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Original Research

Prevalence of Various Components of Metabolic Syndrome in Patients with Acute Myocardial Infarction during Hospital Stay

Dr. Sudeep Jayaram[1], Dr. Madhu Kumar MH[2], Dr. Nirmal Kumar Sharma[3], Dr. Sourabh Chittora[4]

[1]Senior Clinical Fellow, Ysbyty Ystrad Fawr, Ystrad Mynach, Hengoed CF728GP;
[2]Specialist in General Medicine, District Hospital, Chikkaballapur, Karnataka, India;
[3]Professor, Department of General Medicine, Government Medical College & Hospital, Kota, Rajasthan, India;
[4]Assistant Professor, Department of General Medicine, Government Medical College & Hospital, Kota, Rajasthan, India

ABSTRACT:
METS is associated with a proinflammatory / prothrombotic state that may include elevated levels of C- reactive protein (CRP), endothelial dysfunction, hyperfibrinogenemia, increased platelet aggregation, increased levels of plasminogen activator inhibitor 1, elevated uric acid levels, microalbuminuria, and a shift toward small, dense particles of low-density lipoprotein cholesterol (LDL-C). This was a prospective study of patients with a diagnosis of acute myocardial infarction admitted in Medical OPD, Emergency and various wards of Government medical college and associated group of hospitals KOTA after informed consent. Low HDL cholesterol (HDL<40mg/dl in males and <50mg/dl in females, or specific medication) was present in 66 (87.5%) patients of MI with METS compared to 46 (60.98%) patients of MI without METS and the difference was statistically significant.
Keywords: METS, Metabolic Syndrome, NCEP ATP III

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Corresponding author: Dr. Madhu Kumar MH, Specialist in General Medicine, District Hospital, Chikkaballapur, Karnataka, India

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INTRODUCTION

The contemporary definition of METS "refers to a cluster of metabolic abnormalities related to a state of IR which is often associated with a high-risk overweight/obesity phenotype. The major characteristics of METS include IR, abdominal obesity, elevated BP, and lipid abnormalities [i.e., elevated levels of triglycerides (TGs) and low levels of HDL-C]. METS is associated with a proinflammatory / prothrombotic state that may include elevated levels of C- reactive protein (CRP), endothelial dysfunction, hyperfibrinogenemia, increased platelet aggregation, increased levels of plasminogen activator inhibitor 1, elevated uric acid levels, microalbuminuria, and a shift toward small, dense particles of low-density lipoprotein cholesterol (LDL-C)". [1,2]

In retrospect, it is apparent that the WHO definition more suited as a research tool whereas the NCEP ATP III definition was more useful for clinical practice. The criteria for defining METS in adult Asian Indians need revision. Inclusion of modified cutoffs of waist circumference (>90 cm for men, > 80 cm women) and BMI (>23 kg/cm2) and measures of truncal subcutaneous fat in the NCEP ATP III definition requires further validation.20 Yet another attempt at definition came from the American Association of Endocrinology and American Association of clinical endocrinologist.[3]

There were problems associated with all these definitions in terms of applicability, uniformity and positive predictive value. A major problem was applicability to different ethnic groups, especially among East Asians and South Asians.

The International Diabetes Federation (IDF) has recently revised the guidelines to remedy the ethic group based disparities in the original classification.

Comparisons of published prevalence of different population are difficult despite attempts to reach agreement on the definition of the METS.

Despite differences in the design of these studies and other variables, certain inferences can be made. For example, even for studies involving participants in the same age groups, there is wide variation in the prevalence in both sexes. In those studies that include people 20-25 years and older, the prevalence varies in urban population from 8% (India) to 24% (USA) in men, and from 7% (France) to 43% (Iran) in women. There is also an ethnic difference in the prevalence of METS.[4]

A very consistent finding is that the prevalence of METS is highly age – dependent, in USA (National health and Nutrition examination surgery [NHANES III]) prevalence of METS increased from 7% in participants aged 20-29 years to 44% and 42% for those aged 60-69 years and at least 70 years respectively.

Data from 12-19 years age group is the NHANES III study, with NCEP: ATP III criteria modified for adolescents, reported that the prevalence of the METS in adolescents was 4.2%.

Of particular interest are the two Indian studies, which differed in their definition of obesity; one study used obesity criteria that were suitable for Indians, while the others used the standard ATP III definition of obesity. Both studies used population-based samples writing the same age range but reported prevalence of 13% in Jaipur and 41% in Chennai. [5]

Interestingly, a third Indian study30 also from Chennai, reported a METS prevalence of 11.2% (using EGIR criteria), which was much closer to the prevalence reported for Jaipur than the other Chennai study. Therefore, even within the same ethnic population group it appears that there can be significant differences in the prevalence of both the individual factors that constitute the METS and the METS itself.

