

HbA1c, hs-CRP AND ANTHROPOMETRIC PARAMETERS EVALUATION IN THE PATIENTS OF DIABETES MELLITUS OF CENTRAL RURAL INDIA

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DOI: 10.5455/ijmsph.2013.2.291-294 Received Date: 31.12.2012

Accepted Date: 02.01.2013

ABSTRACT

Background: C-reactive protein is one of the most sensitive markers of systemic inflammation. Numerous studies have found that baseline levels of C-reactive protein are associated with risk of future myocardial infarction, stroke, peripheral vascular disease and cardiovascular death amongst apparently healthy populations.

Aims & Objective: To find the association of hs-CRP and diabetes mellitus in the population of our region.

Material and Methods: hs-CRP level in cases of diabetes was compared with that of non-diabetic healthy controls in our rural based tertiary care hospital. The analysis was done with 50 diabetic and 50 non-diabetic individuals. Anthropometric and biochemical parameters were studied to assess the association of hs-CRP with in diabetes mellitus.

Results: Anthropometric parameters were found to be high in diabetic subjects compared with non-diabetic subjects. The high hs-CRP levels in diabetic subjects were also observed.

Conclusion: Serum hs-CRP levels were positively related to anthropometric parameters. The relationship of hs-CRP with glycaemic control was studied with HbA1c, and it was positively correlated with hs-CRP. The results concluded that hs-CRP has strong association with diabetic individuals.

KEY-WORDS: Diabetes Mellitus; hs-CRP; BMI; HbA1c; Association

Introduction

Diabetes is one of the major components of metabolic-disorders leading to metabolic syndrome with hyperglycaemia due to defect in the biologic effectiveness of insulin. The chronic extra cellular hyperglycaemia results in tissue damage and chronic vascular complications.^[1]

CRP, a pentameric protein produced by the liver has emerged as the 'golden marker for inflammation'. Among several markers of inflammation, hs-CRP is found to be significant in people with diabetes. Hyperglycaemia is an associated factor to the increase of serum CRP levels.^[2] C-reactive protein is one of the most sensitive markers of systemic inflammation. Numerous studies have found that baseline levels of C-reactive protein are associated with risk of future myocardial infarction, stroke, peripheral vascular disease and cardiovascular death amongst apparently healthy populations.^[3] Hypertensive patients with DM had higher levels of hs-CRP, a circulating inflammatory marker,

than normal subjects. This finding suggests that patients with two associated diseases have a more active inflammatory state.^[4]

There are several studies on hs-CRP and diabetes mellitus association but the data on the people residing in our region was limited. So the current study was carried out to find the association of hs-CRP and diabetes mellitus in the population of our region.

Materials and Methods

All patients gave their informed consent to participate in the study. The patients visited to our rural based tertiary care hospital were included in the study.

Analysis was carried out on the biochemical parameters for the 50 healthy non-diabetic subjects and 50 diabetic individuals.

After excluding subjects who smoked (current or within the past 6 months), had any acute infective illness (current or within the past 6 months), or

had any chronic illness, a total of 250 subjects remained. Of these, 50 subjects were randomly selected as cases for the analysis of the study.

Anthropometric Measurements

Weight and height measurements were obtained, using standardized technique.^[5] The BMI was calculated as the weight (kg)/height squared (m)². Blood pressure was recorded in the sitting position by using the right arm with a mercury Sphygmomanometer.

Biochemical Parameters

Fasting plasma glucose (glucose-oxidase peroxidase method), Subjects were instructed to fast from 2200 hr in the evening prior to blood sampling. Blood samples were obtained between 0800 and 0900 hrs and were analyzed in the central laboratory immediately. Samples were centrifuged and the sera were divided into separate aliquots and stored at -20°C. Estimation of fasting blood glucose (FBG), HbA1c and hs-CRP were done on semi-autoanalyzer (Biotron BTR 830) in our clinical biochemistry laboratory.

A Turbidimetric immunoassay for the high sensitive determination of C-reactive protein (hs-CRP) in human serum was used which was based on the principle of agglutination reaction. Measuring Range is 0.15 mg/L to 10 mg/L.

