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Original Research Article

Study of Metabolic Syndrome and Framingham Risk Score in Coronary Artery Disease Patients at Tertiary Care Centre

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ABSTRACT

Background: Metabolic syndrome or syndrome X, is an indicator of coronary artery disease (CAD) risk level. Framingham Risk Score (FRS) is a scoring system which is used for risk scoring for CAD.
Materials and Methods: This was an observational and cross sectional study conducted at a tertiary care teaching hospital. Aim and Objectives: To find the relation between Metabolic syndrome (MeTS) and Framingham risk score (FRS) in coronary artery disease patients. This study was conducted in patient undergoing coronary angiogram, over period of 18 months.
Results: The majority of patients were males (60.35%), predominant age groups were 51 – 60 years and 41 – 50 years. A total 462 (47.58%) patients had MetS. Significant association was seen between the CAD risk factors (hypertension, DM and tobacco consumption) with metabolic syndrome. Single vessel disease (SVD) was found in 321 (33.05%) patients, 207 (21.31%) patients had DVD, 80 (8.23%) patients had TVD, and 363 (37.38%) patients had normal CAG findings. The metabolic syndrome and FRS > 20% are associated with CAD risk in present study.
Conclusions: About two-third of population had Framingham risk score more than twenty. About half of the population had metabolic syndrome. The Framingham risk score had positive correlation with severity of coronary artery disease and waist circumference. The presence of metabolic syndrome had positive correlation with severity of coronary artery disease. Framingham risk score and metabolic syndrome had critical input as a score and risk factors with presence of and severity of coronary artery disease.
Keywords: Metabolic Syndrome, Framingham risk score, CAD, Coronary Angiogram, Single vessel disease

INTRODUCTION

Metabolic syndrome considers central obesity, presence of diabetes, hypertension and dyslipidemia while FRS focuses on age, gender, TC, HDL-cholesterol, systolic blood pressure, and smoking habits. The metabolic syndrome (MS) is a known risk factor in the development of cardiovascular disease events and was associated with accelerated atherosclerosis. [1] Overall, metabolic syndrome is associated with a two-fold increase in the risk of CVD, CVD mortality, and stroke, and a 1.5-fold increase in risk of all-cause mortality. [1, 2] The Framingham risk score (FRS) is a simplified and common tool for the assessment of risk level of CAD over 10 years. The FRS considers six coronary risk factors (age, gender, total cholesterol (TC), high density

lipoprotein cholesterol (HDL), smoking habits, and systolic blood pressure). Because this risk score gives an indication of the likely benefits of prevention, it can be useful for both the patients and clinicians deciding who are at increased risk for future cardiovascular events. [3] The FRS is applicable method for predicting a person's chance of developing cardiovascular disease (CVD) in long-term. Despite the applicability of FRS, it is weak to evaluate some key factors, which influenced by dietary and metabolic patterns modification. It remained unknown whether the FRS is a good predictor of metabolic disturbances and underlying ischemic heart disease. The limited data are available evaluating the predictive value of FRS in detecting the risk of CVD in patients with metabolic syndrome. There is difference in the nature of CVD risk factors in different populations; its replication seems to be necessary. [4] The present study was aimed at studying association between metabolic syndrome and Framingham risk score in coronary artery disease patients.

MATERIAL AND METHODS

Aim and Objectives: To find the relation between Metabolic syndrome (Mets) and Framingham risk score (FRS) in coronary artery disease patients. This was a observational and cross sectional study done in patient undergoing coronary angiogram (CAG) for evaluation of coronary artery disease (CAD). This study was approved by Institutional protocol and Ethics committee. Informed and written consent from patients were taken before enrolling in study. A total Nine hundred and seventy one patients undergoing coronary angiogram were incorporated in present study. This study was conducted over period of 18 months (October 2016 to March 2018). This study was carried out in ward patients undergoing CAG at Krishna Hospital and Medical Research Centre, Karad. All patients satisfying the inclusion criteria were selected during the study period.

Inclusion criteria: All patients with coronary artery disease (CAD) undergoing coronary angiogram with age >40 years were included in this study.

Exclusion criteria: Age ≤ 40 years and >75 years, valvular heart disease, cardiomyopathies, congenital heart diseases, renal dysfunction and hepatic dysfunction were excluded from study.

