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# Distribution Of Metabolic Syndrome Components In Patients Younger Than 50 Years Of Age Of Indian Population

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***ABSTRACT:***
***Background: Prevalence of the metabolic syndrome (MetS) is associated with increased risk of cardiovascular disease and diabetes. Present study aimed to assess the frequency distribution of various components of metabolic syndrome in patients younger than 50 years of age.***
***Materials and method: The study group consisted of 100 patients less than 50 years of age admitted at Rajindra Hospital with acute coronary disease.***
***Results: Most common age group was 45-50 years in both males and females, with 66% patients belongs to this age group. 37 patients of ACS with MS, most common component in males was raised blood pressure (SBP and DBP), in females most common component was impaired fasting plasma glucose (FPG). Waist circumference was statistically significantly raised in patients of ACS with MetS as compared to patients of ACS without MetS. Systolic blood pressure (SBP) was statistically significantly raised in patients of ACS with MS as compared to patients of ACS without MS. Systolic blood pressure (SBP) was statistically significantly raised in patients of ACS with MetS as compared to patients of ACS without MetS. Fasting plasma glucose (FPG) Serum triglycerides(TGc) and Serum high density lipoproteins (LDL) was statistically significantly raised in patients of ACS***
***Conclusion: All the five components of metabolic syndrome i.e. waist circumference, systolic blood pressure, fasting plasma glucose, serum triglycerides, serum high density lipoproteins were significantly associated with patients of acute coronary syndrome with metabolic syndrome as compared to patients of acute coronary syndrome without metabolic syndrome.***

***Key words: central obesity, hypertension, glucose intolerance, Metabolic syndrome, triglyceride, cholesterol***

## 1. INTRODUCTION

The metabolic syndrome (MetS) is a clinical entity in which many inter-related metabolic risk factors are present in the same patient. The presence of MetS is one of the major risk factor associated with cardiovascular disease (CVD) events.[1] Approximately 12-37 percent of the Asian population and 12-26 percent of the European population are projected to suffer from metabolic syndrome.[2] MetS has been reported to be more common among Native

Americans, with approximately 60% of women aged 45-49 and 45% of men aged 45-49 meeting the National Cholesterol Education Program and Adult Care Panel III guidelines(NCEP:ATPIII).[3] The risk factors associated with MetS include overweight/obesity, sedentary life style, aging, diabetes mellitus, cardiovascular disease, lipodystrophy, ethnicity, genetic factors, endocrine factors, inflammation and co-morbidities like diabetes mellitus, hypertension and CHD.[4]

The rate of obesity has doubled in 73 countries since 1980, and has grown in most other countries. In 2015 global survey of obesity performed in 195 countries, reported 604 million adults and 108 million children to be obese.[5] The main reason associated with increased obesity rate is attributed to the greater global industrialization which adds to the increase in the prevalence of the metabolic syndrome, especially as the population ages. Furthermore, the increased severity and prevalence of obesity among children may be considered as feature of the metabolic syndrome in a younger population.[6]

There have been many theories linked with metabolic syndrome. An explanation of ageing and the predisposition to metabolic syndrome is given by the oxidative stress hypothesis. In several studies performed in people with insulin-resistance, obesity or type 2 diabetes, and in the offspring of patients with type 2-diabetes, and the elderly, a defect in mitochondrial oxidative phosphorylation has been identified . This defect leads to the accumulation of triglycerides and related lipid molecules in muscle.[7]

Recently, the gut microbiota has been identified as a contributor to the development of metabolic disorders such as obesity, CVS and diabetes. Although the mechanism is unclear uncertain, interaction among genetic predisposition, diet, and the intestinal flora is important.[7] In this study we studied the frequency distribution of various components of metabolic syndrome in patients younger than 50 years of age.

## 2. MATERIALS & METHODS

Inclusion criteria:

The study group consisted of 100 patients less than 50 years of age admitted at Rajindra Hospital with acute coronary disease.

Patients having Three or more of the following factors were included in the study :

- Waist circumference more than 102 cm for males and more then 88 cm for females
- Triglycerides levels more than or equal to 150 mg/dL or specific medication
- HDL cholesterol levels less than 40 mg/dL in males and less then 50 mg/dL in females, or specific medication
- Blood pressure if more than 130 mmHg systolic or more than 85 mmHg diastolic or specific medication.
- Fasting plasma glucose ≥ 100 mg/dL or specific medication or previously diagnosed type2 diabetes or specific medication.

