

TO STUDY THE RISK FACTORS ASSOCIATED WITH METABOLIC SYNDROME IN CORONARY ARTERY DISEASE PATIENTS

JASPREET KAUR¹, JASWANT KAUR², MRIDULA MITTAL³, TEJINDER SINGH^{4*}, VISHAL GUPTA⁵

¹Department of Biochemistry, Noida International Institute of Medical Sciences, Noida, Uttar Pradesh, India. ²Department of Biochemistry, NC Medical College and Hospital, Panipat, Haryana, India. ³Department of Physiology, Adesh Medical College, Bathinda, Punjab, India.

⁴Department of Biochemistry, GMC, Amritsar, Punjab, India. ⁵Department of Community Medicine, GGSMCH, Faridkot, Punjab, India.

Email: v_tajinder79@yahoo.com

Received: 05 September 2022, Revised and Accepted: 25 October 2022

ABSTRACT

Objective: Indians are more likely to develop metabolic syndrome (MetS). The additive predictive value of MetS components for cardiovascular disease is still under debate. The current study aimed to study the risk factors associated with MetS in coronary artery disease (CAD) patients.

Methods: This retrospective study was conducted in the Department of Biochemistry in collaboration with the Department of Medicine, Noida International Institute of Medical Sciences, Gautam Buddha Nagar, Up on 100 patients already diagnosed with CAD, attending medicine OPD and IPD. Anthropometric measurements, and estimation of fasting blood glucose, high-density lipoprotein-cholesterol, and triglycerides were done. MetS prevalence was estimated as per the guidelines of NCEP ATP III.

Results: In our study, we observed a high incidence of MetS in patients with CAD. MetS was diagnosed, gender-wise distribution resulted in 62% in females and 48% in males. Risk factors for MetS in CAD patients were highly significant with increasing age, sedentary lifestyle, and diabetes. Waist circumference, fasting blood glucose levels, and triacylglycerol were found to have a significant * $p < 0.001$ value with MetS in CAD patients.

Conclusions: The current study found a strong link between MetS and its risk factors in CAD patients. Thus, the assessment of MetS and its components might help identify people at a higher risk of advancing CAD in the future. Hence, effective MetS management may significantly reduce morbidity and mortality due to CAD.

Keywords: Metabolic syndrome, Coronary artery disease, National cholesterol education program-adult treatment panel-III, Diabetes mellitus, Obesity.

© 2023 The Authors. Published by Innovare Academic Sciences Pvt Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>) DOI: <http://dx.doi.org/10.22159/ajpcr.2023v16i1.46282>. Journal homepage: <https://innovareacademics.in/journals/index.php/ajpcr>

INTRODUCTION

The metabolic syndrome (MetS) consists of a group of metabolic abnormalities, that is, characterized by four essential components, including intra-abdominal obesity, dyslipidemia, hypertension, and impaired glucose tolerance, and is associated with a high risk of both type 2 diabetes and CAD [1]. These risk factors tend to cluster together in patients, and when they do, the risk of developing cardiovascular disease is significantly increased. MetS are becoming more common, coinciding with rising levels of obesity caused by sedentary lifestyles and poor nutrition habits [2]. Central fat distribution is more atherogenic than peripheral obesity and waist circumference (WC) is used to identify central obesity. Thus, abdominal obesity is regarded as one of the components of MetS, which has been linked to the development of dyslipidemia, diabetes, and an increased risk of cardiovascular events [3]. Many epidemiological and clinical studies have confirmed the link between MetS and an increased risk of coronary artery disease (CAD), which is the leading cause of death worldwide. Morbidity and mortality from CAD are higher in MetS patients [4]. India accounts for 17% of global CAD mortality. South Asians have a disproportionately high risk of developing type 2 diabetes mellitus and CAD. Clinical diabetes and CAD are preceded by several risk factors that are also components of MS. Individuals with MetS is a complex web of metabolic factors that are associated with a 5-fold increased risk of developing diabetes, a 3-fold increased risk of myocardial infarction, or stroke, and a 2-fold increased risk of MI-related mortality [5]. According to a meta-analysis, the burden of MetS in India is 30%, affecting mostly older adults, females, and the urban population [6]. Our objective was to study the risk factors associated with MetS in CAD among CAD patients.

