



## COMPARISON OF METABOLIC SYNDROME WITH FRAMINGHAM RISK SCORE CATEGORIES IN PATIENTS OF ACUTE MYOCARDIAL INFRACTION

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### ABSTRACT

**Background-** The present study was conducted to find association between components of metabolic syndrome with FRS categories in patients presenting with first episode of acute MI. **Methodology-** This was a facility based cross sectional study on patients diagnosed with acute MI (first episode). Metabolic syndrome was diagnosed based on the guidelines NHLBI and AHA. Framingham risk score was calculated for each patient and it was divided in low risk (<10%), intermediate risk (10-20%) and high risk (>20%). **Results-** A statistically significant association between metabolic syndrome and FRS among various age and gender group ( $p < 0.01$ ) was observed. Also significant association was observed between FRS and various components of MS. **Conclusions-** MS correlates well with FRS, it can be used in developing countries like India as markers for CVD, hence it is important to look for the metabolic syndrome parameters during routine checkup in order to decrease the risk of CVD.

**KEYWORDS :** FRS, metabolic syndrome, acute MI, CVD

### INTRODUCTION-

According to World Health Organization (WHO), cardiovascular diseases (CVD) are most common cause of death globally. WHO estimated that 17.9 million people died from CVD in 2016, representing 31% of all global deaths. Of them, three fourths of CVD deaths occur in low and middle income countries.[1] Myocardial infarction (MI) is the most common form of coronary heart disease (CHD). The incidence of MI varies greatly worldwide. The Spanish study estimated the crude CHD incidence rate of 300.6/100,000 person-years for men and 47.9/100,000 person-years for women.[2] However, the incidence of MI in India is estimated to be 64.37/1000 people in men aged 29-69 years.[3]

Metabolic syndrome (MS) is associated with a two fold increase in the risk of occurrence of CVD, stroke and 1.5 fold increase in risk of all-cause mortality.[4]

The Framingham risk score (FRS) is a simplified and common tool for the assessment of risk level of coronary artery disease (CAD) over 10 years. The FRS considers six coronary risk factors, including age, gender, total cholesterol (TC), high density lipoprotein cholesterol (HDL), smoking habits, and systolic blood pressure (SBP).[5] Because this risk score gives an indication of the likely benefits of prevention, it can be useful for both the patients as well as clinicians in deciding whether to start only lifestyle modification or start preventive medical treatment; also it is useful for patients education by identifying men and women at increased risk for future cardiovascular (CV) events. Since MS is a complete cluster of metabolic risk factors of CV events including insulin resistance, central obesity, diabetes mellitus, and hyperlipidemia, it is necessary to predict the risk of CV disease in these patients. Moreover, limited data are available evaluating the predictive value of FRS in detecting the risk of CVD in patients with MS, and because of difference in the nature of CVD risk factors in different populations, its replication seems to be necessary.[6] However, it has not been established whether MS is a better predictor of CHD risk than the FRS, recent US studies indicate that MS is inferior to the FRS in predicting CHD.[7] The present study was thus conducted to find association between components of MS with FRS categories in patients presenting with first episode of acute MI.

### METHODOLOGY-

This study was conducted as facility based cross sectional study at Department of Medicine, Gandhi Medical College & associated Hamidia Hospital Bhopal for a period of 1 year i.e. from 1st November 2018 to 30th October 2019. All patients diagnosed with acute MI (first episode) based on WHO criteria i.e. presenting with any two of the following- cardiac chest pain, ECG changes or elevated cardiac enzymes belonging to age group of 20 to 80 years and giving consent to participate in the study were included whereas patients with diabetes mellitus (type I & II) and other comorbidities such as stroke, malignancy, renal disease were excluded from the study.

After obtaining ethical clearance from Institute's Ethical Committee, all the cases diagnosed with first episode of acute MI fulfilling the inclusion criteria during the study period were enrolled in the study. All the study participants were subjected to detailed clinical history followed by general examination along with blood pressure measurements. Following this, systemic examination was conducted for all the patients and further all participants were subjected to routine and special investigation such as complete blood counts, lipid profile, liver function test, fasting and post prandial blood glucose, cardiac enzymes. Also patients were subjected to Chest X ray and ECG.

MS was diagnosed based on the guidelines from the National Heart, Lung, and Blood Institute (NHLBI) and the American Heart Association (AHA). Any three of the following traits in the same individual meet the criteria for the MS-

- Abdominal obesity: A waist circumference (WC) of  $\geq 102$  cm (40 inches) in men and  $\geq 88$  cm (35 inches) in women. For Asian Americans, the cut-off values are  $\geq 90$  cm (35 inches) in men or  $\geq 80$  cm (32 inches) in women.
- Serum triglycerides 150 mg/dl or above.
- HDL cholesterol 40 mg/dl or lower in men and 50 mg/dl or lower in women.
- Blood pressure of 130/85 mmHg or more.
- Fasting blood glucose of 100 mg/dl or above.

