Original Research

Assessment Of Association Of High-Sensitivity C-Reactive Protein, Malondialdehyde With Glycated Hemoglobin In Type 2 Diabetes Patients

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ABSTRACT:
Background: Type 2 Diabetes Mellitus is a major public health problem worldwide and is accompanied by significant vascular complications. The present study was conducted to assess High-Sensitivity C-Reactive Protein(hs-CRP), Malondialdehyde(MDA), and their association with Glycated Hemoglobin (HbA1c) in patients with Type 2 Diabetes Mellitus(T2DM). **Materials & Methods:** Group I comprised subjects with T2DM and Group II comprised healthy controls. Serum insulin was estimated by Enzyme-Linked ImmunoSorbent Assay (ELISA), HbA1c was estimated by Ion Exchange Resin method, and hs-CRP was assessed by Latex Turbidimetric Immunoassay. Homeostatic Model Assessment for Insulin Resistance (HOMA-IR) was calculated using the following formula: HOMA-IR = Fasting Insulin (microU/L) x Fasting Glucose (nmol/L)/22.5. The serum MDA levels were measured spectrophotometrically. Serum creatinine was estimated by alkaline Jaffe's Picrate method and levels of serum cystatin C were measured by the latex agglutination test. **Results:** Group I had 45 male and 35 female subjects, and group II had 30 male and 50 female subjects. The mean HOMA-IR was 4.7 in group I and 1.6 in group II. The mean MDA level was 5.02 μmol/L in group I and 1.36 μmol/L in group II. The mean Creatinine level was 0.97 mg/L in group I and 0.82 mg/L in group II. The mean Cystatin C level was 0.01 mg/L in group I and 0.85 mg/L in group II. The mean hs-CRP (mg/L) level was 4.9 in group I and 1.7 in group II. The difference was significant (P< 0.05). **Conclusion:** The levels of Malondialdehyde and High-sensitivity C-reactive protein were elevated in patients with Type II Diabetes Mellitus.
Keywords: High-Sensitivity C-Reactive Protein, Malondialdehyde, Glycated Hemoglobin, Diabetes Mellitus.

INTRODUCTION

Type 2 Diabetes Mellitus is a major public health problem worldwide and is accompanied by significant vascular complications, which adds to its morbidity and mortality. Inflammation plays a pivotal role in the development of Type II Diabetes and its vascular complications.[1] Impaired insulin secretion and sensitivity lead to oxidative stress, endoplasmic reticulum stress, lipotoxicity, glucotoxicity, and amyloid deposition in the pancreas. Studies report that insulin resistance, inflammatory biomarkers, metabolic syndrome, dyslipidemia, and hypertension are predictive markers of cardiovascular disease (CVD) in Type 2 Diabetes Mellitus.[2] Malondialdehyde(MDA) is a major player in low-density lipoprotein (LDL) modification and is a product of the peroxidation of Arachidonic acid,

Eicosapentaenoic acid, and Docosahexaenoic acid. Oxidized LDL (ox-LDL) results from the interactions between aldehydes such as MDA, and Lysine residues in apoB-100 of LDL.[3] hs-CRP is an acute phase reactant protein produced by the liver in response to several cytokines and is a sensitive marker of low-grade systemic inflammation. Studies report that hs-CRP directly binds to oxidized low-density lipoprotein cholesterol (LDLC), and induces expression of Plasminogen Activator Inhibitor-1.[4,5] Hemoglobin A1c (HbA1c) can be measured in blood samples from patients regardless of their fasting or non-fasting state. Thus, it can be used as an indicator of diabetes instead of measuring blood sugar levels before or 2 hours after meals. The American Diabetes Association has added HbA1c ≥6.5% as a diagnostic criterion for diabetes.[6] The present study was

conducted to assess High-Sensitivity C-Reactive Protein(hs-CRP), Malondialdehyde(MDA), and their association with Glycated Hemoglobin (HbA1c) in patients with Type 2 Diabetes(T2D).