METHODS

This retrospective study was conducted in the Department of Biochemistry in collaboration with the Department of Medicine, Noida International Institute of Medical Sciences, Gautam Buddha Nagar, UP. Prior Permission from the institutional ethical committee was taken. Written informed consent was obtained from all the participants. Hundred patients diagnosed with CAD attending medicine OPD and IPD patients were selected by a simple random sampling method. Clinical diagnosis of a patient with MetS was done according to the guidelines of NCEP ATP III. A 5 mL overnight fasting venous blood from the antecubital vein was taken with a dry disposable syringe under aseptic conditions in a vacutainer. Laboratory investigations for biochemical parameters were done such as fasting blood glucose and lipid profiles. The enzymatic method was performed for biochemical investigations on semi autoanalyzer. All study participants were interviewed using a questionnaire, including data on smoking, and physical activity. Blood pressure, height, weight, waist, and hip circumference were measured. All the patients were suffering from CAD attending OPD included in the study. Patients suffering from chronic kidney disease, hepatic dysfunction, rheumatological diseases, and cancer were excluded from the study.

Statistical analysis

Analysis of data was done on SPSS version 15. The study's findings were presented as a number, and percentage. Pearson correlation coefficient value < 0.005 was regarded as significant and used to detect the association among different variables.

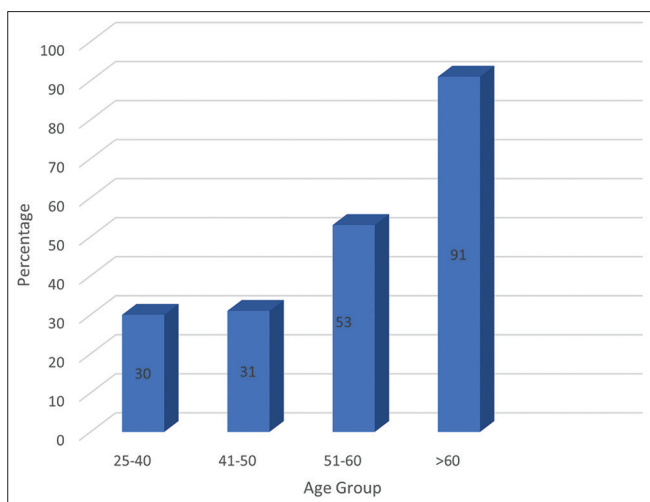


Figure 1: Prevalence of metabolic syndrome in coronary artery disease patients according to age groups

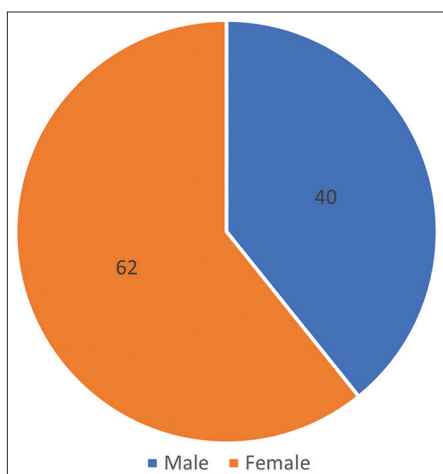


Figure 2: A pie chart shows the prevalence of metabolic syndrome in females and males

Table 1: Percentage of biochemical parameters in CAD patients associated with and without metabolic syndrome in CAD patients

Parameters	With MetS	Without MetS	p-value
FBS (>110mg/dL) %	66.66	33.34	<0.0001*
HDL-C (<40 mg/dL) %	61.5	38.5	<0.0001*
TG (>150 mg/dL) %	86.7	13.3	<0.0001*
Waist circumference %			
Male >102	29.1	9.44	<0.0001*
Female >88	44.5	16.33	

CAD: Coronary artery disease, MetS: Metabolic syndrome, FBS: Fasting blood glucose, HDL-C: High-density lipoprotein-cholesterol, TG: Triacylglyceride. p<0001*: Highly significant

Table 2: The percentage of risk factors associated with metabolic syndrome.

Group	Risk factors (%)					
	Smokers	Nonsmokers	HTN	Non-HTN	DM	Non-DM
With metabolic syndrome	55	45	71	29	66.6	33.5
Without metabolic syndrome	58	42	41	59	34	66

*HTN: Hypertension, DM: Diabetes mellitus

RESULTS AND DISCUSSION

The current study was conducted on 100 patients who suffered from CAD, attended OPD, and were admitted to IPD in Noida International Institute of Medical Sciences, Gautam Buddha Nagar, UP. In this study, MetS and its risk factors associated with CAD patients were analyzed.

The present study showed the percentage of patients with MetS having increased fasting blood glucose was 66.6% as compared to 33.34% without MetS. Decrease levels of high-density lipoprotein cholesterol (HDL-C) (<40 mg/dL) were found MetS patients compared to 38.5% without MetS. The percentage of Triacylglyceride (TG) was high, that is, 86.7% with MetS as compared to 13.3% without MetS. In addition, percentage of clinical parameter, WC level (>90 cm) among 100 patients found significantly high with MetS indicated by Table 1. Numerous studies have found similar results [1]. Dyslipidemia is also prevalent in the Iranian population [7,8]. Low HDL-C was identified as one of the most common abnormalities, in other words, high TG has been identified as the second most common abnormality [9] and the strongest independent risk factor for CAD in the Iranian population [10]. Asian Indians have a high prevalence of low HDL. The previous studies from India found that low HDL was the most common abnormality, followed by elevated blood pressure [11,12].