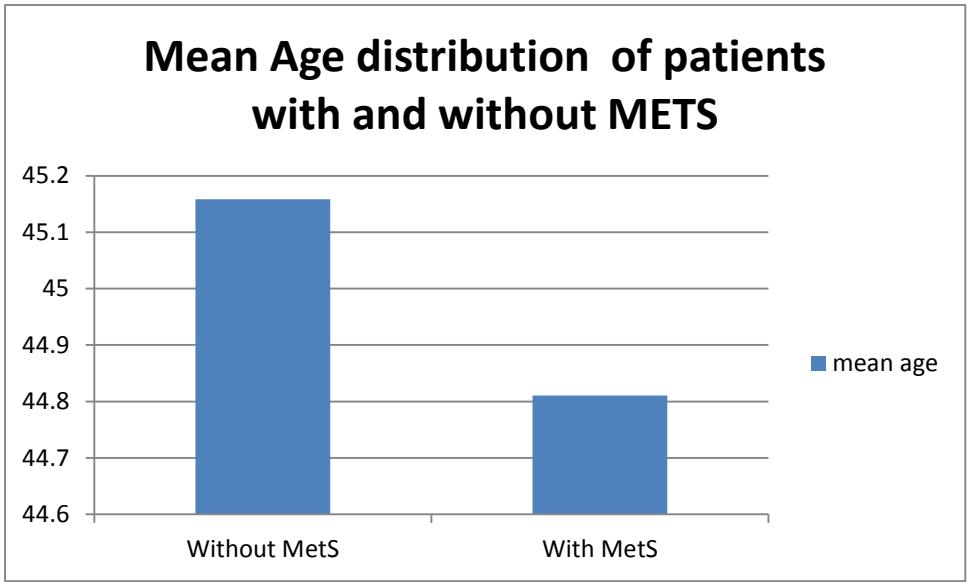
Acute coronary syndrome involves patients with ST-segment elevation (STEMI) acute myocardial infarction on their presenting electrocardiogram and those with acute coronary syndrome without ST-segment elevation (NSTE-ACS). NSTE-ACS diagnosis was made on the basis of clinical presentation of the patient and evidence of myocardial necrosis, which was confirmed by elevated levels of cardiac necrosis biomarkers. Elevated levels of these markers distinguish patients with NSTEMI from those with Unstable Angina.

Complete physical examination and systemic examination was performed. Fasting plasma glucose levels, CPK-MB and lipid profile were measured.

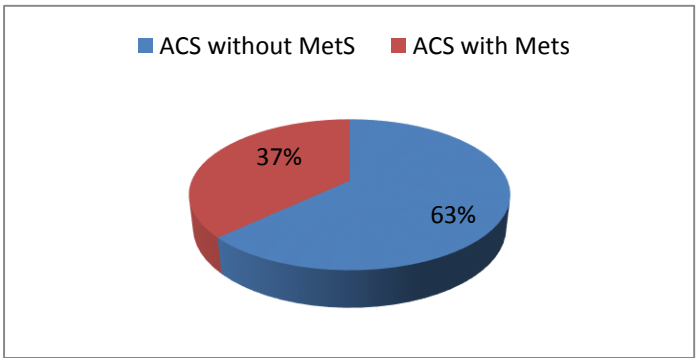
Each patient's anthropometrical measurements were obtained with emphasis on measurement of weight, height, waist circumference, body mass index (BMI). Nutrition

Examination Survey (NHANES) guidelines were used to determine waist circumference. Results were subjected to statistical analysis. P value less than 0.05 was considered significant.