The American Heart Association and US Centers for Disease Control and Prevention have defined risk groups as follows:

Low risk: <1.0 mg/L

Average risk: 1.0 to 3.0 mg/L

High risk: > 3.0 mg/L

Statistical Analysis

All the analysis was done by using the Windows based SPSS statistical Package (Version 16.0; SPSS) and P- values <0.05 were taken as the level of significance.

Results

The clinical and biochemical characteristics in relation to hs-CRP of the study group were shown in the table-1. In comparison with non-diabetic

subjects, the diabetic subjects were older (P < 0.008) and had higher BMI (P<0.006). They also had higher systolic blood pressure (P<0.05) and diastolic pressure blood pressure (P<0.05), fasting plasma glucose (P<0.001), HbA1C % (P<0.001). hs-CRP levels were significantly higher among the diabetic subjects with 5.1 ± 2.9mg/L (P<0.05) for non-diabetic subjects with 1.01 ± 0.2mg/L.

When the study subjects were characterized as high risk using hs-CRP cut -off >3.0 mg/L , the subjects with abnormal hs-CRP (hs-CRP>3.0 mg/L) were older (P<0.008) , and also had higher body mass index (P<0.006), systolic pressure (P<0.05) than the subjects with normal hs-CRP (hs-CRP < 3.0 mg/L).

Fasting plasma glucose (P<0.001) and HbA1c (P<0.05) were also higher in subjects with abnormal hs-CRP than the subjects with normal hs-CRP.

The Odd ratio was zero which showed significant association in the levels of low risk hs-crp between diabetic and healthy control group. Also by applying the chi-square test we found significant association (p<0.0001) in each category of hs-CRP in diabetic cases and healthy controls. SE of the difference of mean was 0.2704 and 95% confidence interval for the difference of mean- 3.5535 to 4.6265 with the lower limit was 0.105 and upper limit was 0.308.

The correlation between hs-CRP and HbA1c & hs-CRP and anthropometric parameters has been checked by Pearson's correlation coefficient. They were positively correlated with the level of significance was 0.01 and shown by scatter plot diagram. (Fig: 1 and 2)

Table-1: Clinical and Biochemical Characteristics of Study Subjects

Parameters	Healthy Subjects n = 50	Diabetic Subjects n = 50	P value
Age (yrs)	42 ± 12	51 ± 10	<0.008
BMI (kg/m ²)	20.3 ± 2.3	25.9 ± 4	<0.006
Systolic BP(mm Hg)	112 ± 16	126 ± 16	<0.05
Diastolic BP (mm Hg)	72 ± 10	76 ± 12	<0.05
Fasting Plasma Glucose (mg/dL)	82 ± 6.2	140 ± 5.1	<0.001
HbA1c (%)	4.5 ± 1.2	7.4 ± 2.5	<0.05
hs-CRP (mg/L)	1.01 ± 0.2	5.1 ± 2.9	<0.05

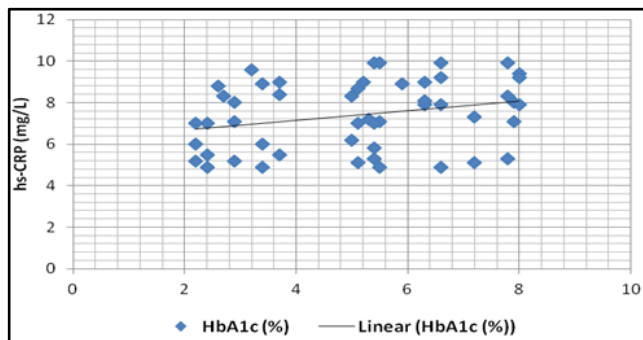


Figure-1: Correlation between hs-CRP (mg/L) and HbA1c (%)

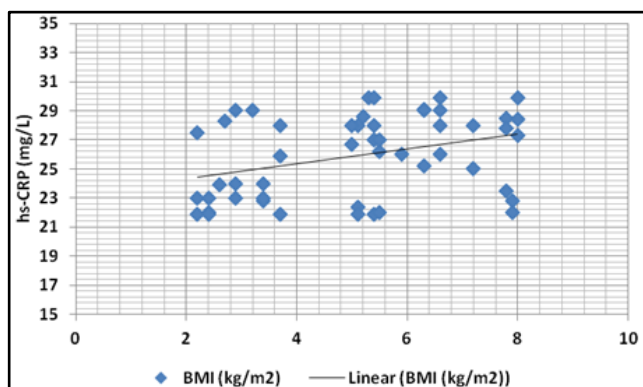


Figure-2: Outcome of Sepsis in Relation to Stage of Sepsis in the Study Population

