

Prevalence of The Metabolic Syndrome in Acute Myocardial Infarction and Its Impact on Hospital Outcome

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ABSTRACT

Background : Metabolic syndrome (METS) is a specific clustering of cardiovascular risk factors (abdominal obesity, atherogenic dyslipidemia, elevated blood pressure (BP), insulin resistance (IR), a prothrombotic state and a proinflammatory state in the same person. The increased risk of morbidity and mortality associated with the METS makes it essential that there be a clear understanding of the dimensions of this syndrome for the allocation of health care and research resources and for other purposes.

Hence this study is undertaken to identify and assess the predominant component of METS in high risk group patients with myocardial infarction and to study the prognosis of myocardial infarction in patients with METS during hospital stay.

Methodology : In this observational comparative case study, 358 patients of acute myocardial infarction were studied for metabolic syndrome. These patients were divided into two groups as patients with METS and without METS.

Results : The metabolic syndrome was present in 163 patients (45.53%). Among the components of metabolic syndrome low HDL-cholesterol was the most prevalent component in both the groups (96.31% and 57.43% respectively) and statistically was highly significant. High triglycerides (82.20%) was the next most prevalent component in metabolic syndrome patients followed by the diabetes or fasting blood sugar > 110mg/dl (77.30%), hypertension or blood pressure of >130/85 mm of Hg (67.48%) and high waist circumference (38.03%). All the complications were more common in the METS group compared to those without METS group. The Heart failure was present in 49.69% of METS patients compared to the 22.56% in those without METS which was statistically highly significant (p value <0.0001). The case fatality was also more common in METS (26.38%) patients compared to those without METS (14.35%) which was statistically significant (p value <0.005).

To conclude, cardiovascular disease patients with METS must be identified and managed aggressively to reduce both morbidity and mortality for what is in large part a preventable condition.

Key Words : Metabolic Syndrome (METS) AMI, Risk factors.

Introduction :

Cardiovascular diseases (CVD) are leading contributors to global burden of disease accounting for 30% of global deaths. Obesity, insulin resistance and type 2 diabetes mellitus are increasing and are powerful risk factors for CVD. In light of projection of large increase in CVD throughout the world, CVD is likely to become the most common cause of death worldwide by 2020.¹

Metabolic syndrome (METS) is a specific clustering of cardiovascular risk factors (abdominal obesity, atherogenic dyslipidemia, elevated blood pressure (BP), insulin resistance (IR), a prothrombotic state and a proinflammatory state in the same person.² The increased risk of morbidity and mortality associated with the METS makes it essential that there be a clear understanding of the dimensions of this syndrome for the allocation of health care and research resources and for other purposes.³ These traditional risk factors all together account for approximately half of the risk of a first myocardial infarction, especially in the Asian Indian population. As a result, both incident and prevalent CVD will likely continue to increase in the next decades with significant socio-economic consequences.⁴

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However, very few studies have reported on the prevalence of IRS as a whole in the native Indian population based on epidemiological studies. This is particularly relevant as India has maximum number of diabetes patients in any given country in the world. Early intervention of this METS with intensive life style changes in the form of diet, exercise and pharmacotherapy can prevent the future development of CVD like myocardial infarction. Hence this study is undertaken to identify and assess the predominant component of METS in high risk group patients with myocardial infarction and its impact on hospital outcome, particularly death and heart failure.

Material and Methods :

In this cross-sectional observational study total 358 consecutive cases of acute myocardial infarction admitted to ICCU over a period of 2 yrs were recruited.

Diagnosis of Acute Myocardial infarction (AMI) was based on following criteria.⁵

Detection of a rise or fall of cardiac biomarker values (preferably cardiac troponin) with at least one value above the 99th percentile URL together with at least one of the following : (i) symptoms of ischemia, (ii) new significant ST changes or LBBB, (iii) development of pathological Q-waves, (iv) imaging evidence, (v) intracoronary thrombus.

All the cases were divided in two groups AMI cases with Metabolic syndrome & Without metabolic syndrome.

Metabolic Syndrome was diagnosed as per NCEP-ATPIII guide lines.⁶ Including any three of following:

1. Central obesity : waist circumference > 102 cm (male) or females > 88 cm
2. Hypertriglyceridemia : Triglycerides >150 mg/dl
3. HDL cholesterol : < 40 mg/dl (male) or <50 mg/dl (female)
4. Hypertension : blood pressure >130/85 mmHg
5. Fasting plasma glucose >110mg/dl.

