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Association of serum high-sensitivity creactive protein level with metabolic syndrome

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***Abstract*---**Background – Metabolic syndrome is considered as pro inflammatory state, measurement of hsCRP might help in the prediction of onset of CVD. We analyzed the association of serum hsCRP level with metabolic syndrome. Methods- the study included the 140 diagnosed case of metabolic syndrome (Men= 81, Women= 5). We measured the fasting glucose, fasting lipid panel & serum hsCRP level. Serum hsCRP level was compared with the components of metabolic syndrome. Results- High level of hsCRP was found in both men (67.9 %) & women (66.1%) with metabolic syndrome. The most common components of metabolic syndrome were abdominal obesity in women, while high TG, hypertension & low HDL-C was common in men. hsCRP level was found to be significantly increased in metabolic syndrome subjects with diabetes mellitus and obesity. In addition, hsCRP was significantly increased with increasing the number of components of metabolic syndrome. Conclusion- Measurement of hsCRP level indicates the inflammation associated with obesity & diabetes mellitus that might be explained the increasing the risk for development of cardiovascular disease.

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***Keywords*---**Metabolic syndrome, High sensitivity C-reactive protein, Obesity, Cardiovascular disease, Diabetes mellitus.

Introduction

The metabolic syndrome is a cluster of several vascular risk factors. To identify the metabolic syndrome, there is a readily applicable definition for daily clinical practice, i.e. the presence of three or more of the following characteristics: hyperglycemia, hypertension, low plasma HDL cholesterol level, high plasma triglyceride level and central adiposity. The metabolic syndrome is associated with increased cardiovascular morbidity and mortality and an increased risk for the development of diabetes mellitus type 2. In subjects with one or two components of the metabolic syndrome and in patients with manifest vascular disease, it seems advisable to be alert to the presence of the other components in order to either diagnose or exclude the metabolic syndrome [1]. C-reactive protein (CRP) is marker of low-grade chronic inflammation. Normal highly sensitive CRP varies from 0-5 mg/L in healthy young adults [2]. Metabolic syndrome is also considered a proinflammatory state [3] and measurement of inflammatory markers like hs-CRP [4] might improve the prediction of cardiovascular disease and diabetes in patients with metabolic syndrome. Previous studies have shown that CRP is associated with components of Metabolic syndrome [5,6]. Very few data available on association of metabolic syndrome and its components with hs-CRP in India. Therefore, we investigated the same in the present study.

Material and Methods

The study was carried out at the Department of Biochemistry M.G.M. Medical College, Indore. Collaboration of the Department of Medicine at MY Hospital was sought in the provision of cases. Volunteer patients diagnosed with the Metabolic syndrome in the clinics of the department were selected for the study. 140 diagnosed cases of metabolic syndrome included in present study. Complete care was taken in protecting the anonymity of patients and the privacy of patient medical records. The study did not involve administration of any drug/medication or any surgical procedure to the patients. Patients who had HIV-positive status, liver disease, renal disorder, thyroid disorder, hormonal disorder and smoking more than 20 cigarettes per day excluded from the study.

Definition of the metabolic syndrome

To identify cases of metabolic syndrome the ATP III (Adult Treatment Panel III) criteria [7] were used i.e. the presence of three or more of the following five characteristics:

1. Elevated triglycerides (>150 mg/dl) or specific treatment for this lipid abnormality.
2. Reduced HDL cholesterol (<40 mg/dl in males and <50 mg/dl in females) or specific treatment for this lipid abnormality.
3. High blood pressure (>130/85 mm/Hg) or on treatment for hypertension.

4. Raised fasting blood glucose (>100mg/dl or 5.6 mmol) or already having type II diabetes.
5. Obesity- measured as waist circumference >35 inches in women and >40 inches in men or BMI 25-30 Kg/m^2 (obesity or overweight).

The approval of institutional ethical committee was taken before initiation of the study. Informed consent was also obtained from each participant before enrolling. Blood collection: A 20 ml venous blood was collected from each participant after an overnight fast (> 8 hours).