The percentage of risk factors associated with MetS that includes hypertension, smoking, and diabetes mellitus of 100 subjects is represented in Table 2. It seems that the incidence of hypertension and diabetes was increased, that is, 71% and 66.6%, respectively, in MetS patients.

In this study, it was observed that the prevalence of metabolic syndrome is higher in the elderly, almost 91% in the age group >60 years. A further account of subjects within the age group of 20–40 years, 41–50 years, and 51–60 years was 30%, 31%, and 53%, respectively, as represented by Table 3 and Figure 1. This study is supported by Ramachandran et al. [13]. According to the NCEPATP III Criteria, the unadjusted and age-adjusted prevalence of MetS in the United States was 21.8% and 23.7%, respectively. The prevalence increased from 6.7% among participants aged 20–29 years to 43.5% and 42% for those aged 60–69 years and at least 70 years [14].

In Table 4 and Figure 2 showed that the maximum percentages were seen higher in females (62%), while in males (40%), as found in the studies done by Gupta et al., that observed a higher prevalence in females according to both the IDF and NCEP [15].

Anurad et al. [16] found a significantly higher prevalence of severe CAD in European American and African American patients with MetS than those in patients without MetS (71% and 57% vs. 29% and 43%). Thus, in all populations studied and across ethnic groups, CAD is more severe in patients with MetS. Several meta-analyses have found a clear link between MS and the occurrence of cardiovascular events during follow-up in primary prevention [17]. MetS increases the risk of CVD, cardiovascular mortality, myocardial infarction, and stroke by half, and increases overall mortality by 50%. As a result, the risk of cardiovascular events in MetS is higher than the risk of overall mortality. Mets are associated with a higher risk of cardiovascular mortality, myocardial infarction, and stroke even in the absence of diabetes, though not significantly higher for overall mortality [18]. A few limitations of our

Table 3: Prevalence of metabolic syndrome in CAD patients according to age groups

S. No.	Age group	Number of patients (n=100)	Metabolic syndrome patients	Percentage
1.	25-40	10	3	30
2.	41-50	16	5	31
3.	51-60	39	21	53
4.	>60	35	32	91

Table 4: Distribution gender-wise prevalence of metabolic syndrome in CAD

Gender	Number of patients (n=100)	CAD patients with metabolic syndrome	Percentage
Male	71	28	40
Female	29	18	62

CAD: Coronary artery disease

study are that observations cannot be generalized due to the small sample size.

CONCLUSION

The study included previously known cases of CAD, and the presence of MetS was found in these cases. A very strong relationship was discovered between blood pressure, WC, TG, and fasting blood glucose levels. In terms of public health, the main benefit of MetS is to highlight the clustering of risk factors associated with obesity, hypertension, smoking, and diabetes. The present study shows the high prevalence of MetS in cardiovascular patients, it is clear that more attention should be paid to the symptoms of this disease. As a result, the risk of cardiovascular disease can be deferred.

AUTHORS' CONTRIBUTIONS

The manuscript writing had accomplished by Jaspreet Kaur and the data collection and analysis were done by Tejinder Singh. Research reviewed and edited by Mridula Mittal and statistical analysis done by Vishal Gupta. Manuscript finalized, edited, and submitted for publication by Jaswant Kaur.

COMPETING INTERESTS

The authors affirm no conflicts of interest.

AUTHORS' FUNDING

None.

REFERENCES

- Montazerifar F, Bolouri A, Mozaffar MM, Karajibani M. The prevalence of metabolic syndrome in coronary artery disease patients. *Cardiol Res* 2016;7:202-8. doi: 10.14740/cr507w, PMID 28197293
- Younis A, Younis A, Tzur B, Peled Y, Shlomo N, Goldenberg I, et al. Metabolic syndrome is independently associated with increased 20-year mortality in patients with stable coronary artery disease. *Cardiovasc Diabetol* 2016;15:149. doi: 10.1186/s12933-016-0466-6, PMID 27793156
- Azizi F, Hadaegh F, Khalili D, Esteghamati A, Hosseinpahan F,

