Original Article

Angiographic profile of NSTEMI patients with or without metabolic syndrome

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Abstract

Background: Metabolic syndrome (MS) constitutes the clustering of clinical and biochemical risk factors, which are associated with increased risk of cardiovascular events. Non ST elevation myocardial infarction (NSTEMI) accounts for the important part of acute coronary syndrome (ACS) with considerable morbidity and mortality. The aim of this study was to investigate the association of MS with angiographic severity of coronary artery disease (CAD) in patients with NSTEMI. ***Methods:*** **This study included** 192 prospectively enrolled NSTEMI patients. The patients underwent coronary angiography (CAG). CAG were evaluated via Sullivan's method. ***Results:*** Statistically significant difference in vessel score observed, such that higher triple vessel disease (TVD) in MS patients (42.7% vs. 15.6%, $p<0.001$) and single vessel disease (SVD) in patients without MS (45.8% vs. 21.9%, $p<0.001$). Patients with MS had higher mean total stenosis score (9.26±4.29 vs. 6.06±3.07, $p<0.001$) and mean extension score (53.70±18.11 vs. 39.11±17.59, $p<0.001$). Correlation analysis found direct correlation between angiographic scores and MS scores, total cholesterol, LDL-C, HDL-C, TG and waist circumference. Individual components of MS were independent predictors of high total stenosis score and extension score on multivariate linear regression analysis. ***Conclusion*****:** Metabolic syndrome, as well as, individual components of MS was independently associated with angiographically severe CAD.

Keywords: NSTEMI; Metabolic syndrome; Angiographic profile

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Introduction

Cardiovascular diseases are the main cause of death in both developed and developing countries which is mainly attributed to coronary artery disease (CAD). Approximately in every 34 seconds, an American experiences a coronary event, and approximately in every minute someone die of with acute coronary syndrome (ACS)[1]. Non ST segment elevation myocardial infarction (NSTEMI) is more heterogeneous in its presentation and may be poorly characterized in clinical practice, leading to greater variation in diagnosis & treatment[2]. Of the NSTEMI patients approximately 15% die and those who recover develop re-infarction within 30 days of diagnosis[3]. The GRACE study demonstrated 6% hospital death rate for patients with NSTEMI[2].

The metabolic syndrome is a constellation of number of metabolic abnormalities. Definition for metabolic syndrome has been proposed by number world and professional bodies of which most notables are by World Health Organization (WHO)[4], National Cholesterol Education Program (NCEP): Adult Treatment panel III[5] and International Diabetic Federation (IDF) definitions[6]. Obesity, hyperglycemia and dyslipidemia

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are common components in all definitions. The IDF criterion appeared be convenient to apply compared to the WHO and other guidelines criteria[7].

There seems to be a socioeconomic transition Bangladesh reflected by lifestyle and dietary pattern of the citizens: habituation in eating high calorie diet, tobacco use, high intake of processed foods and less physical activity. It has been reported that 21.5% adults (male 21%, female 22%) have body mass index (BMI) $\geq$25 kg/m^2 and increased waist circumference, especially in women 33.7%[8]. South Asians are assumed to develop metabolic syndrome and found to have high percentage of body fat, abdominal obesity and insulin resistance [9]. The prevalence of metabolic syndrome reported to be 20.7%, 11.2% and 8.6% following modified Adult Treatment Panel III, IDF, WHO definition respectively. In a recent report it was demonstrated 19.5% of older persons in rural Bangladesh (women 20.8% and men 18.0%) had metabolic syndrome[8].

Most of the available data regarding the effect of MS on CAD is based upon studies conducted in developed world and little focus about the effect of metabolic syndrome on CAD in our population. The aim of this study was to examine the extent of CAD in patients who presented with NSTEMI and to evaluate the relationship of metabolic syndrome with the extent of CAD in NSTEMI patients in Bangladeshi subjects.

Materials and Methods:

This was a cross-sectional study, which included patients presented with the diagnosis of NSTEMI. Patients with STEMI and UA, patients with history and evidence of previous ACS (STEMI/NSTEMI/UA), patients who previously underwent any procedures of myocardial revascularization (PCI and/or CABG), patients with concomitant co-morbid conditions (severe liver and kidney diseases) those are not suitable for CAG, patients with associated congenital and valvular heart disease, Cardiomyopathy, severe systemic illness (Severe dementia, Advanced malignancy) and those who didn't agreed to go through CAG were excluded from the study.

A total of 192 NSTEMI patients (of which 96 patients with metabolic syndrome considered as Group I and equal number of 96 patients without metabolic syndrome considered as Group II) were prospectively enrolled into the study. The patients underwent CAG in the Department of Cardiology, National Heart Foundation Hospital & Research Institute, Dhaka during August 2013 to August 2014. CAG were evaluated via Sullivan's method. Data were analyzed using the SPSS version 16.0 for Windows. A *p*-value of <0.05 was considered as level of significance.

