

Study of Serum Ferritin as a Component of Metabolic Syndrome

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Abstract: Background: The metabolic syndrome (Syndrome X, Insulin resistance syndrome) consists of constellations of symptoms of central obesity, hypertriglyceridemia, low HDL cholesterol, hyperglycemia, and hypertension. Elevated serum ferritin levels independently predicted incident type 2 diabetes in prospective studies in apparently healthy men and women. In cross-sectional studies, elevated ferritin levels have been associated with hypertension, dyslipidemia, elevated fasting insulin and blood glucose and central adiposity. Aims and Objectives: The present study was done to determine the association of serum Ferritin in Metabolic Syndrome as well as to determine the relation between individual component of metabolic syndrome & number of components of metabolic syndrome and plasma ferritin. It is a Correlational clinical single group study. Results: In the present study, there were 99 males & 51 females with mean Age distribution of 57.35±8.03. The majority of patients (40%) were in their sixth decade of life. Mean BMI in our study was 29.39±1.78, with 96(64%) of patients meeting criteria for central obesity, according to NCEP ATP3 guidelines. In our study 126 (84%) of patients had a blood pressure recording of more than 135/85mmHg. Ninety nine patients (66%) were known hypertensives about treatment. 117 patients (78%) were known diabetics on treatment, 33 (22%) patients did not have a history of diabetes. In our study 77(51.33%) patients had abnormal total cholesterol (>200mg/dl), 108 (72%) patients had abnormal triglycerides (>150mg/dl), 113(75.33%) patients had abnormal HDL (<40mg/dl in males, >50 in females) There were 53 (35.3%) patients with 3 components of metabolic syndrome, 57 (38%) with 4 components and 44 (29.33%) with 5 components of metabolic syndrome. The present study revealed that Serum ferritin was increasing significantly with increasing number of components of metabolic syndrome with P=0.052. It also showed that individual components of metabolic syndrome had significant correlation with increasing number of components of metabolic syndrome. Central obesity was increasingly associated with increasing number of metabolic syndrome with a significant p value of <0.001, dyslipidaemia (both triglycerides and HDL criteria) also showed a similar correlation of statistical significance (p value of <0.001). Blood pressure also significantly correlated with a p value of 0.003. Conclusions: There is a positive association between elevated iron stores, measured by serum ferritin levels, and the prevalence of the metabolic syndrome. Ferritin levels also correlated with number of components of the metabolic syndrome. There is a positive correlation between individual components of metabolic syndrome with number of components of metabolic syndrome.

Keywords: Metabolic Syndrome, Serum Ferritin

1. Introduction

The metabolic syndrome (syndrome X, insulin resistance syndrome) consists of a constellation of metabolic abnormalities that confer increased risk of cardiovascular disease (CVD) and diabetes mellitus (DM). Major features of the metabolic syndrome include central obesity, hypertriglyceridemia, low HDL cholesterol, hyperglycemia, and hypertension¹. Prevalence of the metabolic syndrome varies across the globe, in part reflecting the age and ethnicity of the populations studied and the diagnostic criteria applied. In general, the prevalence of metabolic syndrome increases with age. Other Risk Factors include Overweight/Obesity, sedentary lifestyle, aging, Diabetes Mellitus, Coronary heart disease, lipodystrophy.

Elevated serum ferritin levels independently predicted incident type 2 diabetes in prospective studies in apparently healthy men and women^[2]. In cross-sectional studies, elevated ferritin levels have been associated with

hypertension, dyslipidemia, elevated fasting insulin and blood glucose and central adiposity³. The association between elevated iron stores and the metabolic syndrome, however, has been less well explored.

2. Methodology

It is a cross sectional clinical single group study with 150 patients with metabolic syndrome diagnosed, as per National Cholesterol Education Program Adult Treatment Panel III (2001), from Victoria and Bowring & Lady Curzon hospital affiliated to Bangalore medical college and Research institute Bangalore, satisfying both the inclusion and exclusion criteria as stated below.

Method of Collection of Data

- Detailed history of the patients
- Clinical examination of the patients
- All the patients had undergone following investigations:

FBS, PPBS,
 Blood urea and serum creatinine
 Fasting Lipid Profile,
 Baseline ECG
 CRP
 Urine routine
 Complete blood count with peripheral blood smear
 Fasting serum ferritin levels (single-incubation two-site immunoradiometric assay.)

3. Discussion

There is increasing evidence that moderately elevated body iron stores, below the levels which are commonly found in genetic hemochromatosis, may be associated with adverse health outcomes. We hypothesized that the metabolic syndrome would be more common in those with moderately elevated serum ferritin levels. The present study was done to determine the association of serum Ferritin in Metabolic Syndrome as well as to determine the relation between individual component of Metabolic Syndrome & number of components metabolic syndromes and plasma ferritin. It is a Correlational clinical single group study with 102 patients. Patients were evaluated with detailed history, meticulous examination and laboratory investigations. Laboratory investigations included fasting lipid profile, fasting blood sugar, postprandial blood sugar levels, complete blood picture and fasting serum ferritin. Since serum ferritin is an acute-phase reactant and may be elevated in the presence of inflammation, we attempted to minimize this potential source of confounding by adjusting for CRP and by excluding those individuals with suspected inflammation, infection, and liver disease. Most of our patients were selected when they had come for treatment of diabetes and hypertension.

