



E-ISSN: 2706-9575
P-ISSN: 2706-9567
IJARM 2021; 3(2): 423-425
Received: 01-12-2021
Accepted: 15-12-2021

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Prospective case-control hospital based study to clinically evaluate the levels of high-sensitivity C-reactive protein in patients with type 2 diabetes

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DOI: <https://doi.org/10.22271/27069567.2021.v3.i2g.284>

Abstract

Aim: To determine the high-sensitivity C-reactive protein levels in patients with type 2 diabetes mellitus.

Methods: This prospective observational study was carried out at Dhawan Hospital, Ludhiana, Punjab, India, from April 2021 to November 2021. The study was undertaken on 40 type 2 Diabetes mellitus and 40 normal healthy controls. All the patients were advised to fast overnight. Blood samples were collected in fasting condition. 5ml venous blood was collected from the each subject and it was transferred to the Plain tube and serum is separated by centrifugation and stored at -20°C for measured. Estimation of Plasma Glucose by the Glucose Oxidase and Peroxidase (GOD POD) method and estimation of hs-CRP by turbidometric immunoassay using commercially available kit.

Results: Fasting blood glucose, post prandial blood glucose, and hs-CRP levels was measured in 80 T2DM cases and 80 age and gender matched healthy controls. The mean and standard deviation were calculated for all the Biochemical parameters. The significance between the groups was determined using Student t- test for Equality of means. The *p*-value of < 0.05 was considered significant.

Conclusion: From this study it is observed that there is moderate correlation between hs-CRP levels and it increases the risk of atherosclerosis.

Keywords: Diabetes mellitus, hs-CRP, hyperglycemia, inflammation

Introduction

Diabetes is a metabolic -disorder with inappropriate hyperglycemia either due to an absolute or relative deficiency of insulin secretion or reduction in the biologic effectiveness of insulin or both. It is also associated with disturbances concerned with protein, carbohydrate, and lipid metabolism. The decreased uptake of glucose into muscle and adipose tissue leads to chronic extracellular hyperglycemia which results in tissue damage and chronic vascular complications in both types I and II Diabetes Mellitus [1, 2]. Previous studies have shown that hs-CRP is associated with insulin resistance, type 2 diabetes, and higher HbA1c levels. A recently retrospective observed the hs-CRP levels correlated with HbA1c levels. Mean HbA1c levels were significantly higher in patients who had hs-CRP levels of 1 mg/L or more [1]. In the year 2015 Chinese study was also revealed through multivariate stepwise regression analysis that indicated that HbA1c correlated with hs-CRP [2]. A Turkish study also reported a positive correlation between serum hs-CRP and HbA1c [3]. Chronic inflammation plays an important role in the development and progression of late complications of diabetes. C-reactive protein (CRP), an acute phase reactant, is a highly sensitive marker of inflammation. Its level rises dramatically during an inflammatory process [4]. CRP has a long half-life, affordability of estimation, and stability of its levels with no circadian variation, and therefore is one of the best markers of vascular inflammation [5]. CRP has been found to be associated with disorders like DM, cardiovascular disorders, metabolic syndrome, Rheumatoid Arthritis, renal failure, etc [6, 7, 8]. The serum high sensitivity CRP (hsCRP) level is higher in patients with Type 2 diabetes than in normal subjects and plays an important role in the development and progression of Type 2 DM [9]. India is having the highest number of T2D individuals worldwide, with a prevalence of 11.6% in urban populations [10, 11]. Furthermore, Asian Indians are known to be at a high risk for T2D, CVD, and metabolic syndrome [12, 13]. Although elevated levels of hs-CRP have been observed in expatriate adult Indians [14] and adolescents residing in India [15], data on adult individuals residing in India are scanty.

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Material and Methods

This prospective observational study was carried out Dhawan Hospital, Ludhiana, Punjab, India, from April 2021 to November 2021, after taking the approval of the protocol review committee and institutional ethics committee. After taking informed consent detailed history was taken from the patient or the relatives.

Methodology

The study was undertaken on 40 type 2 Diabetes mellitus and 40 normal healthy controls. All of them were in the age group of 30-70 years. Both sexes included. This study includes diabetic for at least one year duration and normal hepatic function and without complications of neuropathy, retinopathy, overt nephropathy, coronary artery diseases. The present study excludes patients with thyroid stimulating drugs, corticosteroids, lipid-lowering drugs, oral contraceptives, aspirin, sulphonamides and pregnant women.

Specimen collection

All the patients were advised to fast overnight. Blood samples were collected in fasting condition .5ml venous blood was collected from the each subjects and it was transferred to the Plain tube and serum is separated by centrifugation and stored at -20°C for measured. Haemolysed and lipemic samples are avoided. For adequate quality control both normal, abnormal reference control serum solutions and calibrators were run before each testing. Other factors influencing the quality like proper functioning of instrument, glassware, cuvettes and distilled water were taken care.

Estimation Of Plasma Glucose by the Glucose Oxidase and Peroxidase (GOD POD) method using a commercially available kit Human (gmbh Germany) using Humastar 300 chemistry analyzer (Human gmbh Germany). Enzymatic colorimetric test for glucose method without deproteinisation. Glucose is determined after enzymatic oxidation in the presence of glucose oxidase. Hydrogen peroxide formed in catalysed by peroxidase to release nascent oxygen. Oxygen is turn for reaction.