MATERIALS & METHODS

The present study comprised 80 diabetic patients of both sexes. Informed consent was obtained in writing from all the participants of the study.

Data such as name, age, gender, etc. were recorded. Patients were divided into 2 groups - Group I comprised subjects with Diabetes and Group II comprised healthy controls. A thorough clinical examination was performed. 5 ml of venous blood sample was obtained. Serum insulin was estimated by Enzyme-Linked ImmunoSorbent Assay (ELISA), HbA1c was estimated by Ion Exchange Resin method, and hs-CRP was assessed by Latex Turbidimetric Immunoassay. Homeostatic Model Assessment for Insulin Resistance (HOMA-IR) was calculated using the following formula:

HOMA-IR = Fasting Insulin (microU/L) x Fasting Glucose (nmol/L)/22.5.

The level of lipid peroxidation was determined by assessment of Malondialdehyde (MDA) using a modified method. Serum creatinine levels were measured by Automatic Picric Acid Colorimetry on Hitachi 7600-110 automatic analyzer. The results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Table I: Distribution of patients

Groups	Group I	Group II
Status	Diabetic	Healthy
Male to Female ratio	45:35	30:50

Table I shows that group I had 45 males and 35 females and group II had 30 males and 50 females.

Table II: Assessment of parameters

Parameters	Group I	Group II	P value
HOMA-IR	4.7	1.6	0.01
MDA(µmol/L)	5.02	1.36	0.02
Creatinine(mg/dL)	0.97	0.82	0.05
Cystatin C(mg/L)	0.80	0.85	0.95
hs-CRP(mg/L)	4.9	1.7	0.01

Table II and Graph I show that the mean HOMA-IR was 4.7 in group I and 1.6 in group II. The mean MDA level was 5.02 µmol/L in group I and 1.36 µmol/L in group II. The mean Creatinine level was 0.97 mg/L in group I and 0.82 mg/L in group II. The mean Cystatin C level was 0.01 mg/L in group I and 0.85 mg/L in group II. The mean Hs-CRP (mg/L) level was 4.9 in group I and 1.7 in group II. The difference was significant (P< 0.05).

Graph I: Assessment of parameters
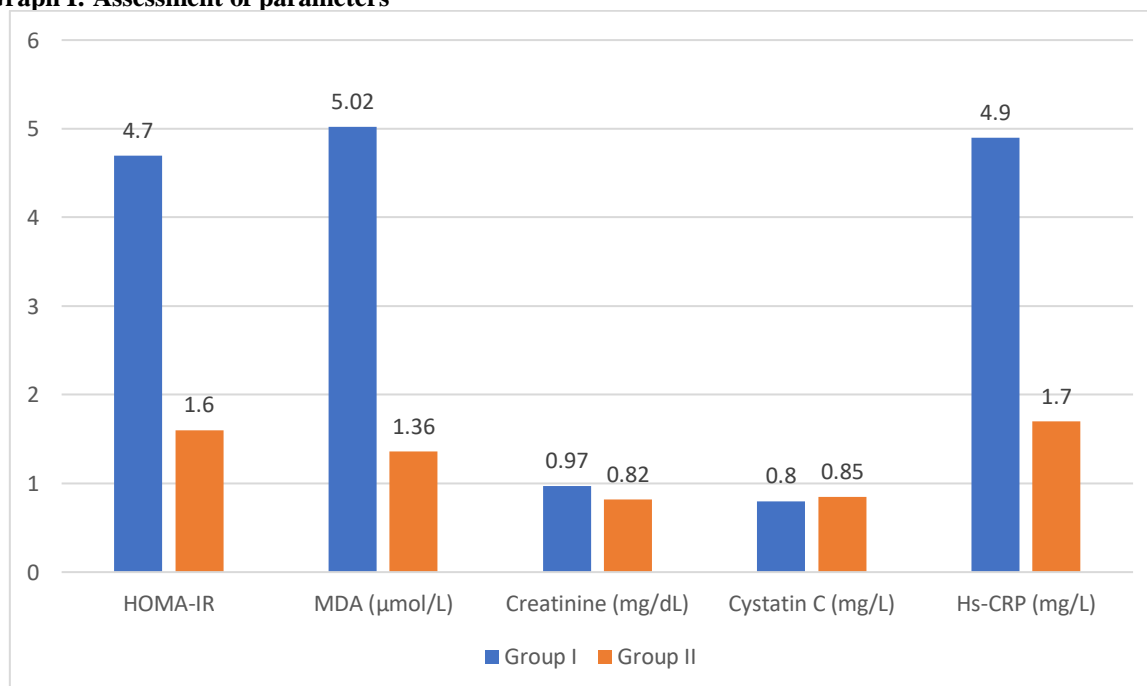
DISCUSSION