## 3. RESULTS




Graph 1: Mean age distribution of patients without and with metabolic syndrome




Graph 2: Distribution of patients without and with metabolic syndrome

| Waist circumference | ACS with MS | ACS without MS | Total | Chi | P value |
|---|---|---|---|---|---|
| <88cm(F) <102cm(M) | 12 | 48 | 60 | 18.597 | <0.001 |
| >88cm(F) >102cm(M) | 25 | 15 | 40 | | |
| Total | 37 | 63 | 100 | | |

Table I: Distribution of waist circumference in ACS patients younger than 50 years of age

| Component | Male(N-21) | Female(N-16) |
|---|---|---|
| WC | 13 (61.90%) | 12 (75%) |
| SBP | 18 (85.71%) | 13 (81.25%) |
| DBP | 16 (76.19%) | 12 (75%) |
| FPG | 13 (61.90%) | 14 (87.5%) |
| TG | 15 (71.42%) | 7 (43.75%) |
| HDL | 15 (71.42%) | 13 (81.25%) |

Table II Sex distribution of individual components of metabolic syndrome in ACS patients with metabolic syndrome

| Components | Male | Female | Total |
|---|---|---|---|
| Any Three | 12 | 6 | 18(48.64%) |
| Any Four | 8 | 9 | 17(45.94%) |
| All Five | 1 | 1 | 2(5.4%) |

Table III Frequency of component combinations in ACS patient with Metabolic Syndrome younger than 50 years of age

| Variables | With/ Without MS | N | Mean | S.D | P value | Significance |
|---|---|---|---|---|---|---|
| Age (years) | Without MS | 63 | 45.1587 | 3.87384 | 0.654 | NS |
| | With MS | 37 | 44.8108 | 3.50268 | | |
| WC (cm) | Without MS | 63 | 89.0159 | 9.71612 | <0.001 | HS |
| | With MS | 37 | 97.4459 | 10.96445 | | |
| SBP (mm of Hg) | Without MS | 63 | 132.702 | 25.32666 | 0.016 | S |
| | With MS | 37 | 145.032 | 22.23422 | | |
| DBP (mm of Hg) | Without MS | 63 | 88.3175 | 17.26905 | 0.367 | NS |
| | With MS | 37 | 91.1892 | 11.11015 | | |
| FPG (mg/dl) | Without MS | 63 | 93.5556 | 25.28277 | <0.001 | HS |
| | With MS | 37 | 140.842 | 60.92733 | | |
| TGs (mg/dl) | Without MS | 63 | 118.482 | 35.20532 | <0.001 | HS |
| | With MS | 37 | 152.322 | 42.68428 | | |
| HDL (mg/dl) | Without MS | 63 | 46.4603 | 8.09983 | <0.002 | HS |
| | With MS | 37 | 41.1081 | 7.66951 | | |

Table IV Mean, SD, SEM of individual components of metabolic syndrome in patients of ACS with MS and patients of ACS without MS

**Graph 1:** Depicts the mean age of 100 patients with ACS less than 50 years of age. The most common age group was 45-50 years in males and females, 66% patients belongs to this age group.

**Graph 2:** depicts the prevalence of the MetS in patients with acute coronary syndrome in patients less than 50 years of age. It was present in 37% patients.
**Table I:** depicts that 40 patients have increased waist circumference and out of them 25 patients fulfilled the criteria of metabolic syndrome and had significant association (p- value <0.001). Hence, increased waist circumference is associated with the development of ACS.
**Table II** depicts in 37 patients of ACS with MS, most common component in males was raised blood pressure (SBP and DBP), in females most common component was impaired fasting plasma glucose (FPG).
**Table III** shows that in 37 patients of ACS with MS, 3 components combination of metabolic syndrome was most common, present in 18 (48.64%) patients, followed by 4 components combination present in 17(45.94%) patients and least common combination was five components combination present in 2 (5.4%) patients.
**Table IV** shows non significant association between the age of ACS patients with MetS and without MetS. Waist circumference was statistically significantly raised in patients of ACS with MS as compared to patients of ACS without MetS. Systolic blood pressure (SBP) was statistically significantly raised in patients of ACS with MetS as compared to patients of ACS without MetS. There was no significant difference in the diastolic blood pressure (DBP) of patients of ACS with MetS and ACS without MetS patients. Fasting plasma glucose (FPG) was statistically significantly raised in patients of ACS with MetS as compared to patients of ACS without MetS. Serum triglycerides (TGs) were statistically significantly raised in patients of ACS with MetS as compared to patients of ACS without MetS. Serum high density lipoproteins (HDL) were statistically significantly decreased in patients of ACS with MetS as compared to patients of ACS without MetS.