Metabolic Syndrome: Patients were examined for the presence of metabolic syndrome according to IDF 2005 guidelines. All patients enrolled were underwent detailed clinical examination and investigations. For a person to be defined as having the metabolic syndrome, according to IDF 2005 guidelines, he/she must have: [5, 6]

Central obesity: waist circumference ≥90 cm for males and ≥80 cm for females

Plus any two of the following four factors:

Hypertriglyceridemia ≥150 mg/dl

Low HDL cholesterol <40mg/dl in males and <50mg/dl in females

Hypertension: Blood pressure ≥ 130 mm of Hg systolic, ≥ 85 mm of Hg diastolic

Fasting blood sugar ≥100mg/dl or previously diagnosed type 2 diabetes mellitus or on treatment

Framingham risk score: FRS was used to investigate the risk of cardiovascular disease. FRS scores were calculated based on the six coronary risk factors including age, gender, TC, HDL-cholesterol, systolic blood pressure, and smoking habits. The cut-offs for calculating FRS were as follows: for systolic blood pressure: <120, 120-129, 130-139, 140-159, and ≥160 mmHg; and for HDL-C: <40, 40-49, 50-59, and ≥60 mg/dl. Ten-year risk percentage was calculated by total points (1 point 6%,2 points 8%,3 points 10%, 4 points 12%,5 points 16%,6 points 20%,7 points 25%,10 points or more >30%). Absolute CVD risk percentage over 10 years was classified as low risk (<10%), intermediate risk (10-20%) and high risk (>20%). [7] **(Figure 1)**

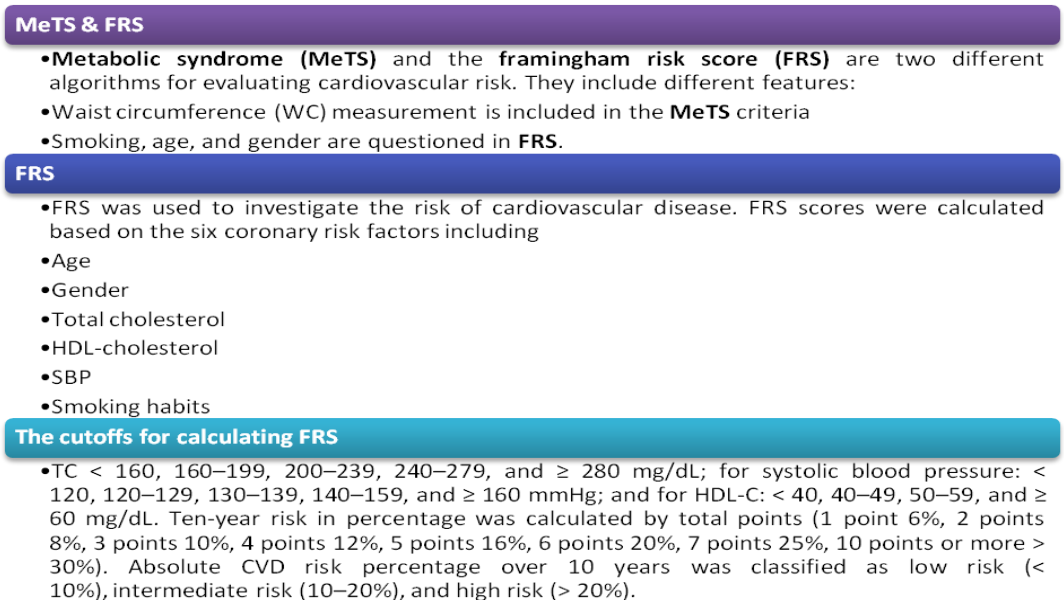

Figure 1: FRS score and Metabolic syndrome (MeTS)

Statistical Analysis: Statistical Analysis was done by using Statistical Package for Social Sciences (SPSS) trial Version 21.0, and Microsoft Excel. Proportion and percentages were obtained. Mean values were calculated. Pearson chi-square test was applied to get 'p' values and check the difference. The 'p' values of <0.05 was considered significant. Relative risk and correlation was calculated.

RESULTS

A total of 971 patients were included in present prospective observational study, undergoing coronary angiogram (CAG). Of them 586 (60.35%) patients were males and 385 (39.64%) patients were females, predominated by male gender. Male to female ratio was (3:2). There were 203 patents (2.90%) from age group of 41 – 50 years, 336 patients (34.60%) from 51 – 60 years, 339 patients (34.91%) from 61 – 70 years and 93 patients (9.57%) from age group of 71 years and above. (**Table1)**

Table1: Age and gender wise distribution of the patients

	Age group(years)								Total (n=971)	
	41-50 (n=203)		**51-60** (n=336)		**61-70** (n=339)		**71-80** (n=93)			
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Male (n=586)	121	59.60	189	56.25	221	62.24	65	69.89	586	60.35
Female (n=385)	82	40.39	147	43.75	128	37.75	28	30.10	385	39.64
Total (n=971)	203	20.90	336	34.60	339	34.91	93	9.57	971	100

