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Original Research Article

Prevalence of metabolic syndrome in patients with premature coronary artery disease proven by coronary angiogram

Varun Sundaramoorthy[1], Anith Kumar Mambatta[2]*, Yoganathan Chidambaram[2], Rajendiran Gopalan[3], Sujaya Menon[2]

[1]Department of Infectious Diseases, IDTRC, Christian Medical College and Hospital, Vellore, Tamil Nadu, India
[2]Department of Medicine, [3]Department of Cardiology, PSG Institute of Medical Sciences and Research, Coimbatore, Tamil Nadu, India

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***Correspondence:**
Dr. Anith Kumar Mambatta,
E-mail: anithkumar_m@yahoo.com

ABSTRACT

Background: Metabolic syndrome (MS) is associated with premature coronary artery disease (CAD). The aim of this study was to evaluate the prevalence of MS and its association with severity of CAD proven by coronary angiogram (CAG) in young patients.
Methods: We included patients, aged 45 years or less, admitted with acute coronary syndrome (ACS), who had CAD confirmed by coronary angiography. They were divided into two groups according to the presence or absence of MS based on International Diabetes Federation (IDF) criteria. CAD was classified into single, double and triple vessel disease (TVD). The prevalence of MS and its individual parameters was calculated.
Results: Among 90 young patients who presented with ACS, MS was present in 67 patients (74.44%). Among those with MS, the prevalence of each individual criterion was statistically significant in MS group (P <0.05). Prevalence of pre-existing hypertension and diabetes was significantly higher in MS group (p <0.01). Smoking, alcohol consumption and family history of CAD were not statistically significant in patients with and without MS. Fifteen out of 90 patients (14 in MS group) who presented with ACS had TVD in CAG, but this was not statistically significant (p 0.06).
Conclusions: This study confirms a very high prevalence of MS in young Indian patients with premature CAD. MS was more prevalent than the conventional risk factor smoking in young CAD patients. We could not find significant difference in severity of CAD based on CAG between MS and non-MS group.

Keywords: Coronary angiogram, Coronary artery disease, Metabolic syndrome, Young patients

INTRODUCTION

Coronary artery disease (CAD) affecting younger individuals has reached enormous proportions. There is no doubt that it will become a major public health problem in the future unless we concentrate on reversible causes and prevention, through research studies. CAD is increasing in developing and transitional countries because of urbanization, demographic and lifestyle changes, whereas it is decreasing in many developed countries.[1] Studies have suggested that the risk of myocardial infarction is mostly due to modifiable risk factors like smoking, physical inactivity, poor diet, psychosocial stress, hypertension ,diabetes mellitus, dyslipidemia and increased waist-hip ratio.[2,3] Many of these risk factors are grouped or are seen at the onset of metabolic syndrome (MS).

Metabolic syndrome, a cluster of glucose intolerance, hypertension, dyslipidemia and abdominal obesity, has

been recognized as a major predeterminant of type 2 diabetes mellitus and CAD.[4,5] MS was associated with a 1.5 fold increase in all-cause mortality and a two fold increase in cardiovascular outcomes in a recent metaanalysis.[6] Presence of MS with or without diabetes was found to be an independent determinant of premature CAD.[7] CAD in younger population is an area of increasing interest because of its potential for long-term disability and premature death.

Few studies have reported MS and its association with CAD in the young.[7-9] We found only very limited studies in an Indian setting analyzing the association of MS with premature CAD.[10] The prevalence of MS in young patients with angiographically proven premature CAD has not been studied in Indians, to our knowledge. Understanding the impact of MS on CAD in younger age group is important for developing public health policy towards prevention and management. Hence this study was undertaken to know the prevalence of metabolic syndrome using International Diabetes Federation (IDF) criteria in patients with premature coronary artery disease proven by coronary angiogram (CAG). We also tried to evaluate any association between the presence of metabolic syndrome and severity of CAD.