Patients of ischaemic heart disease other than acute myocardial infarction were excluded from the study

All selected patients were subjected to detail history, complete physical examination and investigations.

A careful physical examination was done with special reference to Waist circumference (WC), Height and weight. The Body mass index (BMI) was calculated using the formula : $BMI = \text{Weight in kg} / \text{Height in m}^2$. WC was recorded according to the national health and nutrition survey.⁷

12 lead Electrocardiogram. Cardiac enzymes, creatinine kinase or troponin-T, Fasting blood sugar, Fasting lipid profile including serum cholesterol, serum triglycerides, HDL-C, LDL-C. 2DECHO were done in all the patients. Fasting blood sugar was done on day 5.⁸

All the MI patients were followed up over a period of one week for the development of complications like Heart failure, Ventricular tachycardia / fibrillation, Bundle branch block, cardiac shock and Case fatality. Heart failure was defined according to Killip's classification.⁹

Study was approved by Institutional Ethic committee and written consent was obtained from all the patients.

Statistical analysis :

Results were expressed as mean \pm SD for continuous variables (age, BMI, Components of metabolic syndrome) and were compared between two groups METS and non METS by unpaired t test. Categorical variables were expressed in actual numbers and percentages, were compared by chi-square test. For small numbers Fisher exact test was applicable wherever applicable. Odds ratios and 95% confidence interval were calculated to predict independent factors of acute MI.

A p value of 0.05 or less was considered for statistical significance. Statistical software STATA version 10.0 was used for statistical analysis.

Results :

Total 358 patients of acute MI were included in the study. AMI with METS group comprised of 163 (45.53%) cases & with non METS gr were 195 (54.16%). The prevalence of METS in our study was found to be 45.53%.

The maximum number of patients were present between the age group of 51-60 years with mean age of 56.19 ± 11.56 in METS and 54.82 ± 10.94 in without METS groups. The difference between two groups for age was not statistically significant (p value 0.48).

Males were out numbering females in both the group. 116 (71.16%) males were present in METS group and 152 (77.94%) male patients were in without METS group. The METS was more in females with MI but it was not statistically significant (p value 0.25).

BMI >30, Positive family history of IHD & Diabetes were found highly significant statistically in METS group in inter group comparison for prevalent risk

factors. Next significant risk factor was Hypertension (**Table 1**)

Amongst comparison of various components of Metabolic syndrome, all the components were found to be statistically highly significant (p = < 0.0001) in METS group. (**Table 2**)

The Heart failure was the most common complication observed in 49.69% of METS group cases as compared to the 22.56% in those without METS which was statistically highly significant (p value < 0.0001). The case fatality was also more common in METS (26.38%) group cases compared to those without METS (14.35%) which was statistically significant (p value < 0.005). (**Table 3**)

Table 1 : Inter group Comparison of cases for prevalent risk factors

Sr. No.	Risk Factors	With METs	Without METs	P value
1	Mean age in years	56.19±11.56	4.62±10.94	0.48 NS
2	Male	116 (71.16%)	152 (77.94%)	0.25 NS
3	Females	47 (28.83%)	43 (22.05%)	0.25 NS
4	BMI (Kg/m ²) =30 <30	42(25.77%) 121 (74.23%)	07 (3.59%) 188 (96.41%)	<0.0001 HS
5	Positive family history	36 (22.09%)	72 (30.17%)	<0.0023 HS
6	Diabetes	91 (55.87%)	67 (44.13%)	<0.0001HS
7	WC>102in males>88cm in females	62 (38.03%)	29 (14.87%)	<0.0001NS
8	Hypertension	68 (41.74%)	59 (30.26%),	<0.0240 S
9	Smoking	55 (33.74%)	72 (36.92%),	<0.5310NS
10	Alcoholism	47 (28.63%)	59 (30.25%)	<0.7691NS

HS - Statistically Highly significant S - Statistically significant NS - Not significant

Table 2 : Comparison of Components of Metabolic Syndrome

PARAMETERS	METS	NON METS	P-VALUE
FBS	163±2.89	137.54± 62.91	<0.0001, HS
SBP	138.18 ±25.53	130.48± 21.56	00.0021, HS
HDL	35.41± 7.63	40.42 ±6.15	<0.0001, HS
WC	94.52± 7.51	91.30± 5.33	<0.0001, HS
TG	240.14± 112.76	157.45± 47.22	<0.0001, HS