A low education level links cardiovascular disease with risk factors such as smoking, HTN, impaired glucose tolerance, diabetes mellitus, physical inactivity and overweight associated with other metabolic abnormalities. The prevalence of METS was found to be elevated in women who abstained from alcohol. Slight and moderate alcohol consumption has been found to be associated with low coronary heart disease risk possibly through beneficial alterations in HDL cholesterol and BP.

High prevalence of obesity and IR in urban Indian population is well known. A study from Chennai report 18.7% prevalence of IRS in upper socio-economic strata in south India, while it was 6.5% in the low socio-economic strata. [6]

METHODOLOGY

This was a prospective study of patients with a diagnosis of acute myocardial infarction admitted in Medical OPD, Emergency and various wards of Government medical college and associated group of hospitals KOTA after informed consent:

INCLUSION CRITERIA OF CASES WILL BE:

1. Patients who have at least 2 out of 3 following criteria for myocardial infarction, as defined by WHO
- Typical history of severe chest pain radiating to the neck or arms for duration >30 minutes.
- ECG changes of ST elevation >2mm in two or more chest leads or >1mm in two or more limb leads.
- Rise in serum cardiac enzymes concentration (Troponin-T) more than twice the upper limit of normal.
- New onset LBBB

2. Patients with Non ST elevation myocardial infarction
- Chest pain with atleast one of the 3 features

a. Occuring at rest (or minimal exertion) and usually lasting >20 minutes (if not interrupted by nitroglycerine administration);
b. Being severe and described as frank pain, and of new onset (i.e., within 1 month); and
c. Occouring with a crescendo pattern (i.e., more severe, prolonged, or frequent than previously).

- Evidence of myocadial necrosis on the basis of elevated cardiac serum markers, such as creatine kinase isoenzyme (CK)-MB, and/or troponin T or I.

3. Age and sex matched normal healthy adults without any evidence of ischaemic heart disease.

Prognosis will be assesed in terms of the following during the hospital stay of day 0 to day 7:

- Arrhthymias
- Heart failure
- Recurrent ischaemia
- Stroke
- Mortality

Standardized definition of MI and clinical outcome will be used. A final diagnosis of MI will be made in the presence of serial increases in serum biochemical markers of cardiac necrosis, associated with typical electrocardiographic changes and/or typical symptoms as defined by the joint committee of the European society of cardiology and the American college of cardiology.

A detailed case history will be taken including the symptoms, past history of diabetes mellitus, hypertension (HT), smoking and alcohol consumption.

A careful physical examination will be done with special reference to resting blood pressure (BP), waist circumference (WC), Height and weight.

Blood pressure will be recorded in the following way with a standard sphygmomanometer :

Before the blood pressure measurement is taken, the individual should be seated quitely in a chair (not the exam table) with feet on the floor for 5 min in a private, quiet setting with a comfortable room

temperature. At least two measurements will be taken. The centre of the cuff will be at the heart level, and the width of the bladder cuff will equal at least 40% of the arm circumference; the length of the cuff bladder will be enough to encircle atleast 80% of the arm circumference. The cuff will be inflated to 20-30mm above the pulse extinction, and the rate of deflation will be 2mmHg/s. Systolic blood pressure is the first of at least two regular "tapping" Korotkoff sounds, and diastolic blood pressure is the point at which the last regular Korotkoff sound is heard.

The BMI will be calculated using the formula BMI = Weight in kg/Height in m^2.

Waist circumference (WC) will be recorded in the following manner· "The subject will be standing and the examiner, positioned on the right of the subject, palpates the upper bone to locate the iliac crest. Just above the uppermost lateral border of right iliac crest, a horizontal mark is drawn, and then crossed with vertical mark on the midaxillary line. The measuring tape is placed in a horizontal plane around the abdomen at the level of this marked point on the right side of the trunk. The plane of the tape is parallel to the floor and the tape is snug, but does not compress the skin. The measurement is made normal minimal inspiration."

INVESTIGATIONS

The following investigations will be done in all the patients.