METHODS

This cross-sectional study was conducted at our centre, a large tertiary care teaching hospital in South India. The study was done after obtaining institutional ethical committee clearance and informed consent. All patients, aged 45 years or less, admitted with acute coronary syndrome (ACS) [ST-elevation myocardial infarction (STEMI)/non-ST-elevation myocardial infarction (NSTEMI) and unstable Angina as per standard definition], in our hospital during the period March 2014-August 2014 were included in the study. We excluded patients younger than 18 years or older than 45 years of age and patients who did not undergo coronary angiogram for various reasons.

ACS was diagnosed in patients with symptoms compatible with myocardial infarction (MI), based on electrocardiogram (ECG) changes and cardiac enzymes. Ejection fraction (EF) and left ventricular systolic dysfunction (LVD) was assessed by echocardiography. CAG was done in all subjects either at admission for primary Percutaneous Coronary Intervention (PCI) or electively after initial medical stabilization with thrombolysis or conservative treatment, depending on the clinical circumstances and consent from the patient. CAD was diagnosed as a 50% or greater stenosis in one of the three major coronary arteries and classified as single vessel disease (SVD), double vessel disease (DVD) and triple vessel disease (TVD) based on the number of arteries involved. The IDF criteria were used for a diagnosis of MS, which is suitable for Indian population.[4] MS was defined as the presence of abdominal obesity (defined by waist circumference ≥ 90 cm for men and ≥ 80 cm for women) plus two or more of the following factors

- Triglycerides ≥150 mg/dL or specific treatment for this lipid abnormality,
- High density lipoprotein (HDL) cholesterol <40 mg/dL for men or <50 mg/dL for women or specific treatment for this lipid abnormality,
- Blood pressure ≥130/85 mm Hg or treatment of previously diagnosed hypertension,
- Fasting plasma glucose ≥ 100 mg/d L or previously diagnosed type 2 diabetes.

Detailed history was taken including presenting symptoms, history of diabetes/systemic hypertension/ history of CAD in the family/usage of alcohol and smoking. A careful physical examination was done with reference to waist circumference (WC) and blood pressure. About ≥3 measurements of BP at the time of entry with values greater than or equal to 130/85mmHg on an average or any medications for hypertension was considered significant. WC was recorded according to the national health and nutritional survey. Peripheral venous blood samples were drawn at the time of admission, the following morning after an overnight fast for lipid profile (total cholesterol, high density lipoprotein cholesterol (HDL-C), low density lipoprotein cholesterol (LDL-C) and triglycerides) and at day 5 for fasting plasma glucose.

Statistical analysis

The data were analyzed using Statistical Package for Social Science (SPSS) Version 19.0, and Microsoft Excel 2010. Continuous variables were expressed as mean/SD and compared with independent sample t-test. Categorical variables were expressed as percentage and compared with chi-square test. A predictive value of less than 0.05 was taken as statistically significant.

RESULTS

A total of 90 young patients with ACS, who underwent CAG were studied. The key demographics of the study group are summarized in Table 1. Patients ranged from 26 to 45yrs. The mean age of the patients was 39.7 yrs. Among 90 patients, 82 were male and eight were female. Out of 90 cases, 67 (74.44%) had MS according to IDF criteria and 23 (25.55%) did not. Of these 67 patients with MS, 29 (43.28%) met three, 24 (35.82%) met four and 14 (20.89%) met all five criteria for MS. MS was found in 60 men out of 82 (73.17%) and seven women out of eight (87.5%), thus a greater percentage of young women had MS than men, but this was not statistically significant.

The distribution of MS criteria as defined by IDF in those 67 patients was as follows (Figure 1).

Table 1: Baseline demographic characteristics.