## 4. DISCUSSION

Metabolic syndrome (MetS) is considered as a clinical predictor of cardiovascular disease (CVD). A reduction of HDL cholesterol is the main lipoprotein disruption in metabolic syndrome. These changes are associated with disruption in composition and metabolism of HDL. a decrease in the cholesterol content of HDL in hypertriglyceridemia, is a result of reduced cholesteryl ester content of the lipoprotein core along with cholesteryl ester transfer protein-mediated alterations in triglyceride which are responsible for making the particle small and dense. This change in the composition of lipoprotein leads to the increased HDL clearance from the circulation. These changes in HDL have an indirect relationship to insulin resistance, that occurrs in conjunction with the changes in triglyceride-rich lipoprotein metabolism.[8]
The diagnosis of the metabolic syndrome on basis of the criteria as recommended by WHO as impaired glucose regulation or diabetes, insulin resistance, raised arterial pressure >160/90 mmHg, raised plasma triglyceride >150 mg/dl and/or low HDL cholesterol < 35 mg/dl in men, or < 39 mg/dl in women, central obesity (males: waist to hip ratio, 0.9; females: waist to hip ratio 0.85) and/or generalized obesity (body mass index (BMI)>30 kg/m2), micro albuminuria: (urinary albumin excretion ratio (UAER)>20 microg/min or albumin: creatinine ratio >20 mg/g). To satisfy the criterion of metabolic syndrome, a patient needed to have either criterion (1) or (2) positive along with at least 2 of the remaining criteria.[9]

In present study it was found that the most common age group was 45-50 years in both males and females, with 66% patients belongs to this age group(graph 1) . The mean age of patients of ACS with MS was 44.81±3.5 as compared to 45.15±3.87 in patients of ACS without MS. Similar results were obtained by the study performed by Hassanin N et al[10] (2015) and Danciu SC et al[11] (2012) who in their study observed mean age of the patients with metabolic

syndrome to be 44.64± 5.59 and 44±5 respectively. In the current study, 56.7% males and 43.2% females have MS. The results were comparable to the study by Quiros AM et al[12] (2017) who observed more males to be affected by MetS than females.

In the current study the Prevalence of MetS was 37%. In a study done by Turhan H et al,[13] prevalence of MetS was 37% and in Milionis HJ et al,[14] prevalence was 40.4%, that was in concordance with the current study. Sundaramoorthy V et al[15], Hassanin N et al[10] and Ranjith N et al[16] found high prevalence of MetS i.e. 74.44%, 66.4% and 60% respectively in their studies. Aggarwal A et al[17] and Danciu SC et al[18] showed low prevalence of MS i.e. 26.8% and 26% respectively in their studies. In the studies conducted by Chung EH et al[19], Wadhwa A et al[20] and Oz TK et al[21], the prevalence of MS was observed to be 47%,47.5% and 46.8% respectively

In present study, it was observed that total 40% patients have increased waist circumference and out of them 62.5% of patients fulfilled the criteria of metabolic syndrome, p value was significant (<0.001). the results were in agreement with Hassanin N et al[10] who observed the that 62.9% patients in their study with MetS had increased abdominal circumference. Hence, the increased waist circumference as a component of metabolic syndrome is associated with the development of ACS. However in a study by Pandey S et al[22] non significant relationship was observed between both parameters. In study conducted by Oz TK et al[21], waist circumference was increased in 46% patients of ACS with MS as compared to 8% patients of ACS without MetS.

We observed that in 37 patients of ACS with MS, most common component in males was raised blood pressure (SBP and DBP), in females most common component was impaired fasting plasma glucose (FPG). Turhan H et al[13] evaluated the prevalence of metabolic syndrome in female and male patients with newly diagnosed premature coronary artery disease. The majority of patients were male (85% versus 15%). The overall prevalence of metabolic syndrome was 37%. Women with premature coronary artery disease were found to have a higher prevalence of metabolic syndrome than men (73% versus 31% respectively, p<0.001). Furthermore, the mean number of components of metabolic syndrome was significantly higher in women compared to men (2.81±1.09 versus 1.85±1.08 respectively, p<0.001).
In present study, in 37 patients of ACS with MS, 3 components combination of metabolic syndrome was most common, present in 48.64% patients, followed by 4 components combination present in 45.94% patients and least common combination was five components combination present in 5.4%) patients. In concordance with the current study, in studies conducted by Chung EH et al[19] and Sundaramoorthy V et al[15], the most common combination was 3 component combination which was present in 49% and 43.28% patients respectively followed by 4 component combination present in 32% and 35.82% patients respectively and least common was 5 component combination present in 19% and 20.89% patients respectively.