Diagnosis of CAD was made based upon WHO criteria-

- Patient with chest pain
- ECG changes

- Elevated cardiac enzymes (troponin I or CPK-MB over 6 hour).

FRS was calculated for each patient and it was divided in low risk (<10%), intermediate risk (10-20%) and high risk (>20%).

**Statistical analysis-**

Data was compiled using MS Excel and data analysis was performed using IBM SPSS ver 20 software. Categorical data was expressed as frequency and percentage. Chi Square test was used to compare the categorical data. P value <0.05 was considered as significant.

**RESULTS-**

The present study included a total of 200 patients with acute MI belonging to age group of 20 to 80 years. Majority of patients belonged to age group of 40 to 64 years (54%). Males preponderance was reported in present study (75.5%). About 85.1% and 78,7% patients belonging to age group <40 and 40-64 years respectively were males. However, in patients belonging to age group of >65 years, 57.8% were males and 42.2% were females. MS was documented in 136 (68%) patients in present study. However, FRS revealed low risk, intermediate risk and high risk in 84 (42%), 47 (23.5%) and 69 (34.5%) patients respectively.

**Table 1- Association of FRS category with metabolic syndrome in patients of acute MI-**

FRS Category	Metabolic syndrome		Total	P value
	Yes (%)	No (%)		
Low risk (<10%)	43 (51.2)	41 (48.8)	84	<0.001
Intermediate risk (10-20%)	35 (74.5)	12 (25.5)	47	
High Risk (>20%)	58 (84)	11 (16)	69	
Total	136 (68)	64 (32)	200	

On comparing the MS status among the patients with FRS, about 51.2%, 74.5% and 84% patients with low, intermediate and high risk respectively had MS and the observed difference was statistically highly significant (p<0.01).

**Table 2- Comparison of FRS category with metabolic syndrome according to age and gender-**

	FRS Category	Metabolic syndrome		Total	P value		
		Yes (%)	No (%)				
Gender	Male (159)	Low (<10%)	27 (42.2)	37 (57.8)	64	0.001	
		Intermediate (10-20%)	15 (60)	10 (40)			25
		High (>20%)	51 (82.3)	11 (17.7)			62
	Female (49)	Low (<10%)	16 (80)	4 (20)	20		
		Intermediate (10-20%)	20 (91)	2 (9)	22		
		High (>20%)	7 (100)	0 (0)	7		
Age	<40 Years	Low (<10%)	13 (48.1)	14 (51.9)	27	0.001	
		Intermediate (10-20%)	00	00			00
		High (>20%)	00	00			00
	40-64 Years	Low (<10%)	29 (54.7)	24 (45.3)	53		
		Intermediate (10-20%)					
		High (>20%)					

≥65 years	Intermediate (10-20%)	25 (78.1)	7 (21.9)	32
	High (>20%)	41 (93.2)	3(6.8)	44
	Low (<10%)	1 (25.0)	3 (75.0)	4
	Intermediate (10-20%)	10 (66.7)	5 (33.3)	15
	High (>20%)	17 (68.0)	8 (32.0)	25

It was observed that higher the FRS risk there is higher chances of MS among males (p<0.001). Similarly among females as the FRS risk increased there is higher chances of MS (p<0.001) in females. Males have higher risk of MS as compared to females.

Among the age group 40-64 years, out of 53 low risk patients, 54.7% had MS, out of 32 Intermediate risk (10%-20%) patients, 78.1% had MS whereas out of 44 patients with high risk as per FRS score, 93.2% had MS. Similarly, among the patients with age ≥65 years, out of 4 low risk patients, 25% had MS, out of 15 Intermediate risk (10%-20%) patients, 66.7% had MS whereas out of 25 patients with high risk as per FRS score, 68% had MS. The comparison was highly significant with p value of <0.001.

**Table 3: Prevalence of metabolic syndrome components according to FRS-**

Patients group	N (%) (n=200)	Low risk N (%) (n=84)	Intermediate risk N (%) (n=47)	High risk N (%) (n=69)	P value
High SBP	61 (30.5)	9 (14.8)	17 (27.9)	35 (57.4)	<0.001
High DBP	44 (22)	5 (11.4)	13 (29.5)	26 (59.1)	0.003
High WC	66 (33)	25 (37.9)	10 (15.1)	31 (47.0)	<0.001
High FBS	13 (6.5)	6 (46.1)	3 (23.1)	4 (30.8)	0.012
High TC	58 (29)	12 (20.7)	15 (25.9)	31 (53.4)	<0.001
High TG	152 (76)	54 (35.5)	39 (25.7)	59 (38.8)	0.022
Low HDL	166 (33)	62 (37.3)	41 (24.7)	63 (38.0)	0.034