Discussion

Diabetes mellitus (DM) is characterized by clustered metabolic abnormalities including hyperglycaemia, elevated triglycerides, low HDL cholesterol, and central obesity. Levels of high-sensitivity (hs) C-reactive protein (CRP) are significantly elevated in individuals with DM and are associated with measures of adiposity. The predominant role of adiposity on the regulation of the inflammatory response is not surprising. Adipose tissue is in itself a source of CRP and a major producer of interleukin-6, a key stimulator of CRP secretion. In obesity, adipose tissue contains an increased number of resident macrophages and T cells, which interact closely with adipocytes to modulate the inflammatory response.^[6]

The C-reactive protein derives from the fact that it reacts with capsule polysaccharide of streptococcus pneumonia. It is an acute phase response protein markedly increased in both inflammatory and infectious diseases. It plays an important role in innate immunity.^[3] In vivo release of interleukin-6, linked closely to CRP pathway which is related to insulin resistance, has

been reported in human subcutaneous adipose tissue (SAT).

The relatively large SAT mass (truncal and peripheral SAT) in Asian Indians, may generate relatively more CRP and preferentially drive this pathway rather than the insulin resistance pathway, although both appear to be interlinked.^[7] Persistent and mild elevations in hs-CRP levels in Asian Indians residing in India could be due to increased exposure to repeated infections.⁷ Thus, a single value of an elevated CRP level may not have adequate predictive importance for Diabetes mellitus.

Diabetic subjects have higher Body Mass Index³ (BMI) which was also proved by our results. BMI have the positive correlation with the obesity which leads to DM.^[8] Cosin Aguilar from his study state that the obese patients showed higher prevalence of diabetes.^[9]

Higher CRP levels in Asian Indians than white Caucasians, may contribute to a high prevalence of DM in this ethnic group. High CRP concentrations significantly correlate with insulin resistance and the metabolic syndrome in adults.^[7] In the present study, serum hs-CRP levels were positively related to anthropometric variables such as Body Mass Index (BMI) and Systolic and Diastolic blood pressure which is in relation to other similar previous studies.^[10]

Hb1Ac was higher in the diabetic subjects than normal subjects. The present study showed the significance increase of hs-CRP in subjects with diabetes mellitus. Also the correlation of hs-CRP with fasting plasma glucose and HbA1c observed is similar to the previous study. Another interesting observation was the relationship of hs-CRP with glycemic control could influence inflammation. In diabetic subjects hs-CRP was positively correlated with HbA1c. Similar results were found in earlier studies.^[11,12]

The present study showed that hs-CRP has a strong association with diabetes mellitus in Central Rural India population. It is also concluded that age and body mass index has strong association with diabetic individuals. It is very well understand that the levels of hs-CRP

significantly associated with age, BMI, systolic and diastolic pressure. Also the conclusion has been drawn that elevated hs-CRP level significantly different with different age groups of diabetes mellitus individuals.

A limitation of this study was the cross-sectional design. We only performed measurements at one time point. hs-CRP is a sensitive marker for acute phase inflammation and has a high within-subject variability. The findings of this investigation need to be confirmed in a larger number of Asian Indians of both genders, and the clinical significance of the correlations observed in this study need to be evaluated in prospective studies. However, hs-CRP is likely to remain the standard for assessing inflammation because of the availability and ease of use of this assay.

Conclusion

Thus the study concluded that HbA1c, hs-CRP has a strong association with diabetes mellitus in the population of Central Rural India. The present analysis is exploratory in nature, but serves to add clinical insight on the inflammatory burden of the populations residing in our region.

ACKNOWLEDGMENTS

Authors are grateful to Datta Meghe Institute of Medical Sciences (Deemed University) for funding this work.

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Cite this article as: Meshram A, Agrawal U, Dhok A, Adole P, Meshram K, Khare R. HbA1c, hs-CRP and anthropometric parameters evaluation in the patients of Diabetes Mellitus of Central Rural India. *Int J Med Sci Public Health* 2013; 2:293-296.

Source of Support: Nil

Conflict of interest: None declared