Type II Diabetes is a multicausal disease that develops slowly in a step-wise manner. It initially presents as insulin resistance and progressively the body fails to maintain glucose homeostasis, leading to glucose intolerance.[7] Type 2 diabetes mellitus (T2DM) is a metabolic disease characterized by hyperglycemia due to damage to insulin secretion, insulin action, or both.[8,9] Diabetes is a chronic disease that requires multifactorial risk reduction strategies.[10] The present study was conducted to assess High-Sensitivity C-Reactive Protein(hs-CRP), Malondialdehyde(MDA), and their association with Glycated Hemoglobin (HbA1c) in patients with Type 2 Diabetes(T2D).

We found that group I had 45 males and 35 females and group II had 30 males and 50 females.

We found that the mean HOMA-IR was 4.7 in group I and 1.6 in group II. The mean MDA level was 5.02 µmol/L in group I and 1.36 µmol/L in group II. The mean Creatinine level was 0.97 mg/L in group I and 0.82 mg/L in group II. The mean Cystatin C level was 0.01 mg/L in group I and 0.85 mg/L in group II. The mean Hs-CRP (mg/L) level was 4.9 in group I and 1.7 in group II. Santhi et al[11] evaluated hs-CRP and MDA levels in type 2 diabetic patients, compared these with healthy controls, and correlated them with levels of glycated hemoglobin (HbA1C) and insulin resistance. 50 patients with T2DM in the age group of 35 to 45 years were selected for this study and 50 age-matched healthy subjects were selected as controls. Serum hs-CRP and insulin levels were assessed by ELISA; MDA levels were assessed by Thiobarbituric Acid Reactive Substances (TBARS) method and other routine investigations were carried out by standardized protocols with ERBA EM-360 fully automated analyzer. The mean serum hs-CRP and MDA levels were significantly increased in T2DM patients compared to healthy controls. hs-CRP and MDA levels were shown to have a significant positive correlation with HbA1c, insulin resistance, triglycerides, and a negative correlation with HDL cholesterol. Elevated hs-CRP and MDA levels are potentially important diagnostic markers for the assessment of endothelial dysfunction in T2DM patients. Tight blood glucose control, regular monitoring of hs-CRP, and MDA levels might be useful for the reduction of vascular complications in patients with T2DM

Agrawal et al[12] evaluated the total antioxidant status in comparison to oxidative stress in Type 2 Diabetes Mellitus. 110 patients with T2DM in the age group of 30- 60 years and 110 age-matched healthy subjects were selected as controls. Fasting blood glucose & Postprandial blood glucose was estimated using Glucose Oxidase Peroxidase (GOD POD) Method (Enzymatic method). MDA levels were assessed by Elico spectrophotometer. The total antioxidant capacity of plasma was measured with a Colorimetric assay using the Cayman kit. A significant increase in MDA levels was reported among Diabetic patients compared to the controls. A decrease in the total antioxidant status was also reported among diabetics when compared to healthy controls.

The limitation of the study is the small sample size.

CONCLUSION

Authors found elevated levels of Malondialdehyde and High-Sensitivity C-Reactive Protein in patients with Type 2 Diabetes Mellitus.

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The patients on insulin treatment, hypertension, ischemic heart disease, neurological disorders, renal failure, chronic liver disease, cancer, and immunological disorders were excluded from this study.