Physical and biochemical examination

Physical examination was done for vital parameters, anthropometry (height, weight and waist circumference measurement) and the systemic examination the body mass index and blood pressure (systolic & diastolic). BMI was calculated by using formula (BMI= weight in kg/ height in m2). Biochemical investigation included fasting lipid profile, fasting glucose and fasting hsCRP level. Glucose levels were measured by hexokinase enzymatic methods [8], lipid panel was assayed by enzymatic methods (Total cholesterol by CHOD/PAP method [9], High density lipoprotein cholesterol by Direct enzymatic method [10], Triglycerides by GPO/PAP method [11] & hsCRP level was measured by ELISA method [12]. Data analysis: Data analysis was done using the IBM SPSS Statistics version 20 and MedCalc version 14 program with a value of $p<0.0001$, $p<0.01$ and $p<0.05$ considered highly significant and significant respectively. Two groups comparison were done by the student's paired or unpaired t-test and the test for parametric or non-parametric data.

Results

The study included 140 metabolic syndrome cases (Men= 81 & 59 women) (Table I). The prevalent components of metabolic syndrome differed by sex: for men they had elevated blood pressure, elevated blood fasting glucose, high triglycerides level and low HDL-C level and for women they had high abdominal obesity. Men had significantly higher triglyceride level and low HDL-C level whereas significantly higher proportion of women had abdominal obesity. No significant differences by sex were found for elevated blood pressure and elevated fasting glucose level (Table II).

Table I
Characteristics by sex, of 140 metabolic syndrome cases

Characteristics	Men n= 81	Women n= 59	P value
Age years (mean ± SD)	53.2 ± 10.6	50.7 ± 13.4	0.23
BMI (kg/ m^2)	25.1 ± 6.3	30.6 ± 7.5	0.53
WC (cm)	84.6 ± 13.2	91.2 ± 15.6	0.34
hsCRP (mg/L)	3.57 ± 0.60	3.54 ± 0.79	0.78
History of Diabetes (%)	94.9	85.1	
History of hypertension (%)	65.4	64.4	
Smoking (%)	29.6	0	
hsCRP > 3 mg/L	67.9	66.1	

Table II
Metabolic syndrome components in different genders

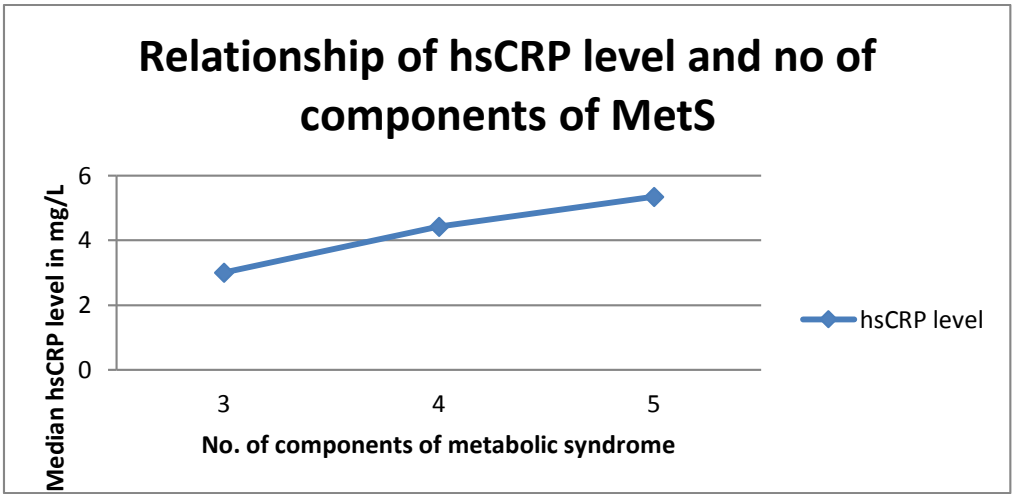
Variable	Men n = 81	Women n= 59	Overall	p value
Obesity (%)	28 (34.5)	52 (88.1)	80 (57.1)	0.02
Hypertension (%)	54 (66.6)	38 (64.4)	92 (65.7)	0.56
Elevated fasting glucose (%)	70 (86.4)	49 (83.0)	119 (85)	0.92
High Triglycerides (%)	60 (74)	40 (67.7)	100 (71.4)	0.05
Low HDL (%)	80 (98.7)	57 (96.6)	137 (97.8)	0.02