FBS - Fasting blood glucose, SBP - Systolic blood pressure, DBP - Diastolic blood pressure
HDL - High density lipoprotein, WC - Waist circumference, TG - Triglyceride

HS - Statistically Highly significant S - Statistically significant NS - Not significant

Table 3 : Complications in Acute MI

COMPLICATIONS	METS (N=163)	NON METS (N=195)	P-VALUE
BUNDLE BLOCK	5 (03.06%)	9 (04.61%)	0.452,NS
HEART FAILURE	81 (49.69%)	44 (22.56%)	<0.0001, HS
VENTRICULAR TACHYCARDIA	15 (09.2%)	18 (09.23%)	0.993, NS
CARDIAC SHOCK	12 (07.3%)	12 (06.15%)	0.649,NS
CASE FATALITY	43 (26.38%)	28 (14.35%)	0.005, HS

HS - Statistically Highly significant S - Statistically significant NS - Not significant

Discussion :

We have studied 358 patients of acute myocardial infarction, which were analysed into two groups those with metabolic syndrome (163) and those without metabolic syndrome (195). The prevalence of METS was found to be 45.53 % These findings suggest that METS is very common among the patients with coronary heart disease (CHD) because almost 1 of 2 patients had METS, and that it is associated with an advanced vascular damage. The strong association between METS and the occurrence of severe CHD has remained highly significant¹⁰ we have found that out of 358 patients male (268) outnumbered females (90) and prevalence of metabolic syndrome in males was found to be 71.16% and in females 28.83%.

A higher prevalence in men might be related to their higher rates of overweight, high BMI, impaired blood glucose levels, high triglycerides, and low levels of HDL-C¹¹. In our study 55.82% patients were diabetic, 41.71% were hypertensive and 22.09% had positive family history of coronary heart disease in METS group. When these risk factors were compared with non METS group there was significant statistical difference in patients with METS. However smoking and alcohol consumption was not found to be significantly correlated.

Among the components of metabolic syndrome low HDL-cholesterol was the most prevalent component in both the groups (96.31% in METS and 57.43% in without METS patients). The statistical difference was highly significant when compared between both the groups. These findings were consistent with other authors^{10,11}. High triglycerides (82.20%) was

the next most prevalent component in metabolic syndrome patients followed by the diabetes or fasting blood sugar > 110 mg/dl (77.30%), hypertension or blood pressure of > 130/85 mm of Hg (67.48%) and high waist circumference (38.03%).

The serum TG was found to be very high in the our study (240±112mg/dl) which may be related to the Indians who have high percentage of body fat and low muscle mass. Additionally insulin resistance also reduces the concentration of lipoprotein lipase in the peripheral tissues resulting into hypertriglyceridaemia.¹² The pathophysiologic mechanisms known to increase cardiovascular disease risk in individuals with insulin resistance include the development of advanced glycation end products, hypertension, proinflammatory and prothrombotic states and dyslipidaemia. The increased flux of free fatty acids from adipose tissue to the liver promotes dyslipidaemia. The insulin resistance and the impaired glucose tolerance are associated with the increased risk. The individuals with coexisting METS and diabetes have the highest prevalence rated of CHD¹⁰.

Nevertheless, high TG is an excellent reflection of the insulin resistant condition and is one of the important criteria for diagnosis of METS.

Waist Circumference (WC) was the minor component in both the groups but was also found to be statistically significant in our study. WC = 102cm in males and = 88cm in females were present in 38.03% of patients with metabolic syndrome with mean value of 94.52±7.51. This value of WC was lower than the other studies.^{13,14}

The WC was less in the present study compared to the other studies. This may be related to the adult Asian Indians, who have different anthropometric characteristics compared with others. Metabolic abnormalities contributing to cardiovascular risk factors are detectable at a lower WC in Asians compared with Caucasians, suggesting that NCEP ATP III criteria might underestimate 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 sub scapular skin fold thickness may be considered as defining variables of METS in the future studies on Asian Indians and other Asian ethnic groups.¹⁵

In our study, we found that heart failure was predominant complication. It was present in 49.69% of patients with METS which was statistically highly significant. Other complications like ventricular tachycardia, bundle blocks, cardiac shock were less common and were statistically not significant.

Similarly, Zeller M¹³ et al also reported heart failure as a major complication. They found heart failure in 41.7% of patients with METS.

In the acute MI patients, presence of METS was associated with about 4 fold increase risk of complications (odds ratio 3.8, p value <0.001 HS) to those without METS.