The mean for the age for patients undergoing coronary angiography was 58.97 (±10.89) years. The mean for fasting blood sugar level was 134.72 (±50.76). The mean for triglycerides level was 160 (±50.76). The mean for HDL level was 38.9 (±11.5). The mean for systolic blood pressure was 134.17 (±15.45). The mean for diastolic blood pressure was 82.79 (±8.62). The mean for waist circumference was 86.95 (±9.56 cm). The mean for hip circumference was 89.96 (±9.34). The mean for weight was 67 (±11.5 kg). The mean for height was 162.97 (±6.37 cm). The mean for body mass index was 25.27 (±4.82 Kg/M^2). The mean for waist to hip ratio was 0.96 (±0.05). The mean for total cholesterol was 190.5 (±28.79).

Total 505 (52.10%) patients had BMI more than 25 and 476(47.90%) patients had BMI less than 25, mean for BMI was 25.77±4.82 Kg/M^2. Out of total 971 patients, 359 patients (36.97%) had diabetes, 318 had hypertension (32.75%),

241 patients (24.81%) had history of tobacco consumption. Obesity was present in 160 males (Waist circumference > 90cm) and 203 females (WC > 80cm) with total 363 patients (37.38%) were overweight or obese. The triglyceride (TG) > 150 mg/dl was present in 665 patients (68.48%). Of total patients 971, undergoing coronary angiogram, 462 (47.58%) patients had MetS. Past history of presence of hypertension, type 2 diabetes mellitus and tobacco consumption was significantly associated with metabolic syndrome (χ^2=11.2216, 'p' = 0.0037). **(Table 2)**

Table 2: Relation between coronary artery disease risk factors and MeTS

CAD Risk factor	MeTS present	%	MeTS absent	%
Hypertension	152	47.05	171	52.94
Type 2 DM	201	55.98	158	44.01
Tobacco consumption	103	42.73	138	57.26
χ^2=11.2216,'p' = 0.0037				

FRS was present mild (<10%) in 233 patients (23.99%), moderate (10 – 20%) in 334 patients (34.39%) and high risk scores (>20%) were in 404 patients (41.60%). Coronary angiogram showed that Single vessel disease (SVD) in 321 (33.05%) patients, 207 (21.31%) patients had double vessel disease (DVD), 80 (8.23%) patients had triple vessel disease (TVD), and 363 (37.38%) patients had normal coronary angiogram (CAG) findings. Presence of single vessel disease (SVD), double vessel disease (DVD) and triple vessel disease (TVD) in patients with MetS were 50.86%, 42.78% and 46.40% respectively. TVD was more common in patients with MeTS and DVD was more common in patients without MeTS (χ^2=3.5920 DF-3; 'p' = 0.309). **(Table 3)**

Table 3: Relation between coronary vessel involvements with MeTS

Vessels affected	MeTS present	%	MeTS absent	%	Total	%
SVD (n=289)	147	50.86	142	49.13	289	29.76
DVD (=187)	80	42.78	107	57.21	187	19.25
TVD (n=92)	48	52.17	44	47.82	92	9.47
Normal CAG (n=568)	187	46.40	216	53.59	403	41.50
Total	462	47.57	509	52.42	971	100
χ^2=3.5920 DF-3; 'p' =0.309						

The FRS had positive correlation with severity of CAD and waist circumference (WC). The presence of MeTS had positive correlation with severity of CAD. FRS and METS had critical contribution as score and risk factor with presence of and severity of CAD. **(Figure 2)**