The present study showed that Waist circumference was statistically significantly raised in patients of ACS with MetS as compared to patients of ACS without MetS. Systolic blood pressure (SBP) was statistically significantly raised in patients of ACS with MS as compared to patients of ACS without MS. The mean waist circumference (cm) in current study was 97.44±10.96.
In Rajbhandari et al[23] the mean waist circumference being 87.58±14.37 and 83.66 ± 14.03 in patients with and without MetS. The results of their study were not in agreement with the

present study. In a study by Oz TK et al[21] study, the mean waist circumference was 98.4±11.3 in patients with MetS and 91.5 ± 8.5 and the difference was statistically significant which was in agreement with our study.
Systolic blood pressure (SBP) was statistically significantly raised in patients of ACS with MetS as compared to patients of ACS without MetS. Fasting plasma glucose (FPG) Serum triglycerides(TGc) and Serum high density lipoproteins (LDL) was statistically significantly raised in patients of ACS with MetS as compared to patients of ACS without MetS. There was no significant difference in the diastolic blood pressure (DBP) of patients of ACS with MetS and ACS without MetS patients. The results were in accordance with the study done by Oz TK et al[21] where both systolic and diastolic pressures, FPG, TGC were significant. However HDL were non significant. In a study by rajbhandari et al[23] the values for TG and FBS were significant rest all the parameters were non significant.

## 5. CONCLUSION

All the five components of metabolic syndrome i.e. waist circumference, systolic blood pressure, fasting plasma glucose, serum triglycerides, serum high density lipoproteins were significantly associated with patients of acute coronary syndrome with metabolic syndrome as compared to patients of acute coronary syndrome without metabolic syndrome. The high prevalence of metabolic syndrome in young patients reinforces the need for a comprehensive non communicable disease prevention and control program. Increasing awareness and early identification of these clusters of risk factors should be emphasized in designing population wide prevention strategies.

## REFERENCES

[1] Sumner AD, Sardi GL, Reed III JF. Components of the metabolic syndrome differ between young and old adults in the US population. The Journal of Clinical Hypertension. 2012 Aug;14(8):502-6.
[2] igit, F.S., Tahapary, D.L., Trompet, S. *et al.* The prevalence of metabolic syndrome and its association with body fat distribution in middle-aged individuals from Indonesia and the Netherlands: a cross-sectional analysis of two population-based studies. *Diabetol Metab Syndr* 12, 2 (2020).
[3] Abda E, Hamza L, Tessema F, Cheneke W. Metabolic syndrome and associated factors among outpatients of Jimma University Teaching Hospital. Diabetes Metab Syndr Obes. 2016 Mar 4;9:47-53.
[4] Schwortz CJ, Valente AJ, Spraque EA, Kelley JL, Cayatte AJ, Rozek MM. Pathogenesis of the atherosclerotic lesion: Implications for diabetes mellitus. Diabetes Care. 1992; 15:1156-67.
[5] Saklayen MG. The Global Epidemic of the Metabolic Syndrome. Curr Hypertens Rep. 2018 Feb 26;20(2):12. doi: 10.1007/s11906-018-0812-z. PMID: 29480368; PMCID: PMC5866840.
[6] Misra A, Khurana L. Obesity and the metabolic syndrome in developing countries. J Clin Endocrinol Metab. 2008 Nov;93(11 Suppl 1):S9-30.
[7] Bonomini F, Rodella LF, Rezzani R. Metabolic syndrome, aging and involvement of oxidative stress. Aging Dis. 2015 Mar 10;6(2):109-20. doi: 10.14336/AD.2014.0305. PMID: 25821639; PMCID: PMC4365955.
[8] Borggreve SE, De Vries R, Dullaart RP. Alterations in high-density lipoprotein metabolism and reverse cholesterol transport in insulin resistance and type 2 diabetes

mellitus: role of lipolytic enzymes, lecithin:cholesterol acyltransferase and lipid transfer proteins. Eur J Clin Invest. 2003 Dec;33(12):1051-69.