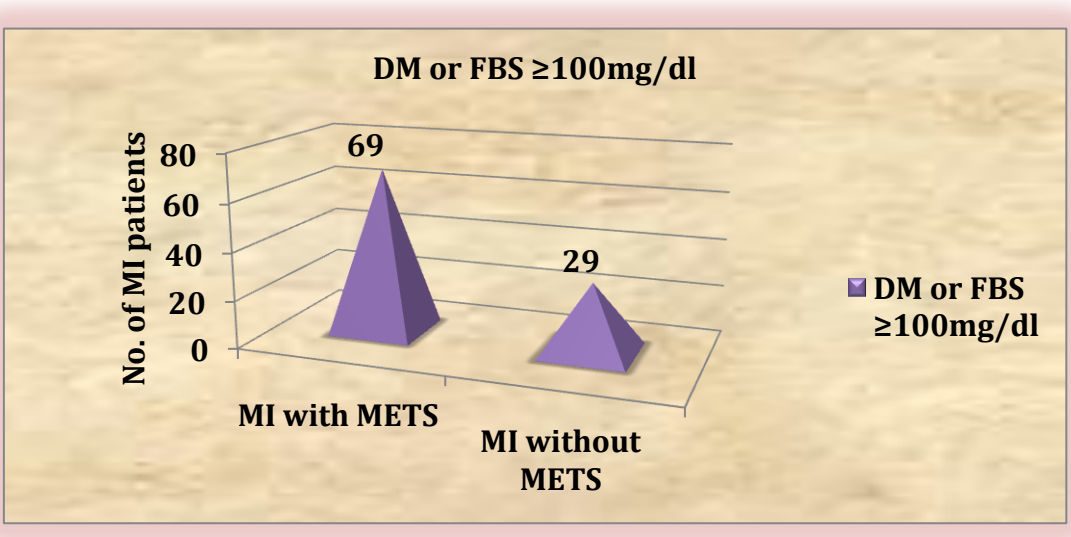
The blood samples will be drawn at the admission, the following morning (lipid profile) and day 5 for FBS.

- Cardiac enzymes:
- Creatinine kinase (CPK MB) : measured using Immunoinhibition / Modified IFCC method.
- Troponin-T : using the TROPT KIT. It uses sensitive rapid assay, detects Troponin T using an immunoassay with two cardiac-specific monoclonal antibodies.
- Serum LDH : using the CalKine LDH (P – L) Kit (Mod. IFCC method).
- Fasting blood sugar: blood sugar estimated after no caloric intake for atleast 8 hours using the Glucose Oxidase / Peroxidase method (GOD / POD)
- Fasting lipid profile including
- Serum cholesterol : (CHOD / POD METHOD)
- Serum triglycerides : (GPO / POD METHOD)
- High density lipoprotein cholesterol (HDL-C) : measured using the Direct Enzymatic Method on CORALYZER 200
- Low density liopoprotein cholesterol (LDL-C) calculated using the formula (Friedwald formula) : LDL = Total cholesterol – [HDL cholesterol + Triglycerides / 5]

RESULTS

Diabetes Mellitus (DM) [fasting plasma glucose≥100mg/dl or specific medication or previously diagnosed Type 2 diabetes] was present in 69 (92%) patients of MI with METS compared to 29 (38.46%) in patients of MI without METS and the difference was statistically significant.

CHART 1: Diabetes mellitus (dm) [fasting plasma glucose≥100mg/dl or specific medication or previously diagnosed type 2 diabetes].



Diabetes Mellitus (DM) was significantly more among patients of MI with METS compared to patients of MI without METS and the difference was statistically significant.

TABLE-1: Hypertension (HTN) [blood pressure ≥130mmhg systolic or ≥85mmhg diastolic or specific medication]							
Component of METS	MI With METS		MI Without METS		Total		P value
	N =75	%	N = 75	%	N = 150	%	
HTN or BP ≥130/85mm Hg	57	76.13	33	43.95	90	59.77	<0.001

Hypertension (HTN) [Blood Pressure (BP) ≥130mmHg systolic or ≥85mmHg diastolic or specific medication] was present in 57 (76.13%) patients of MI with METS compared to 33 (43.95%) in patients of MI without METS and the difference was statistically significant.

TABLE-2: Hypertriglyceridemia: Triglycerides (TGS) ≥150MG/DL or specific medication.							
Component of METS	MI With METS		MI Without METS		Total		P value
	N =75	%	N = 75	%	N = 150	%	
TGS ≥150mg/dl	63	84.09	30	39.56	92	61.45	0.001

Triglycerides [(TGS) ≥150mg/dl or specific medication] was present in 63 (84.09%) patients of MI with METS compared to 30 (39.56%) of patients of MI without METS and the difference was statistically significant.

TABLE-3: Low HDL cholesterol (<40mg/dl in males and <50mg/dl in females, or specific medication).							
Component of METS	MI With METS		MI Without METS		Total		P value
	N =75	%	N = 75	%	N = 150	%	
HDL <40mg/d (males) <50mg/dl (females)	66	87.5	46	60.98	111	74.02	<0.001

Low HDL cholesterol (HDL<40mg/dl in males and <50mg/dl in females, or specific medication) was present in 66 (87.5%) patients of MI with METS compared to 46 (60.98%) patients of MI without METS and the difference was statistically significant.

