Original Research Article

Metabolic syndrome's risk factor and relation with coronary artery disease

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Abstract

Background: Metabolic Syndrome (MS) represents a constellation of risk factors. Modified IDF definition for Asian Indian MS is any 3 out of five – abd obesity male ≥ 90 cm, female ≥ 80cm, fasting blood glucose≥100 mg, Hypertension ≥130 SBP, ≥ 85 DBP, High Triglyceride ≥150 mg/dl, Low HDL Male ≤40 mg /dl Female ≤50 mg/dl. Each risk factor of MS is pre atherogenic and prothrombotic. Considering this interrelationship between MS risk factor and atherosclerosis, we planned this study to observe the impact of MS risk factor over coronary artery. **Method:** 76 Cases of Metabolic Syndrome (MS) fulfilling the criteria of MS, symptomatic for IHD and willing for coronary angiography were included in this study. Coronary angiography was done as per standard protocol. Coronary angiography finding were noted by two experienced cardiologist, who were blinded for symptomatology and MS risk factor. **Observation and Results:** The age distribution in angio proved CAD was in the range of 32-78 years, maximum cases were seen in 41-50 yrs. (37%). Male female ratio was 3.9:1. Thus male preponderance and CAD at early age group is noted in this study. Waist circumference in CAD group is 97.04 ± 6.57, while normal coronary artery group is 93.37 ± 6.61.In multivariate analysis abdominal obesity is statistically significant (or -9.72,95% c1(1.35-69.67),(p=0.024). Coronary artery disease was noted in 49 cases, 26 (53%) had hypertension, while 23 (47%) were normotensive. This difference between two group is not significant (p-0.835). Impaired fasting blood sugar was noted in 53 (59.7%) MS cases. Out of 53, CAD was seen in 38 (71.7%) while 15 (29%) had normal coronaries. This finding is statistically significant (p-0.046). In multivariate analysis impaired fasting blood glucose between CAD and normal coronary group found significant (OR-1.02, 95% (1.00 – 1.04)) (P-0.043). Mean TG level in CAD group is (161.16 ± 41.3), normal coronary group is (137.70 ± 32.27) (p-0.0072), this difference is statistically significant. The mean HDL Level is 36.99 ± 8.6 in CAD group while normal coronary art group is 39.52± 9.88, (p-0.805), this is statistically insignificant. CAD was noted in MS five risk factor 21/26 (80%), four risk factor 16/25 (64%), three risk factor 12/25 (48%).We found coronary artery disease in 14 cases of smoker while normal coronary artery in 2 smokers (p-0.030), this is statistically significant. **Conclusion:** Central Obesity, impaired fasting blood glucose and smoking found to be an independent risk factor in MS responsible CAD. Risk for CAD increases as increase in risk factor of MS.

Key Words: Metabolic Syndrome's risk factor, CAD.

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Received Date: 19/09/2017 Revised Date: 14/10/2017 Accepted Date: 09/11/2017
DOI: https://doi.org/10.26611/1021432

Access this article online

Quick Response Code:

Website: www.medpulse.in

Accessed Date: 21 December 2017

INTRODUCTION

Coronary Artery Disease is the leading cause of morbidity and mortality in both developing and developed countries. Approximately one sixth of world's population lives in India and CAD remains the highest cause of mortality in India[1]. Changing life style i.esedentary life style and high calorie food intake is leading to central adiposity. Central adiposity is an important clue to the presence of insulin resistance and hyperinsulinemia[2]. The metabolic syndrome (MS) represents a constellation of risk factor. These metabolic risk factor include atherogenic dyslipidemia, elevated

How to cite this article: Raut S G, Chavan M S, Deshpande M A, Washimkar S N. Metabolic syndrome's risk factor and relation with coronary artery disease. *MedPulse International Journal of Medicine.* December 2017; 4(3): 109-113. https://www.medpulse.in/Medicine/

blood pressure and blood glucose, prothrombotic and proinflamatary factors. Each component of metabolic syndrome is pre-atherogenic and prothrombotic[3]. And summation of risk factor will increase the risk of CAD. Considering this interrelationship between risk factor and CAD, we planned this study.

MATERIAL AND METHODS

This hospital base, observation study was conducted tertiary care center Super – Speciality Hospital and Govt. Medical College, Cardiology Department, Nagpur. 76 cases admitted for coronary angiography fulfilling ≥3 criteria for metabolic syndrome (MS) were included in the study. (MS according to modified IDF definition for Asian adults)[4], after estimation of sample size as per expected prevalence of MS in India[5].

Study period- May 2007 to May 2009.

Exclusion Criteria

1. Cases of acquired andcongenital heart or pericardial disease.
2. Patient with chronic illness like chronic liver disease, renal disease, thyroid dysfunction, chronic respiratory diseases and other endocrine dysfunction.
3. Refusal to give informed consent.

Coronary Angiography

Catheterisation and Coronary Angiography was done using standard technique and protocol after 2DECHO and doppler assessment for LV function in all cases of MS. Nitroglycerine was administered routinely in all cases suspected of having coronary spasm. Angiogram were assessed independently by experienced interventional cardiologist who were blinded to patients clinical parameters.