This may be related to the more advanced vascular damage associated with the presence of METS in patients with manifest vascular disease like coronary artery disease, which may worsen the prognosis METS also represent a cluster of several risk factors, each of which may be involved in this poor outcome.

Implication :

The metabolic syndrome is a highly prevalent condition among the patients with acute myocardial infarction and has detrimental impact on short-term outcome.

Metabolic syndrome is a clustering of risk factors of metabolic origin that are together associated with higher risk of cardiovascular disease and the need to

develop strategies for control of this syndrome.

Early diagnosis, treatment including lifestyle modification and prevention of the metabolic syndrome may reduce the development of cardiovascular diseases like myocardial infarction including its complications and it present a major challenge for health care professionals facing an epidemic of overweight and sedentary lifestyle.

There is also a need to identify precociously and treat more aggressively patients with metabolic syndrome with coronary heart disease who have an absolute cardiovascular risk that is definitely higher than that of primary prevention.

To conclude, cardiovascular disease patients with METS must be identified and managed aggressively to reduce both morbidity and mortality for what is in large part a preventable condition.

References :

1. Thomas A et al. Epidemiology of Cardiovascular disease and Elliott M et al in Ischemic heart disease : 18th edition of Harrisons™ principles of internal medicine 2012; 1811, 1998.
2. Third report of the National Cholesterol Education Program (NCEP) Expert panel on Detection, Evaluation, and Treatment of high blood cholesterol in adults (Adult Treatment Panel III) Final report. *Circulation* 2002; 106 : 3146-3421.
3. TFord EA, Giles WH. A comparison of the prevalence of the metabolic syndrome using Two Proposed Definitions. *Diabetes Care* 2003; 26 : 575-581.
4. Munjal YP, Sarena A. Metabolic syndrome : Assessing Cardiometabolic risk, Chapter 50 : In YP Munjal, Post-graduate medicine (Recent Advances in Medicine) : JP Publishers : 2007; XXI : 461.
5. K. Thygesen, J. Mair, E. Giannitsis et al., "How to use highsensitivity cardiac troponins in acute cardiac care," *European Heart Journal*, 2012, vol. 33, no. 18, pp. 2252-2257.
6. Executive summary of the third report of the National Cholesterol Education Program (NCEP) Expert panel on Detection, Evaluation, and Treatment of high blood cholesterol in adults (Adult Treatment Panel III). *JAMA* 2001; 285: 2486-97.
7. Munjal YP, Sarena A. Metabolic syndrome : Assessing Cardiometabolic risk, Chapter 50 : In YP Munjal, Post-graduate medicine (Recent Advances in Medicine) : JP Publishers : 2007; XXI : 461.

8. Norhammar A, Tenerz A, Nilsson G. Glucose metabolism in patients with acute myocardial infarction and no previous diagnosis of diabetes mellitus : a prospective study. *Lancet* 2002; 359 : 2140-44.
9. Hardai D, Topol EJ, Califf RM, Berger PB, Holmes DR Jr. Cardiogenic shock complicating acute coronary syndrome. *Lancet* 2000; 356 : 749-56.
10. Lucica Agoston-Coldea, Teodora Mocan et al, The impact of the metabolic syndrome on the patients with acute coronary syndrome ROM.J, INTREN, MED, 2008, 46, 1, 55-62.
11. Apurva Sawant, Ranjit Mankeshwar et al, prevalence of metabolic syndrome in urban India, *Cholesterol* volume 2011(2011), Article ID 920983, pages 7 <http://dx.doi.org/10.1155/2011/920983>.
12. Deedwania PC, Gupta R. Management issues in the metabolic syndrome. *J Assoc Physicians India* 2006; 54 : 797-810.
13. Zeller M, Gabriel P, Ravisy J, Laurent Y, Manifican LJ, Hüller et al. Prevalence and impact of metabolic syndrome on hospital outcomes in acute myocardial infarction. *Arch Intern Med.* 2005; 165 : 1192-1198.
14. Milani RV, Lavie CJ. Prevalence and profile of metabolic syndrome in patients following acute coronary events and effects of therapeutic life style change with cardiac rehabilitation. *Am J Cardiol* 2003; 92(1) : 5054.
15. Misra A, Wasir JS, Pandey RM. An evaluation of candidate definitions of the metabolic syndrome in Adult Asian Indians. *Diabetes Care* 2005; 28 : 398-403.