This study was approved by ethics committee of National Heart Foundation Hospital & Research Institute, Dhaka.

Results:

Most of the (77.1 %) patients were male and 22.9 % patients were female. The mean (±SD) age (yrs) all subjects was 55.35 ± 10.31. Mean (±SD) age (yrs) of women was 57.05±10.48 and men 54.85±10.24 (p>0.05). Mean (±SD) age (yrs) in metabolic syndrome group was significantly higher compared to the non-metabolic (58.26 ± 8.7 vs 52.45±10.9 respectively, (p<0.001) (Table 1). Smoking did not show any association with the condition (p=0.288) (Table 1). Hypertension, diabetes mellitus, family history of diabetes and dislipidemia demonstrated significant association (p<0.05) with NSTEMI with metabolic syndrome (Table 2). Mean (±SD) fasting blood glucose (mg/dl) and triglyceride (mg/dl) was significantly higher in Groups I compared to Group II (p<0.001 and 0.002 respectively) (Table 2). Mean (±SD) HDLc (mg/dl) in male of Group I had significantly low compared to the Group II (p<0.001) but no difference observed in case of female (p=0.285).

In assessing metabolic syndrome presence of all 5 criteria was present in 16.7% (n=32), 4 criteria 28.1% (n=54), 3 criteria 13 % (n=25), 2 criteria 32.3% (n=62) and 1 criterion in 9.9% (n=19) cases. Concerning individual components of metabolic syndrome, waist circumference criterion was noted in 79.7% (n=153), high triglyceride in 64.05% (n=123), low HDL-c in 60.95% (n=117), high blood pressure in 57.8% (n=111) and diabetes in 43.25% (n=83) of all patients. Mean metabolic syndrome score was 4.23±0.62 and 1.96±0.59 in Group I and Group II respectively (p<0.001). Coronary angiographic severity was assessed by vessel score, total stenosis score and extension score (Table 3). Mean (±SD) vessel score was 2.12 ± 0.89 in Group I and 1.66 ± 0.76 in Group II (p<0.00). Vessel scores distribution was as follows: Score 3 found in 42.7% vs. 15.6%, score 2 in 31.2% vs. 36.5%, score 1 in 21.9% vs. 45.8% and score 0 in 4.2% vs. 2.1% in Group I and Group II respectively (p<0.001). Mean (±SD) total stenosis score was 9.26 ± 4.29 and 6.06 ± 3.07 in Group I and Group II respectively (p<0.001) and extension score (53.70 ± 18.11 versus 39.11 ± 17.59 in Group I and Group II respectively (p<0.001). Total

stenosis and extension scores were significantly and modestly correlated with metabolic syndrome score (r=0.330 for total stenosis score and r=0.349 for extension score; P<0.001 for both).

Statistically significant association observed between metabolic and non-metabolic patients in total stenosis score when patient divided into two groups with a cutoff value of 16 points (9.4% in Group I and 1% in Group II; p=0.009). When patients were classified by extension score into two groups with a cutoff point of involvement of 50% of coronary artery territory, significant association was observed between two groups (46.9% in Group I and 24% in Group II; p=0.001). Correlation analysis showed correlation with metabolic syndrome scores (for vessel score r=0.202, p=0.005, for total stenosis score r=0.330, p<0.001 and for extension score r=0.349, p<0.001), total cholesterol (for vessel score r=0.181, p=0.012, for total stenosis score r=0.199, p=0.006 and for extension score r=0.202, p=0.005), LDL-c (for vessel score r=0.163, p=0.024, for total stenosis score r=0.180, p=0.012 and for extension score r=0.165, p=0.022), HDL-c (for vessel score r= -0.228, p=0.001, for total stenosis score r= -0.236, p=0.001 and for extension score r= -0.244, p=0.001), triglyceride (for vessel score r=0.179, p=0.013, for total stenosis score r=0.241, p=0.001 and for extension score r=0.219, p=0.002) and waist circumference (for vessel score r=0.230, p=0.005, for total stenosis score r=0.248, p=0.001 and for extension score r=0.238, p=0.001).