Statistical Analysis: Continuous parameters were presented as mean ± SD. Categorical variables were expressed in percentage. Continuous variable were compared between coronary artery disease and normal coronary artery using unpaired t-test. Categorical variables were compared by chi-square statistics. In case of small number, fisher exact test was applied. To assess significant predictors far CAD, multiple logistic regression back word elimination method was applied, $p<0.005$ was considered as statistically significance. Data was analysed on statistical software version 10.0.

OBSERVATION AND RESULTS

Table 1: IHD presentation in MS

	CAD	Normal CAG
	n=49	n=27
Q Wave Infarct	26	3
Non Q Infarct	10	8
USA	7	4
CSA	4	7
Atypical Chest Pain	2	5

Table 2: Comparison of conventional risk factors in metabolic syndrome between CAD and normal CAG

Sr. No.	Risk Factor	CAD	Normal CAG	p	Significance
1	Age	53.42 ±11.16	50.50 ± 10.20	0.723	NS
2	Systolic BP	147 ±15.90	142.67 ± 16.70	0.208	NS
3	Diastolic BP	88.88 ±10.22	88.07 ± 8.88	0.893	NS
4	Waist Circumference	97.04 ±6.57	97.37 ± 6.61	0.228	S
5	Total Cholesterol	185 ±43.81	174 ± 14.74	0.2550	NS
6	Tri-glyceride	161 ±41.3	135 ± 32	0.0072	HS
7	HDL	32.23±8.2	39.52±9.8	0.2350	NS
8	VLDL	116.53 ±8.2	57.14 ± 6.4	0.0072	HS
9	LDL	116.53 ± 43.90	107.33 ± 39.12	0.367	NS
10	Bld. Sugar Fasting	119.93 ±25.05	106.18 ± 0.23	0.0239	S
11	Smoking	14	2	0.030	S
12	Tobacco	9	5	0.987	NS
13	Alcohol	10	2	0.137	NS

NS- Not Significant S- Significant HS- Highly Significant

Table 3: Comparison of Risk factor of MS with CAD

Risk Factor	CAD n=49	Normal CAG n=27	p-value
A Hypertension mm of Hg SBP ≥130	26	15	
DBP ≥85			0.835 (NS)
Normotensive SBP ≤ 129			
DBP ≤ 84	23	12	
B Waist Circumference (cm) Male ≥ 90	36	12	
≤ 89	2	1	0.000
Female ≥ 80	10	14	(HS)
≤ 79	1	0	
C Triglyceride Level			
TG≥150	30	12	0.159
TG≤149	19	15	(NS)
D HDL Level			
HDL Male ≤ 40	25	6	
≥ 41	14	7	0.805 (NS)
Female ≤ 50	10	14	
≥ 41	0	0	
E Fasting Blood Sugar			
≥ 100	38	15	0.046
≤ 99	11	12	(S)

Table 4: Comparison of number of risk factor of MS and angiographic profile

No. of Vessel	Risk factors of Metabolic Syndrome		
	5	4	3
0 (Normal)	5	9	13
1 (SVD)	5	8	10
2 (DVD)	7	6	1
3(TVD)	9	2	1
Total	**26**	**25**	**25**

RESULTS

The coronary angiography was performed and finding were recorded in 76 cases of MS, presenting for IHD symptoms. Age distribution in CAD was in the range of 32-78 years. The mean age of CAD patient was 53.42 yrs. ± 11.16 (p-0.2723) The age distribution in normal coronary artery groups was in the range of 32-72 yrs and maximum cases were seen in 41-50 yrs. i.e. 10 (37%). Male preponderance is present in our study, male: female ration in CAD group is 3.9:1. More number of cases had q-wave infarct i.e. 38% and CAD found in 23/26 (89%). Metabolic| Syndrome (MS) is constellation of risk factor. Each factor of MS and its association with CAD were studied independently and in group also. Hypertension (SBP ≥130 mm of hg and DBP ≥85 mm of hg) detected in (53.9%) cases of M.S. Coronary artery disease was noted in 49 cases, 26(53%) had hypertension, while 23 (47%) were normotensive. This difference between two group is statistically not significant (p-0.835). Waist circumference ≥ 90 cm for men ≥ 80 cm for women were considered as obese. In CAD group waist circumference is 97.04 ±6.57, while normal coronary artery group is 93.37 ±6.61. This difference between two group is statistically significant. In multivariate analysis abdominal obesity is statistically significant (OR-9.72, 95% CI, (1.35 – 69.67), (p-0.024). Dyslipidemia was assessed in both the groups (CAD and normal coronary artery) in MS. Total cholesterol mean in CAD group is 185.77 ± 43.81and in normal coronary group is 174±14.94 (p-0.2550). This difference between two group is not significant. The mean triglyceride (TG) level in CAD group is 161.16 ± 41.34 and normal coronary group is 135.70 ±32.27, (p-0.0072). This difference of TG level in two groups is statistically significant. The mean HDL level is 36.99 ± 8.6 in CAD group, while normal coronary group is 39.52 ± 9.88. This difference between two group is not significant (p-0.805). The mean VLDL level in CAD group is 32.23 ± 8.26, while normal coronary group is ±27.14±6.45. This difference between two group is highly significant. The mean LDL level in CAD group is 116.53 ±43.90, while normal coronary group is 107.33 ±39.12. This difference between two group is not significant (p- 0.3671). Fasting blood sugar ≥ 100 mg is considered impaired for MS. Out of 76,53 (59.7%) MS patient had impaired fasting glucose. CAD was seen in 38 (71.7%) while 15 (29%) had normal coronaries. This difference between two group is statistically significant (p 0.04),in multivariate analysis fasting blood sugar is statistically significant, (OR-1.02, 95% 1.00-1.04) (p-0.043). Thus fasting blood sugar level is an independent