- Delavari A, et al. Appropriate definition of metabolic syndrome among Iranian adults: Report of the Iranian national committee of obesity. *Arch Iran Med* 2010;13:426-8. PMID 20804311
- Mahalle N, Garg MK, Naik SS, Kulkarni MV. Association of metabolic syndrome with the severity of coronary artery disease. *Indian J Endocrinol Metab* 2014;18:708-14. doi: 10.4103/2230-8210.139238, PMID 25285291
- Ravikiran M, Bhansali A, Ravikumar P, Bhansali S, Dutta P, Thakur JS, et al. Prevalence and risk factors of metabolic syndrome among Asian Indians: A community survey. *Diabetes Res Clin Pract* 2010;89:181-8. doi: 10.1016/j.diabres.2010.03.010, PMID 20381187
- Krishnamoorthy Y, Rajaa S, Murali S, Rehman T, Sahoo J, Kar SS. Prevalence of metabolic syndrome among adult population in India: A systematic review and meta-analysis. *PLoS One* 2020;15:e0240971. doi: 10.1371/journal.pone.0240971, PMID 33075086
- Hajian-Tilaki KO, Heidari B. Prevalence of obesity, central obesity and the associated factors in the urban population aged 20-70 years, in the North of Iran: A population-based study and regression approach. *Obes Rev* 2007;8:3-10. doi: 10.1111/j.1467-789X.2006.00235.x, PMID 17212790
- Ghayour-Mobarhan M, Shapouri-Moghaddam A, Azimi-Nezhad M, Esmaili H, Parizadeh SM, Safarian M, et al. The relationship between established coronary risk factors and serum copper and zinc concentrations in a large Persian cohort. *J Trace Elem Med Biol* 2009;23:167-75. doi: 10.1016/j.jtemb.2009.03.006, PMID 19486826
- Sharifi F, Mousavinasab SN, Soruri R, Saeini M, Dinmohammadi M. High prevalence of low high-density lipoprotein cholesterol concentrations and other dyslipidemic phenotypes in an Iranian population. *Metab Syndr Relat Disord* 2008;6:187-95. doi: 10.1089/met.2008.0007, PMID 18774906
- Ebrahimi M, Kazemi-Bajestani SM, Ghayour-Mobarhan M, Moohebaty M, Paydar R, Azimi-Nezhad M, et al. Metabolic syndrome may not be a good predictor of coronary artery disease in the Iranian population: Population specific definitions are required. *Sci World J* 2009;9:86-96. doi: 10.1100/tsw.2009.17
- Gupta R, Deedwania PC, Gupta A, Rastogi S, Panwar RB, Kothari K. Prevalence of metabolic syndrome in an Indian urban population. *Int J Cardiol* 2004;97:257-61. doi: 10.1016/j.ijcard.2003.11.003, PMID 15458693
- Misra A, Pandey RM, Devi JR, Sharma R, Vikram NK, Khanna N. High prevalence of diabetes, obesity, and dyslipidemia in urban slum population in Northern India. *Int J Obes Relat Metab Disord* 2001;25:1722-9. doi: 10.1038/sj.ijo.0801748, PMID 11753596
- Ramachandran A, Snehalatha C, Satyavani K, Sivasankari S, Vijay V. Metabolic syndrome in urban Asian Indian adults—a population study using modified ATP III criteria. *Diabetes Res Clin Pract* 2003;60:199-204. doi: 10.1016/s0168-8227(03)00060-3, PMID 12757982
- Ford ES, Giles WH, Dietz WH. Prevalence of the metabolic syndrome among US adults: Findings from the third national health and nutrition examination survey. *JAMA* 2002;287:356-9. doi: 10.1001/jama.287.3.356, PMID 11790215
- Gupta RD, Tamanna R, Akonde M, Biswas T, Chakraborty P, Hossain MB. Prevalence and associated factors of metabolic syndrome among Bangladeshi adults: Evidence from a nation-wide survey. *Diabetes Epidemiol Manag* 2021;5:100037. doi: 10.1016/j.deman.2021.100037
- Anuurad E, Chiem A, Pearson TA, Berglund L. Metabolic syndrome components in African-Americans and European-American patients and its relation to coronary artery disease. *Am J Cardiol* 2007;100:830-4. doi: 10.1016/j.amjcard.2007.04.025, PMID 17719328
- Novo S, Peritore A, Guarneri FP, Corrado E, Macaione F, Evola S, et al. Metabolic syndrome (MetS) predicts cardio and cerebrovascular events in a twenty years follow-up-A prospective study. *Atherosclerosis* 2012;223:468-72. doi: 10.1016/j.atherosclerosis.2012.05.018, PMID 22704563
- Motillo S, Filion KB, Genest J, Joseph L, Poirier P, et al. The metabolic syndrome and cardiovascular risk: A systematic review and meta-analysis. *J Am Coll Cardiol* 2010;56:1113-32.