Metabolic syndrome components are distributed according to NCEP-ATP III criteria. In 140 metabolic syndrome patients hsCRP level was correlated with the components of metabolic syndrome. Univariant analysis was done (Table III). In 80 obese subjects, the median hsCRP was 3.60 mg/L, compared to non-obese subjects, was highly significant (<0.02). In 125 diabetic subjects, median hsCRP was 3.54 mg/L highly significant (<0.03) compared to non-diabetic subjects while subjects those had high triglycerides, hypertension & low HDL-C the median hsCRP were not significantly change in this group (not shown in table).

We also measured the hsCRP levels with increasing the no of components of metabolic syndrome. 140 subjects of metabolic syndrome divided in 3 groups, had 3 components, 4 components and had all 5 components. Majority of subjects of morbid group had diabetes, hypertension, obesity & low HDL-C level, which is common combination, consider for metabolic syndrome. Subjects with minimum 3 components, median hsCRP was 3.00 mg/L, with 4 components the median hsCRP value was 4.42 mg/L and those had 5 components median hsCRP value was 5.35 mg/L. (Table III) (Figure1)

Table III
hsCRP level with increasing the no of components of metabolic syndrome

Varibles	Metabolic components (3) N= 48	Metabolic components (4) n= 73	Metabolic components (5) n= 19
hsCRP mg/L (median)	3.00	4.42	5.35



Discussion

In present study we investigated the association of hsCRP levels in metabolic syndrome. 140 metabolic cases were included and analyzed by sex. 57% of the men & 42.1% women had metabolic syndrome. As in other studies no differences found in metabolic syndrome prevalence by sex. In other published studies, men had less prevalence than female. In our study metabolic syndrome was more common in men than women same data supported by Sudha Vidyasagar et.al [13].

In present study abdominal obesity was most prevalent in women while high TG & low HDL were prevalent in men. In other published studies it has found that men had a greater amount of abdominal fat than women [14,15], but we found that women had more abdominal obesity and the high TG was more prevalent in men that also observed by Huffman et.al [16].

Metabolic syndrome is also considered as pro-inflammatory state. Prevalent components of metabolic syndrome like abdominal obesity, hypertension & diabetes have been associated with increased level of hsCRP might improve the prediction of CVD [4]. In present study we also found high median hsCRP level in subjects with metabolic syndrome than without metabolic syndrome.

We also analyzed the association of hsCRP with components of metabolic syndrome. Significant association was found of hsCRP with diabetes mellitus and central obesity. Obesity is now recognized as a state of chronic, low grade inflammation [2] and is associated with increased serum marker of inflammation and oxidative stress & metabolic syndrome has been linked with inflammation & oxidative stress.

Van Guilder et al. [17] studied that CRP was significantly elevated in both obese with metabolic syndrome & obese without metabolic syndrome groups compared to the normal weight group but was significantly elevated in the obese with metabolic syndrome compared to obese without metabolic syndrome.

In present finding we found that central obesity and diabetes mellitus had significant association with high hsCRP levels. Our findings also supported by the previous studies, showed abdominal obesity only component of metabolic syndrome was significantly associated with elevated levels of hsCRP [18, 19]. In some other studies, it was observed that diabetes mellitus was associated with high hsCRP levels [20, 21].

In addition to this we also found increased hsCRP level as the components of metabolic syndrome increased. A significant positive linear association was found with the increasing number of the syndrome. Other published studies also supported the data as they found similar findings [22, 23].

This finding suggests that as the no of components of metabolic syndrome increases in subjects, that might be have higher risk for the development of Cardio vascular disease. From previous data it has reported that the presence of more components of metabolic syndrome was associated with the increase in subclinical atherosclerosis and incidence and mortality of coronary artery disease [24].

Conclusion

The present study concluded that as the components of metabolic syndrome increases that affects the subjects as we found positive correlation of hsCRP with obesity and diabetes mellitus and also there was linear increased in hsCRP level with the increase in number of components of metabolic syndrome. The management and treatment of obesity and diabetes mellitus might help to take care of subjects before the onset of CVD.

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