Variable value	Ms		P
	Yes (n=67)	No (n=23)	
Blood pressure ≥130/85mmhg	44 (65.67%)	6 (26.08)	<0.01
Fasting blood glucose ≥100mg/dl	43 (64.17%)	9 (39.13%)	<0.05
Triglycerides (mg/dl)	179.14	115.86	<0.01
HDL-C (mg/dl)	32.36	36.78	<0.05
WC (in cms)	95.64	87.23	<0.001
Age	40.49	37.39	<0.01
Sex			
Male	60	22	0.674
Female	7	1	
Diabetes mellitus	37 (55.22%)	5 (21.73%)	<0.01
Pre-existing hypertension	31 (46.26%)	3 (13.04%)	<0.01
Family history of CAD	10 (14.92%)	2 (8.69%)	0.448
Smoking	42 (62.68%)	15 (65.21%)	0.825
Alcohol consumption	32 (47.76%)	13 (56.52%)	0.468
Dyslipidemia	15 (22.3%)	2 (8.69%)	0.148
STEMI	36 (53.7%)	18 (78.26%)	<0.05
LVD	23 (34.32%)	11 (47.82%)	0.24

MS: Metabolic syndrome, HDL-C: High density lipoprotein cholesterol, WC: Waist circumference, CAD: Coronary artery disease, STEMI: ST-elevation myocardial infarction, LVD: Left ventricular systolic dysfunction.

All (100%) had abdominal obesity, 60 (89.55%) had low HDL or treatment for lipid abnormality, 45 (67.16%) had BP≥130/85 mmHg or treatment for hypertension, 43 (64.17%) had elevated triglycerides or treatment for lipid abnormality and 43 (64.17%) had raised FBS or DM. All these criteria were statistically significant in MS group.

Table 2: Angiography results in MS/non- MS.

Angiogram result	MS		Non-MS		P value
	N= 67	%	N=23	%	
SVD	39	58.2	16	69.56	0.335
DVD	14	20.89	6	26.08	0.605
TVD	14	20.89	1	4.34	0.066

MS: Metabolic syndrome, SVD: Single vessel disease, DVD: Double vessel disease, TVD: Triple vessel disease.

MS patients had significantly higher prevalence of pre-existing hypertension and diabetes (p<0.01). Alcohol consumption, smoking status, patients receiving treatment for dyslipidemia and family history of CAD were not statistically significant in patients with and without MS (Table 1).

Thirty-six patients (53.7%) out of 67 in MS and 18(78.26%) out of 23 in non-MS cohort presented with ST elevation MI, which was statistically significant (p <0.05). Twenty-three patients (34.32%) in MS and 11(47.82%) in non-MS group had LVD with the p value of 0.24, which was not significant.

Majority of patients in both MS and non-MS groups had SVD, 58.2 % and 69.56 % respectively; it was not significant (p 0.33). Fifteen out of 90 patients who presented with ACS had TVD. Fourteen patients with TVD had MS, whereas only one patient in non-MS group had TVD, even though TVD was more common in MS, it was not statistically significant (p 0.06) (Table 2).

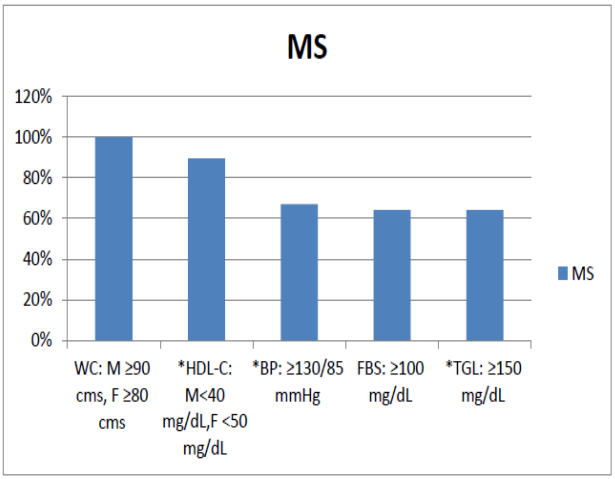

Figure 1: Prevalence of each criterion in MS group. MS: metabolic syndrome, WC: waist circumference, HDL-C: high density lipoprotein cholesterol, BP: blood pressure, FBS: fasting blood glucose or known type 2 diabetic, TGL: triglycerides. M: male, f: female, * or on treatment.