Estimation Of hs-CRP by turbidometric immunoassay using commercially available kit (Erba) and Humastar 300 chemistry analyzer (Human gmbh Germany).The CRP-ultrasensitive is a quantitative turbidimetric test for the measurement of low levels of CRP in human serum or plasma. Latex particles coated with specific anti- human CRP are agglutinated when mixed with samples containing CRP. The agglutination causes an absorbance change dependent upon the CRP contents of the patient sample that can be quantified, by comparison from a calibrator of known CRP concentration.

Results

Fasting blood glucose, post prandial blood glucose, and hs-CRP levels measured in 40 T2DM cases and 40 age and gender matched healthy controls. The mean and standard deviation were calculated for all the Biochemical parameters. The significance between the groups was determined using Student t- test for Equality of means. The p-value of < 0.05 was considered significant.

Table 1: High-sensitivity C-reactive protein levels in cases and controls

Parameter	Cases	Controls		P value	t value
	Mean \pm S.D	Mean	S.D.		
hs-CRP (mg/dl)	1.42 \pm 1.22	0.67	0.42	<0.0001	8.12

Table 2: Fasting blood glucose levels in patients and controls

Parameter	Cases	Controls		P value	t value
	Mean \pm S.D.	Mean	S.D.		
FBS (mg/dl)	161.74 \pm 76.63	103.01	20.78	0.0001	5.32

Table 3: Post prandial blood glucose levels in patients and controls

Parameter	Cases	Controls		P value	t value
	Mean \pm S.D.	Mean	S.D.		
PPBS (mg/dl)	237.69 \pm 93.87	152.69	20.36	0.0001	6.74

Table 4: Mean + SD and P, t value in t2DM and controls

Parameter	Cases	Controls	P value	t value
	Mean \pm S.D.	Mean \pm S.D.		
hs-CRP	1.42 \pm 1.22	0.067 \pm 0.42	0.0001	8.12
FBS	161.74 \pm 76.63	103.01 \pm 20.78	0.0001	5.32
PPBS	237.69 \pm 93.87	152.69 \pm 20.36	0.0001	6.74

Discussion

Diabetes mellitus is a metabolic disorder. The metabolic disturbance associated with long standing DM causes secondary pathophysiologic changes in multiple organ systems leading to various life threatening complications like atherosclerosis, retinopathy, neuropathy, nephropathy. The prevalence of T2DM is increasing alarmingly worldwide. Coronary artery atherosclerosis is the major cause of mortality among diabetes population. Diabetes mellitus can accelerate atherosclerotic processes. The study is aimed at "evaluating the hs-CRP levels in type 2 diabetes mellitus patients". The present study included 80 subjects. Among them 40 were type 2 diabetes cases and 40 were healthy controls. In both cases and controls high- Sensitivity C-Reactive Protein levels measured.

In this study mean and standard deviation of hs-CRP in cases were 1.42 ± 1.22 and in controls were 0.067 ± 0.42 . This increase was statistically significant ($P=0.0001$). Increasing evidence suggests that hs- CRP may be directly involved in atherothrombosis that extends beyond its previously accepted role as an inflammatory marker. This hs-CRP is present in the vessel wall, where it induces expression of the adhesion molecules Eselectin, VCAM-1 and ICAM-1 by endothelial cells, and serves as a chemoattractant for monocytes as mediated by induction of MCP-1. CRP opsonizes LDL and facilitates native LDL entry into macrophages. CRP binds to plasma membranes of damaged cells and activates complement via the classical pathway for maturation of atherosclerotic lesions. CRP is associated with endothelial cell dysfunction and progression of atherosclerosis, possibly by decreasing nitric oxide synthesis. The results were in accordance with the study of Giovanna castoldi *et al.* [15], Lin Lu *et al.* [16], Pfützner A *et al.* [17] shows efficacy of different anti-diabetes treatments on a variety of cardiovascular risk markers. Intensive insulin therapy may be decreases the inflammation, although these effect may influenced through a degree of weight gain.

Treatment within peroxisome proliferator-activated receptor γ has lead directed towards substantial decreased of hsCRP along with further cardiovascular risk markers in different comparator studies. Considering for these outcome is showed to be independent of this degree of glycemic development, it could be considering as a class specific effect. Even if findings translate into a decreases of total cardiovascular mortality will soon be shown through the currently running thiazolidinedione further studies. Positive results in this study have further strengthened the usefulness of hs-CRP as a predictive laboratory marker for cardiovascular disease risk in patients with the T2DM.

Devaraj S, Jialal I. *et al.* [18] reporting following 3 months of supplementation and following a 2 month washout grade. DM2-MV subjects have been increased hs-CRP and monocyte IL-6 compared to controls. Alpha tocopherol (AT) supplementation was shown significantly to reduced levels of C-reactive protein and monocyte interleukin-6 among this group. In conclusion, AT therapy reduced inflammation in T2DM patients and this can be an adjunct therapy in the prevention of atherosclerosis.

Conclusion

The present investigation concluded that high hs-CRP levels in T2DM cases compared with controls. hs-CRP is an inflammatory marker and has role in atherosclerosis. From this study it is observed that there is moderate correlation between hs-CRP levels and it increases the risk of atherosclerosis.

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