[9] Huang PL. A comprehensive definition for metabolic syndrome. Dis Model Mech. 2009 May-Jun;2(5-6):231-7.

[10] Hassanin N, Gharib S, El Ramly MZ, Meged MA, Makram A et al. Metabolic syndrome and coronary artery disease in young Egyptians presenting with acute coronary syndrome. Kasr Al Ainy Medical Journal 2015, 21:27-33

[11] Danciu SC, Iqbal FM, Manankil MF, Koul S, Raghuvir R, Herrera CJ et al. Metabolic Syndrome in Younger Patients with Acute Coronary Syndrome. Eur J Gen Med. 2012; 9(1):22-26.

[12] Quirós AM, Martínez AMS, Garza FJG, Garza-Sagástegui MG, Guzmán-Delgado NE, Palmero-Hinojosa MG et al. Myocardial infarction in young Mexicans associated to metabolic syndrome.Gac Med Mex. 2017;153:269-276

[13] Turhan H, Yasar AS, Basar N, Bicer A, Erbay AR, Yetkin E.High prevalence of metabolic syndrome among young women with premature coronary artery disease. Coron Artery Dis. 2005 Feb;16(1):37-40.

[14] Milionisa HM, Kalantzib KJ, Papathanasioub AJ, Kosovitsasb AA, Doumasa MT and Goudevenos JA.Metabolic syndrome and risk of acute coronary syndromes in patients younger than 45 years of age. Lippincott Williams and wilkins 2007. Coron Artery Dis 18:247–252.

[15] Sundaramoorthy V, Mambatta AK, Chidambaram Y, Gopalan R, Menon S. Prevalence of metabolic syndrome in patients with premature coronary artery disease proven by coronary angiogram. Int J Res Med Sci. 2017 Nov;5(11):5021-5025.

[16] RanjithN, Pegoraro RJ, Naidoo DP, Esterhuizen TM. Metabolic syndrome in young Asian Indian patients with myocardial infarction. Intern Med 2005; 165:1192−1198.

[17] Aggarwal A, Aggarwal S, Sharma V et al. Metabolic Syndrome and Coronary Artery Disease in Indians Younger than 40 years. J EndocrinolMetab, 2012; 2(1):39-45.

[18] Danciu SC, Iqbal FM, Manankil MF, Koul S, Raghuvir R, Herrera CJ et al. Metabolic Syndrome in Younger Patients with Acute Coronary Syndrome. Eur J Gen Med. 2012; 9(1):22-26.

[19] Chung EH, Curran PJ, Sivasankaran S, Chauhan MS, Gossman DE, Pyne CT et al. prevalence of metabolic syndrome in patients ≤45 Years of age with acute myocardial infarction having percutaneous coronary intervention. Am J Cardiol 2007; 100:1052-1055.

[20] Wadhwa A, Avasthi R, Ghambhir JK, Dwivedi S.To Study the Prevalence and Profile of Metabolic Syndrome, Levels of hs-CRP, Lp(a) and Serum Ferritin in Young Indian Patients (≤45 years) with Acute Myocardial Infarction. JAPI, June 2013, vol 61,384-386.

[21] Oz TK, Ozbilgin N, Sungur A, Bas EG, Zengin A, Gurol T et alPrevalence of Metabolic Syndrome in Young Patients with STElevation Myocardial Infarction.International Journal of the Cardiovascular Academy, Volume 4, Issue 3, July-September 2018:53-58.

[22] Pandey P, Baral N, Majhi S, Acharya P, Karki P, Shrestha S et al. Prevalence of the metabolic syndrome in acute myocardial infarction and its impact on hospital outcomes. Int J Diab Dev Ctries, April-June 2009, Volume 29, issue 2, 52-55.

[23] Rajbhandari A, Pandeya DR, Bhattarai MD, Malla R, Sharma A, Shrestha D et al. Prevalence of Metabolic Syndrome and its Component in Patients with Acute Coronary Syndrome. MJSBH. July-December 2013|Vol 12| Issue 2.