DISCUSSION

MS is characterized by a constellation of risk factors such as raised triglyceride, low HDL, glucose intolerance, hypertension and abdominal obesity that may lead to the development of CAD. Asian Indians are more prone to

diabetes and premature CAD, which is attributed to increased insulin resistance and characteristic abdominal obesity. Asian Indians have a different distribution of body fat, with abdominal obesity or a higher body fat content, even in the presence of normal body mass index.[11] Increased visceral fat is a dependable indicator of hyperinsulinemia and insulin resistance, which are risk factors for diabetes, dyslipidemia, hypertension and CAD.[12]

Hence, we have applied IDF criteria which has lower ethnic-specific waist circumference cut-offs for obesity, in our study.

We found that the prevalence of MS among patients presenting with young CAD was alarmingly high (74.44%). The prevalence of MS in young patients with CAD was similarly high in studies done by Hassanin et al. (66.39%) and Ranjith et al. (57%).[9,13] However, other studies have shown lower prevalence of MS in similar groups of patients ranging from 26% to 37%.[8,10,14]

Various studies in young CAD patients have shown a higher prevalence of MS in young women than in men.[9,10,14] In our study too the prevalence of MS was more common in women than men (87.5% versus 73.17%), but the difference was not statistically significant. This is important because Morraquin et al. have shown that women with CAD and MS have significantly higher risk of cardiovascular events and decreased survival than women without MS.[15]

Cigarette smoking was found to be the most common risk factor for premature CAD in earlier studies.[9,10,14,16] This was in contrast to our study, where we found MS was dominating with 74.44% versus smoking (63.33%), as a risk factor for premature CAD. This finding could suggest that MS may play a significantly more important role than smoking in the development of cardiovascular disease in younger age group.

While assessing the various components of MS in patients with the syndrome, we found that all patients had abdominal obesity, low HDL was the next most frequently seen risk factor (89.55%). A similar pattern of the individual components of MS in young patients with CAD was seen in a study done by Sadeghian et al.[17] Another study done in young Indians also showed a higher prevalence of low HDL (78.8%) in MS patients.[10] Higher percentage of low HDL in Indians was seen in a study conducted by Goswami et al. in MS patients with CAD.[18]

Studies have shown the predominance of dysfunctional HDL in MS patients and this proinflammatory HDL can further worsen metabolic dysfunction and hence increase the cardiovascular risk.[19] We also noted in our study that all eight women with premature CAD had low HDL. Hence, our study confirms higher prevalence of abdominal obesity and low HDL, which are well recognized risk factors for CAD.[20-23]

We also found a higher incidence of STEMI in non-MS group (78.26%) than MS (53.7%). This was unlike the results of Danciu et al. and Chung et al., where MS patients had more STEMI.[8,24] Danciu et al. found that STEMI in MS patients was statistically significant, whereas Chung et al. did not.

Although TVD was more common in the MS cohort than non-MS (14 patients versus one patient), this was not statistically significant. Thus, no significant difference in disease severity in terms of number of vessels stenosed, based on CAG, was found in our study. Goswami et al. in an Indian study found that the prevalence of MS increased significantly in patients with TVD, but they had included patients of all age groups.[18] Marroquin et al. showed that women with MS had increased risk of cardiovascular events in angiographically significant CAD patients, but again patients ranged from 21 to 86 years.[15]

There are a few limitations to our study. Those patients who met four out of five criteria for MS without the principal criteria (waist circumference more than 80 in women and more than 90 in men) were excluded from the MS group. We had only few female patients in our study. The strength of our study is that we describe the prevalence of MS in angiographically proven premature CAD, which is the gold standard to diagnose CAD.

CONCLUSION

To conclude, this study clearly indicates a very high prevalence of MS in Indian patients with premature CAD. Our study is important because we found that MS was more prevalent than the conventional risk factor of smoking in young patients with CAD. We could not find significant difference in severity of CAD between MS and non-MS group in young patients, but larger and more studies in a similar age group are required to confirm this finding.

Family physicians have an important role in identifying MS in young healthy individuals and thus, may help find people at risk for premature CAD. Healthcare professionals should routinely measure waist circumference and screen for low HDL, which is usually ignored in practice. The presence of MS or any of its components in young people should trigger an aggressive approach toward patient education and implementation of primary and secondary measures to help reduce the prevalence of premature CAD.

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