TABLE-4: Central obesity: waist circumference (wc) >102mg/dl in males and >88mg/dl in females.							
Component of METS	MI With METS		MI Without METS		Total		P value
	N =75	%	N = 75	%	N = 150	%	
WC >102cm (males) >88cm(females)	29	39.2	12	15.38	41	27.09	0.006

Central obesity [Waist circumference (WC) >102mg/dl in males and >88mg/dl in females] was present in 29 (39.2%) patients of MI with METS compared to 12 (15.38%) patients of MI without METS and the difference was statistically significant.

DISCUSSION

All the components were more common in patients of MI with METS compared to patients of MI without METS and were statistically highly significant.

TABLE 5: Components of mets

	DM or FBS ≥100mg/dl	HTN or BP ≥130/85mm Hg	TGS mg/dl	HDL- C mg/dl	WC in cms
Zeller M[7] et al (2005)	123	-	160	37	106
Schwartz G[8] et al (2005)	-	90%	-	88%	76%
Ninomiya[9] et al (2004)	-	48.2%	43.2%	45%	51%
Present study	**92%**	**76.13%**	**84.09%**	**87.5%**	**39.2%**

TABLE 6: Mean values of components of mets

	FBS mg/dl	BP mm of Hg	TG mg/dl	HDL-C mg/dl	WC in cms
Milani R[10] et al (2003)	111± 26	140± 18/76± 13	176± 101	37.7± 11	102 ±12
Present study	**149± 37.92**	**137 ±20/85± 9**	**200.32 ±55**	**36.82±7.99**	**97.68±12**

Diabetes Mellitus (DM) [fasting plasma glucose≥100mg/dl or specific medication or previously diagnosed Type 2 diabetes] was the most prevalent component in the present study, which may be due to better awareness and early diagnosis of the disease. Low HDL-C was the next most prevalent individual component in patients of MI with METS whereas low HDL-C was the most prevalent component among the patients of MI without METS (87.5% and 60.9%) with mean values lower in patients of MI with METS group (36.82±7.99 vs. 42.89±11.78). Hypertriglyceridemia (High TG) was the next major component prevalent in patients of MI with METS (84%) and HTN (44%) in the patients of MI without METS. The mean FBS was 149± 37.92 in patients of MI with METS and 114.23±36 in patients of MI without METS. Both these values were more than the cutoff value for the inclusion of FBS in the NCEP ATP III criteria for the diagnosis of METS. WC was the minor component in both the groups but was also found to be significantly more prevalent in patients of MI with METS.

In the present study patients of MI with METS had high FBS (149± 37.92) compared to other studies. This may be due to poor control of blood sugar in our study patients and also irregularities in the treatment by these patients. The HTN or BP ≥130/80 was comparable to some studies, and there was also a variation in the incidence of HTN in between the studies. The serum TGS was also found to be very high in the present study (200.3±55mg/dl) compared to the other studies which may be related to the Indians having high percentage of body fat and low muscle mass.[32] Additionally insulin resistance also reduces the concentration of lipoprotein lipase in the peripheral tissues. The predominant component in the present study HDL-C (36.82±7.99) was found to be same as compared to other studies. This low HDL-C may be due to high TGs, which leads to decreased production and also increased clearance of HDL-C from the circulation.[19, 62] The WC was less in the present study (median 97) compared to the other studies. This may be related to the adult Asian Indians, along with the other ethnic groups, have different anthropometric characteristics compared with others. Metabolic abnormalities contributing to cardiovascular risk factors are detectable at a lower WC in Asians as compared to Caucasians, suggesting that NCEP ATP III criteria might under estimate the prevalence of METS in Asians. Obesity criteria for the diagnosis of METS need to be revised in Asian Indians and other Asian ethnic groups. Inclusion of modified WC, BMI cutoffs and subscapular skin fold thickness may be considered as defining variables of METS in the future studies on Asian Indians and other Asian ethnic groups.

Other biochemical parameters serum cholesterol (mg/dl) and LDL-C (mg/dl) were found to be 195± 42 and 144.4± 49 in the present study, which was comparable to Milani R et al (172± 38 and 104± 49),

and there was no significant difference. The STEMI was present in 71.02% patients of MI with METS in the present study, which is almost comparable to Zeller et al (67%). The use of thrombolysis was about 19.8% in the present study, which is consistent with the 16% found in the Zeller et al.

CONCLUSION

Patients of MI with METS were significantly more likely to have an increased BMI (body mass index of ≥30 kg/m2) compared to patients of MI without METS (27.27% vs. 2.74%).

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