In present study, patients who had high SBP, majority had high risk (57.4%) followed by Intermediate risk (27.9%) and low risk (14.8%) (P<0.001). Out of patients who had high DBP (diastolic blood pressure), majority had high risk (59.1%) followed by Intermediate risk (29.5%) and low risk (11.4%) (P=0.003). Out of patients who had high WC, majority had high risk (47%) followed by low risk (37.9%) and Intermediate risk (15.1%) (P<0.001). Out of patients who had high fasting blood sugar (FBS), majority had low risk (46.1%) followed by high risk (30.8%) and Intermediate risk (23.1%) (P=0.012). Out of patients who had high TC, majority had high risk (53.4%) followed by intermediate risk (25.9%) and low risk (20.7%) (P<0.001). Among the patients with High triglycerides, majority had high risk (38.8%) followed by low risk (35.5%) and intermediate risk (25.7%) (P<0.001) and among the patients with Low HDL, majority had high risk (38.0%) followed by low risk (37.5%) and intermediate risk (24.7%) (P<0.001).

**DISCUSSIONS-**

MS 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. MS is a novel risk factor for the incidence of CAD. CAD is among the main causes of death in developed countries, while it has a growing epidemic in developing countries.<sup>4</sup>

The present study observed that about 51.2%, 74.5% and 84% patients with low, intermediate and high risk respectively had MS and the observed difference was statistically highly significant (p<0.01). Similar observation were made by Khanna et al where patients with MS had significantly higher mean FRS than those without MS (15.1 vs 8.65, p value 0.0001). Most patients with MS (74%, n=148) had an intermediate to

high 10 year CV risk (<10%) as estimated by FRS. The proportion of patients with MS progressively increased in those with low, intermediate and high FRS (61, 87 and 92%, respectively).[8] Contrasting results were posted by Widjaja et al where no component of MS associated with increased FRS.[9]

In present study, it was observed that higher the FRS risk there is higher chances of MS ( $p < 0.001$ ) both amongst males as well as females. Also males have higher risk of MS as compared to females. Similar study by Wannamethee et al recorded that men with MS at baseline (26%) showed significantly higher relative risk (RR) than men without MS of developing CHD (RR, 1.64; 95% confidence interval [CI], 1.41-1.90), stroke (RR, 1.61 95% CI, 1.26-2.06), and DM2 (RR-3.57; 95% CI, 2.83-4.50). The FRS was a better predictor of CHD and stroke than MS but was less predictive of DM2.[5]

In present study, it was observed that as the age increased, FRS risk as well as the occurrence of MS was also observed. The comparison was highly significant with  $p$  value of 0.001. Similarly Khanna et al recorded that the prevalence of MS was uniformly similar (74-84%) in all age groups, amongst those 45 years, none of the patients could be categorized as having high CV risk as estimated by FRS despite having angiographic CAD, highlighting the limitation of age dependence of FRS.[8] Results of Bansal et al supports our findings where MS was present in 47.5% (905 of 1905) subjects. Overall, 76.8% patients with MS had 10 year CV risk <10%, 20.6% had 10-20% risk and only 2.7% had >20% risk according to FRS. In the lowest age-quartile, 95.9% patients had 10-year risk <10%, 4.1% patients had 10-20% risk and none had > 20% risk. In contrast, in the highest age-quartile, less than half of the patients had 10-year risk <10% and nearly half had 10-20% risk of CV events.[10]

The present study also observed association between various components of MS and FRS. FRS was significantly associated with all the components of MS i.e. raised SBP, raised DBP, WC (central obesity), high FBS, high TC, high triglyceride, low HDL ( $P < 0.05$ ). Jahangiry et al reported the highest prevalence of all of MS components were in low CVD risk according to the FRS grouping ( $P < 0.05$ ), while the lowest prevalence of these components was in high CVD risk group ( $P = 0.05$ ). According to multiple logistic regression analysis, high SBP and FBS were potent determinants of intermediate and high risk CVD risk of FRS scoring compared with low risk group ( $P = 0.05$ ).[11] Prasad BS, et al study recorded elevated blood pressure (63.1%) was the commonest abnormality observed and elevated blood sugar (31.2%) was the least common. Low HDL (84.5%) was the commonest abnormality among females, followed by elevated blood pressure (56.8%) and elevated blood sugar (28.9%) was the least common abnormality. Among males, elevated blood pressure (69.3%) was the commonest abnormality, followed by central obesity (41.9%). Low HDL (9.5 %) was the least common abnormality among males.[12] Present study has few limitations in terms of small sample size, single centered and cross sectional which do not replicate the real population.

## CONCLUSIONS-

Based on the results it was found that MS was more prevalent among the patients who were in the fourth to sixth decade of their life and among females. With higher FRS risk there is higher chances of MS. FRS risk increases with increasing age and male gender. To conclude MS correlates well with FRS, it can be used in developing countries like India as markers for CVD, hence it is important to look for the MS parameters during routine checkup in order to decrease the risk of CVD.

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