
Triglycerides	147 ± 47	205 ± 86	0.000
HDL	42 ± 3.8	39 ± 6.5	0.017
LDL	114 ± 33	111 ± 31	0.634
VLDL	29 ± 9.4	40 ± 3.4	0.000

[Table/Fig-2]: Fasting, post prandial blood sugar and Lipid profile of both groups. Data expressed as Mean ± standard deviation. Significance = p <0.05

Parameters (mg/dl)	Type 2 DM without metabolic syndrome	Type 2 DM with metabolic syndrome	p value
LDL/HDL	2.9 ± 1.3	2.7 ± 0.83	0.404
TGL/HDL	3.6 ± 1.1	5.2 ± 2.4	0.000
AIP(log TGL/HDL)	0.16 ± 0.14	0.34 ± 0.18	0.000

[Table/Fig-3]: Cardio vascular risk factors Data expressed as Mean ± standard deviation. Significance = p <0.05

Parameters (mg/dl)	Type 2 DM without metabolic syndrome	Type 2 DM with metabolic syndrome	p value
BMI	24 ± 3.6	28 ± 5.4	0.000
Systole	127 ± 12.8	157 ± 26.3	0.000
Diastole	82.4 ± 10.0	95 ± 9.9	0.000

[Table/Fig-4]: BMI and BP of both the groups.
Data expressed as Mean ± standard deviation. Significance = p <0.05

[Table/Fig-3] depicts the cardiovascular risk in both the groups. A significant increase was seen in the TGL/HDL ratio and in the AIP when compared to the LDL/HDL ratio in the type 2 diabetic patients with metabolic syndrome when compared with the type 2 diabetic patients without metabolic syndrome.

[Table/Fig-4] shows that a significant increase was seen in the BMI and BP in the type 2 diabetic patients with metabolic syndrome when compared with the type 2 diabetic patients without metabolic syndrome.

DISCUSSION

The increased risk of cardiovascular disease which is associated with metabolic syndrome has many causes, but dyslipidaemia plays a prominent role in it. Both the metabolic syndrome and type 2 diabetes, are commonly associated with an abnormal lipoprotein phenotype which is characterized by increased TGL, decreased HDL and an accumulation of small dense LDL particles (the so-called atherogenic dyslipidaemia phenotype). The levels of LDL c are often normal [13]. A number of lipid related parameters have been used to predict the risk of coronary artery disease (CAD). According to Grover, either the ratio of LDL/HDL or TGL /HDL is the best related predictor of future cardiovascular events [14]. Later, TGL /HDL were shown to be a more accurate predictor of coronary heart disease [15]. The logarithamatically transformed ratio of plasma TGL to HDL c correlated closely with the LDL particle size and could serve as an indicator of the atherogenic lipoprotein phenotype[16]. AIP indicates a balance between the actual concentration of plasma TGL and HDL, which predetermine the direction of the cholesterol transport in an intravascular pool is the flux of newly produced cholesteryl esters by lecithin cholesterol acyl transferase (LCAT) towards atherogenic LDLs or beneficial HDLs[17] . Clinical studies have shown that AIP predicts cardiovascular risk and that it is an easily available cardiovascular risk marker and a useful measure of the response to treatment [18].

Obesity, which is reported to play a key role in the pathogenesis of metabolic syndrome, promotes inflammation, hypertension and dyslipidaemia, thus leading to the development of type 2 diabetes mellitus and atherosclerosis [19]. Moreover, a higher BP is a strong risk factor for cardio vascular diseases (CVD) [20]. Abdominal fat which is associated with central obesity, a characteristic feature of the metabolic syndrome, is a major source of the excessive flux of free fatty acids which are known to have pro-arrhythmic

properties. The prolonged release of free fatty acids is implicated in the development of type 2 diabetes, since it promotes insulin resistance and the associated loss of pancreatic β cell function [21].

Patients with type 2 diabetes mellitus are at an increased risk of cardiovascular morbidity and mortality. The significant increase in TGL, the TGL/HDL ratio, AIP, BP and the BMI of diabetic patients with metabolic syndrome when compared to the type 2 diabetic patients without metabolic syndrome, predicts that patients with type 2 diabetes mellitus with metabolic syndrome are at a higher risk level for CHD. This is in agreement with the fact that insulin resistance induces several metabolic changes such as hyperglycaemia, dyslipidaemia and perhaps to a lesser extent, hypertension, which all contribute to the development of atherosclerosis (22). The clinical management should be focused on multifactorial intervention to address all the associated cardiovascular risk factors.

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