When the components of metabolic syndrome were enrolled into multivariate linear regression analysis, it was found that waist circumference (β =0.207; 95% CI, 0.026–0.222; t=2.489; P=0.014), raised

Table 1: Baseline characteristics of NSTEMI patients with and without metabolic syndrome (n=192)

Variable		Group I (n=96)	Group II (n=96)	p value
Age (yrs)		58.26 ± 8.7	52.45 ± 10.9	<0.001
Sex	Male	70 (72.9%)	78 (81.2%)	0.170
	Female	26 (27.1%)	18 (18.8%)	
Smoking	Current	28 (29.2%)	40 (41.7%)	
	Recent	8 (8.3%)	9 (9.4%)	0.288
	Former	16 (16.7%)	13 (13.5%)	
	Never	44 (45.8%)	34 (35.4%)	
Hypertension		85 (88.5%)	26 (27.1%)	<0.001
Diabetes		72 (75%)	11 (11.5%)	<0.001

Data were expressed as mean±SD and number (percent).

Table2: Components of metabolic syndrome in patients with and without NSTEMI (n=192)

Variable	Group I (n=96)	Group II (n=96)	p value
Waist Circumference (cm)			
Male	96.70 ± 5.06	92.31 ± 5.03	<0.001
Female	87.81 ± 5.86	82.50 ± 5.82	0.005
High waist circumference	96 (100%)	57 (59.4%)	<0.001
Hypertension	85 (88.5%)	26 (27.1%)	<0.001
Family history of DM	72 (75%)	11 (11.5%)	<0.001
Fasting blood glucose (mg/dl)	109.85 ± 34.17	92.09 ± 14.51	<0.001
Hyperglycemia state	40 (41.7%)	12 (12.5%)	<0.001
Triglyceride (mg/dl)	183.28 ± 61.24	160.10 ± 36.31	0.002
Hyper -triglyceridemia	72 (75%)	51 (53.1%)	0.002
HDL-c (mg/dl)			
Male	36.83 ± 4.83	41.44 ± 6.51	<0.001
Female	43.50 ± 6.71	45.72 ± 6.67	0.285
Low HDLc	74 (77.1%)	43 (44.8%)	<0.001

Data were expresses as mean±SD, number (percent) as appropriate.

blood pressure (β =0.161; 95% CI, 0.120–2.516; t=2.171; P=0.031), reduced HDL-C (β = -0.152; 95% CI, -0.181– -0.04; t= -2.058; P=0.041), and elevated TG (β =0.164; 95% CI, 0.002–0.024; t= 2.324; P=0.021) were independent predictors of high total stenosis score. Furthermore, waist circumference (β =0.183; 95% CI, 0.055–0.985; t=2.206; P=0.029), raised blood pressure (β =0.162; 95% CI, 0.598–11.97; t=2.180; P=0.030), reduced HDL-C (β = -0.157; 95% CI, -0.874– -0.032; t= -2.123; P=0.035), and elevated TG (β =0.146; 95% CI, 0.003–0.107; t=2.081; P=0.039) were also independent predictors of high total extension score.

Unpaired Student's t-tests and Chi-squared test was performed to calculate statistical significant difference and/ or association between groups. P value <0.05 was taken as level of significance.

Table2:

Group 1, NSTEMI patients with metabolic syndrome; Group II, NSTEMI patients without metabolic syndrome; Waist circumference cut-off, male ≥90 cm and female ≥ 80 cm; Hyperglycemia, blood glucose level ≥100 mg/dl; Triglyceride cut-off ≥150 mg/dl; HDLc cut off, male <40 mg/dl and female < 50 mg/dl.

Unpaired Student's t-tests and Chi-squared test was performed to calculate statistical significant difference and/ or association between groups. P value <0.05 was taken as level of significance.

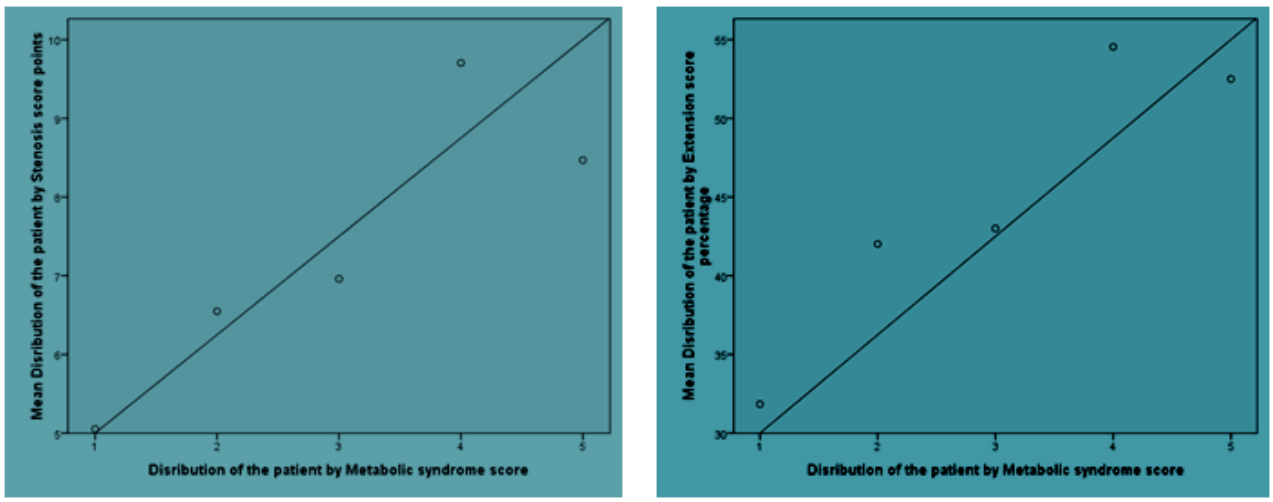
Table 3:

Unpaired Student's t-tests and Chi-squared test was performed to calculate statistical significant difference

Table 3: Summary of CAG scores of the study population (n=192)

Score	Group I (n=96)	Group II (n=96)	p value
Vessel score	2.12 ± 0.89	1.66 ± 0.76	<0.001
Score 0 (No significant)	4 (4.2%)	2 (2.1%)	
Score 1 (SVD)	21 (21.9%)	44 (45.8%)	
Score 2 (DVD)	30 (31.2%)	35 (36.5%)	<0.001
Score 3 (TVD)	41 (42.7%)	15 (15.6%)	
Total stenosis score	9.26 ± 4.29	6.06 ± 3.07	<0.001
<16	87 (90.6%)	95(99%)	
≥16	9 (9.4%)	1 (1%)	0.009
Extension score	53.70 ± 18.11	39.11 ± 17.59	<0.001
<50	51 (53.1%)	73 (76%)	
≥50	45 (46.9%)	23 (24%)	0.001

Data were expresses as mean±SD, number (percent) as appropriate.



Figures: Correlation between metabolic syndrome score with total stenosis score and extension score

Discussion:

Metabolic syndrome is a condition that is considered to promote atherosclerosis, and increases the risk of cardiovascular events[10-,12]. It is characterized by atherogenic dyslipidaemia, a prothrombotic state, insulin resistance, HTN and abdominal obesity[11-13]. Each abnormality promotes atherosclerosis independently, but when clustered together, these metabolic disorders are increasingly atherogenic and enhance the risk of cardiovascular morbidity and mortality[10,14]. Currently, Metabolic syndrome is a term used to define a patient who presents with three or more of the five carefully defined risk factors[15]. These risk factors congregate in some individuals bringing about poor cardiovascular outcomes.

ACSs have been accepted as a major source of cardiovascular morbidity and mortality in adults [3]. There have been numerous trials in order to modify risk profiles for this group of patients [3]. Our study aimed to search for a possible association of metabolic syndrome in clinical and angiographic outcomes in patients with NSTEMI. In a recent study by Yilmaz et al. it was shown that the presence of metabolic syndrome was found to be independently predictive of extension of coronary artery disease (CAD) in a group of patients presenting with NSTEMI[16]. We found in our study, which enrolled patients with NSTEMI, that metabolic syndrome score was modestly, but significantly, correlated with angiographic extent of CAD both in terms of total stenosis and extension scores. Furthermore, we have also shown that metabolic syndrome was independently associated with the extension and severity of angiographically shown CAD. Our results confirmed the findings of a previous study[16].

The extension of CAD might be indicative of poor cardiovascular outcomes, both in the form of morbidity, shown in terms of quality of life and medically refractory angina and cardiovascular mortality. One of the ways in which Metabolic syndrome leads to poor cardiovascular outcomes might be through the extension of CAD in patients with NSTEMI, and regarding Metabolic syndrome as an independent predictor of CAD extension and consequent early identification of the problem might improve survival. However, this issue requires further study.

In terms of limitations, our study was limited to a group of patients with NSTEMI, who underwent diagnostic coronary angiography, and our findings cannot be generalized to all patients with ACS. Furthermore, the evaluation of angiographic extension might underestimate to atherosclerotic burden, which could be better evaluated through intravascular ultrasonography (IVUS).

Conclusion:

Metabolic syndrome, as well as, individual components of metabolic syndrome, waist circumference, raised BP, reduced HDL-C, and elevated TG are independently associated with angiographically severe CAD. By better control of the components of Metabolic Syndrome like hypertension, DM, dyslipidemia and by educating the patients about healthy life style we can prevent the patients from developing Metabolic Syndrome. Early diagnosis and efficient management of the syndrome will result in the reduced risk of future development of CAD, thus decreasing morbidity and mortality of the patients.

Conjflict of interest: None declared

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