risk factor for CAD. On analysis the effect of other risk factors i.e. smoking, tobacco, drugs and alcohol on CAG profile, we found coronary artery disease in 14 smokers and normal coronaries in two smokers, which is statistically significant. (p-0.030).

DISCUSSION

Reaven proposed the concept of syndrome X in 1988[6]. WHO defined MS, considering its prevalence in epidemic proportion[7].Recent data from Asian Populationincluding Asian Indian suggested the separate definition for metabolic syndrome (Modified IDF – International Diabetic Fedration definition). 76 cases of Metabolic Syndrome were included in this study according to modified IDF criteria, and subjected for coronary angiography. In our study mean age of CAD patient is 53.42 ± 11.16 years, suggest early coronary artery disease in MS. Male female ratio in this study, show male preponderance. Male preponderance was also noted by Tenrez and Marianne Zellera *et al*[8-9]. We observe q wave infarction in 38% of cases of MS, CAD found in 23/26 (89%) cases. Kip *et al* in WISE study noted CAG proved CAD in 55.10%symptomatic women.[10] Change in life style, westernization of food practices, high calory food intake and sedentary life style is leading to central adiposity. Abdominal adiposity is one high risk component of MS. Obesity is associated with conventional risk factor (e.g. hypertension, dyslipidemia and diabetes mellitus) and novel risk factor (eg. Inflammatory markers such as hs-CRP and interleukin-6 and endothelial dysfunction)[11-13] Visceral obesity, insulin resistance, oxidative stress, endothelial dysfunction, activated RAS, increased inflammatorymediators and obstructive sleep apnea have been proposed to be possible factor to develop hypertension in Ms. These factor may induce sympathetic over activity, vasoconstriction, increased intravascular fluid, decreased vasodilation leading to development of hypertension. The pathogenesis of the multiple metabolic abnormalities in MS is a consequence of genetic environmental interaction leading to disturbed energy metabolism and body immune response. Adipocytokines, released by adipocyte, paracrine and endocrine signals that cross-talk between different cells and tissues, mediate complex physiological processes. When the cross talk fails, adverse health consequences occur[15]. Obesity in our study is found an important and independent risk factor for coronary artery disease. This is correlating with Kip *et al*, relation of obesity (as per BMl) in metabolic syndrome with CAG proved CAD. Similarly Cassidy AD *et al* also concluded the obesity was associated with increase progression of CAD[16] Hypertension, SBP and DBP was most common in CAD group as compared to normal coronary artery group, but this difference is not significant statistically. Wang W, Lee etal data from Strong Heart Study noted uncontrolled hypertensive develop more cardiovascular disease as compare to normotensive.[17] Impaired fasting blood sugar was significantly associated with coronary artery disease in MS in univariate and multivariate analysis. We found dyslipidemia, hyper triglyseridemia more common in cases of fasting hyperglycemia, responsible for AMI and cardiovascular disease. Ternerzand associates, Melissa etal, Arca M *et al*, also pointed same finding.[18-19] Out of 76 cases, 26 (34.2%) had five risk factors, 25 patient (32.89%) each had four and three risk factor. CAD was noted in MS with five risk factor 21/26 (80%), four risk factor 16/25 (64%), three risk factor 12/25 (48%).Definitely summation of risk factor is compounding the atherosclerosis and CAD.

LIMITATIONS OF THE STUDY

1. This is only observational study and controls were not taken for comparison in this study.
2. Further evaluation of normal coronary artery was not done in this study, hence possibility of microvascular coronary artery disease and vasospastic disease cannot be ruled out.
3. The effect of MS on the progression of CAD and CAD events was not studied as the patients were not longitudinally followed up.
4. Our study comprises of consecutive 76 patients of MS of IHD. Hence the sample size is small with under representation of female.

Implication of Study: Central obesity, impaired fasting glucose and smoking was found important and independent risk factor for CAD in MS in this study. All this factors are modifiable and can prevent progression of CAD.

CONCLUSION

Central obesity and impaired fasting glucose was found to be an independent risk factor for CAD in this study. Smoking was associated with higher incidence of coronary artery disease in Metabolic Syndrome. Coronary artery involvement increases with increasing number of risk factors of MS.

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Source of Support: None Declared
Conflict of Interest: None Declared