In the present study, there were 99 males & 51 females with mean Age distribution of 57.35 ± 8.03 . The majority of patients (40%) were in their sixth decade of life. There were only 7 patients under 40 yrs and only 4 patients above 70 yrs of age. In a study conducted by Claudia bozzini^[4] et al, the mean age distribution among study populations was 58.7 yrs. In a study done by Bilgillisebel et al^[5], mean age of the patients was 51.1 ± 11.8 years. In a study conducted by Vasilistimchodimos et al^[6], mean BMI in the study population was 29.1 ± 3.4 .

In a study done by BilgilliSebel et al^[5], all subjects with metabolic syndrome had BMI >25 Kg/m². Mean BMI in our study was 29.39 ± 1.78 , with 67 (65.7%) of patients meeting criteria for central obesity according to NCEP ATP3 guidelines. All the patients had BMI > 25 Kg/m².

In our study 126 (84%) of patients had a blood pressure recording of more than 135/85 mmhg. Ninety nine patients (66%) patients were known hypertensives about treatment.

In a study done by Jing Wang et al^[7] diastolic blood pressure was significantly higher in males when compared with females. Our study did not show such correlation. In the present study, 117 patients (78%) were known diabetics on treatment, 33 (22%) patients did not have a

history of diabetes. In a study done by Jing Wang et al^[7] fasting blood sugar was significantly higher in females when compared with males. In the present study there was no statistically Significant difference.

In a study done by Jing Wang et al^[7] HDL cholesterol was significantly higher in females when compared to males.

In our study, 77 (51.33%) patients had abnormal total cholesterol (>200 mg/dl), 108(72%) patients had abnormal triglycerides (>150 mg/dl), 113(75.33%) patients had abnormal HDL (<40 mg/dl in males, <50 in females).

In our study, mean value of Blood urea was 30.12 ± 9.64 mg/dl and mean value of serum creatinine was 0.8 ± 0.03 mg/dl without any statistical significance to serum ferritin. The study population was categorized into those having 3, 4 and 5 components of metabolic syndrome. Based on the serum ferritin levels in ng/l, they were divided into 5 quartiles as >50 , 51-100, 101-150, 151-200 & >200 . There were 53 (35.3%) patients with 3 components of metabolic syndrome, 57 (38%) with 4 components and 44 (29.33%) with 5 components of metabolic syndrome.

In our study, we analyzed the association of serum ferritin and other parameters of metabolic syndrome with each group containing 3, 4 and 5 components of metabolic syndrome. The present study revealed that Serum ferritin was increasing significantly with increasing number of components of metabolic syndrome with $p=0.052$. It also showed that individual components of metabolic syndrome had significant correlation with increasing number of components of metabolic syndrome. Central obesity was increasingly associated with increasing number of components of metabolic syndrome with a significant p value of <0.001 , dyslipidemia (both triglycerides and HDL criteria) also showed a similar correlation of statistical significance (p value of <0.001). Blood pressure also significantly correlated with a p value of 0.003. However, there was no significant association between fasting blood glucose and the number of components of metabolic syndrome in our study. An explanation could be that in our study, 78% of patients were known diabetics on treatment and the majority of them falling in the group containing 4 components and 5 components of metabolic syndrome.

In a study conducted by Claudia bozzini^[4] et al, a higher concentration of ferritin was associated with the metabolic syndrome at baseline. In a similar study conducted by Megan jehn^[2], it was revealed that the highest prevalence of the metabolic syndrome occurred in those with higher levels of serum ferritin. The prevalence of elevated blood pressure, elevated plasma glucose, elevated triglycerides, and abdominal adiposity all increased significantly with increasing serum ferritin. The prevalence of elevated triglycerides and abdominal adiposity also increased with increasing levels of serum ferritin. The greater number of metabolic syndrome components present, the greater was the serum ferritin level. The results of this study were similar to our observations. A study by Liang Sun et al^[8], concludes that Elevated circulating ferritin concentrations were associated with higher risk of type 2 diabetes and

metabolic syndrome in middle-aged and elderly Chinese independent of obesity, inflammation, adipokines, and other risk factors. Supporting the crucial role of iron overload for metabolic diseases, even in a country with relatively high prevalence of iron deficiency which is similar to our observations in the present study. A study conducted by Vasilitsimchodimos et al^[6] revealed that patients with metabolic syndrome exhibited increased. The concentration of serum ferritin compared to control group supporting our findings. In a study done by Bilgili Sebel et al^[5] metabolic syndrome patient had significantly higher BMI, waist and hip circumference, systolic and diastolic pressure, fasting glycemia, two-hour postprandial serum glucose, total cholesterol, triglycerides, lower HDL cholesterol.

Study by Istvan s vari, Beverley balkau, Adrian kettaneh^[3], was the first prospective study associating ferritin & transferrin with the metabolic syndrome & its components. The incidence of metabolic syndrome was increased in men & both pre and post menopausal women, among those with higher serum ferritin levels.

4. Summary

In this study, we observed a positive association between elevated iron stores, measured by serum ferritin levels, and the prevalence of the metabolic syndrome. Ferritin levels also correlated with increasing number of components of metabolic syndrome. We also observed that individual components of the metabolic syndrome correlated well with increasing number of components of metabolic syndrome.

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