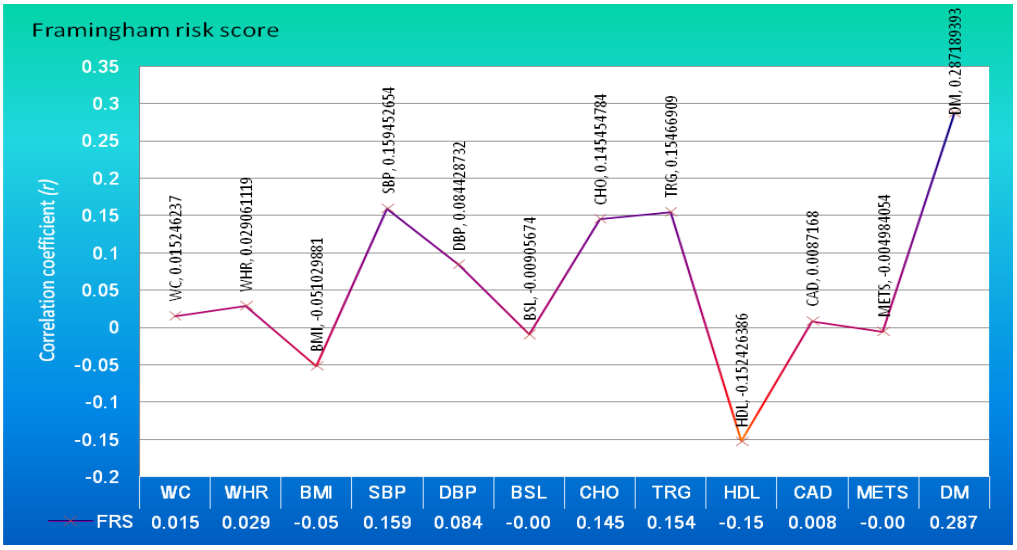

Figure 2: Correlation of FRS to severity of coronary artery disease and MeTS

There was no significant relation between the vessel involvement in CAD and FRS score ('p' = 0.819). **(Table 4)**

Table 4: Relation between vessel involvements with FRS

Frequency distribution of FRS	CAD Present	CAD Absent	Total
FRS < 10	139	95	234
FRS 10 - 20	185	139	324
FRS > 20	244	169	413
Total	568	403	971
X^2=0.398, 'p' =0.819			

There was no statistically significant association between FRS score and presence of MeTS in relation to CAD ('p'=0.56). **(Table 5 & Figure 3)**

Table 5: FRS and presence or absence of MeTS in relation to CAD

CAD Present					CAD Absent					
FRS	MeTS (+)		MeTS (-)		MeTS (+)		MeTS (-)		**Total**	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
<10	73	31.19	66	28.20	54	23.07	41	17.52	234	24.09
10-20	90	26.94	95	28.44	75	22.45	74	22.15	334	34.39
>20	112	27.79	132	32.75	87	21.58	72	17.86	403	41.50
Total	275	28.32	293	30.17	216	22.24	187	19	971	100
X^2 = 4.85, p=0.56										

The distribution of FRS score in relation with presence of Metabolic Syndrome and presence of CAD is shown in **Figure 3**.

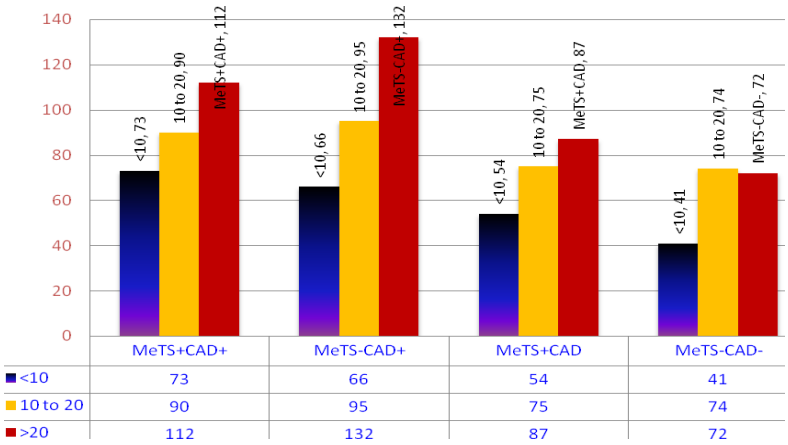

Figure 3: Distribution of FRS in relation with MeTS and presence of CAD

The presence of CAD among FRS < 10 and > 20 score was statistically significant in present study ($X^{2=}$24.52, DF:2; 'p'<0.001) **(Figure 4)**

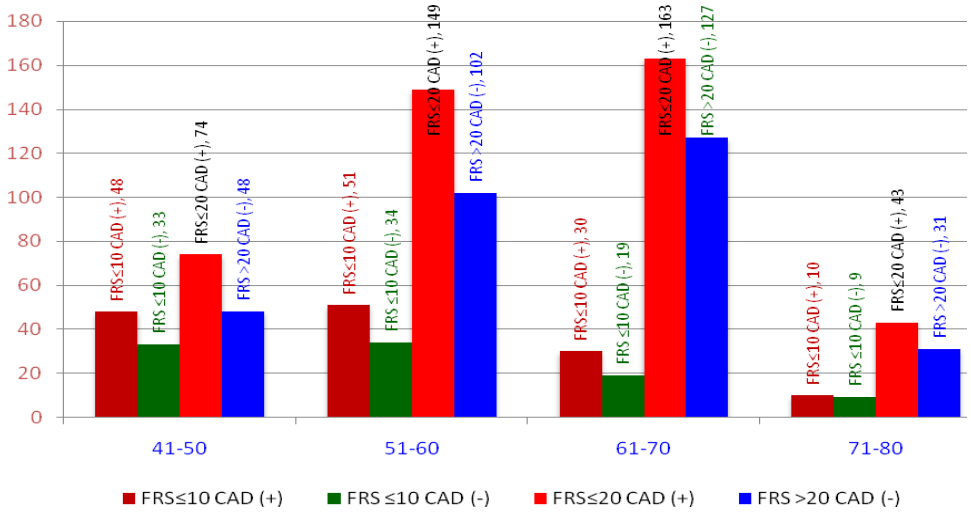

Figure 4: Relation of FRS score CAD

DISCUSSION

Metabolic syndrome (waist circumference) and the Framingham risk score (smoking, age and gender) are the two different parameters for evaluating the risk of cardiovascular disease. Present study population undergoing CAG was predominated by male gender. In present study two-third of population had Framingham risk score more than 20 and about half of the population had metabolic syndrome. Similarly L. Jahangiry et al stated that, significant associations between components of metabolic syndrome and different FRS categorization. [3] In present study about half of population had significant abnormality on coronary angiogram, one-third had Framingham risk score between10-20 and two-third had Framingham risk score more than 20. About half of the population had metabolic syndrome. Khanna R. et al quoted mean age of 56.5 (± 8.6) years in their study, with majority of males (80%) which is comparable with present study. [8] In present study total 359 patients (36.97%) had diabetes, 318 had Hypertension (32.75%), total 363 patients (37.38%) were overweight/obese. The triglycerides > 150 mg/dl was observed in 665 patients (68.48%). Khanna R. et al observed a 36% cases had diabetes similar to our study and 64% had hypertension which was more than present study findings. [8] Huang et al observed in their study that 23.5% patients had history of smoking which is comparable with present study. [9] In current study 462 (47.58%) patients had MeTS. Dada A. et al quoted 24.3% prevalence of MeTS in their study, which was low compared to our study. [10] In present cohort of CAD patients, past history of presence of hypertension, type 2 Diabetes mellitus and tobacco consumption was significantly associated with metabolic syndrome. Galassi A. et al observed patients with the MetS had approximately 60% increased risk of CVD than those without the MetS. [11] In present cohort of CAD patients, FRS was mild (<10%) in 233 patients (23.99%), moderate (10 – 20%) in 334 patients (34.39%) and high risk scores (>20%) were observed in 404 patients (41.60%) in present study. Similarly Yousefzadeh G. et al quoted overall 74.3% patients with MeTS were at low risk, 18.1% of them were at intermediate-risk, and 7.6% were at high risk for 10-year CVD. [4] In present study single vessel disease (SVD) was present in 321 (33.05%) patients, 207 (21.31%) patients had double vessel disease (DVD) and 80 (8.23%) patients had triple vessel disease (TVD). Faria et al quoted SVD in 30.7%, DVD in 23.8%, TVD in 24.6% which is comparable with present study. [12] Present study there was no significant relation between the vessel involvement in CAD and FRS score and association between FRS and presence of METS in relation to CAD. Similarly Zarich S et al in their study observed that the mean age, total serum cholesterol levels and an increased family history of the CAD were not statistically different between the cases with and without diabetes and cases with and without MeTS. [13] Neill M et al suggested that identification of metabolic syndrome may have prognostic value for patients in both the upper (>20%) and lower (<20%) FRS score categories, these findings are comparable with current study. [14] The metabolic syndrome has modifiable CAD risk factors as its components and FRS has combination of modifiable and Non modifiable CAD risk factors.

CONCLUSION

Metabolic syndrome and the Framingham risk score are the two different parameters for evaluating the risk of cardiovascular disease, which include different parameters like waist circumference (Metabolic syndrome), and smoking, age and gender in (Framingham risk score). In present study about half of population had significant abnormality on coronary angiogram. About two-third of population had Framingham risk score more than twenty and about half of the population had metabolic syndrome. Amongst

abnormal coronary angiogram, about half of the patients had single vessel disease. The Framingham risk score had positive correlation with severity of coronary artery disease and waist circumference. The presence of metabolic syndrome had positive correlation with severity of coronary artery disease. Framingham risk score and metabolic syndrome had critical contribution as score and risk factors with presence of and severity of coronary artery disease. It is suggested and emphasised on detection Framingham risk score and components of metabolic syndrome for better management and risk stratification of coronary artery disease.

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