Comparison of Risk Factors & Angiographic Profiles between Young Patients with ST Segment Elevation Myocardial Infarction and Non-ST Segment Elevation Myocardial Infarction

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Abstract:

Background: Coronary artery disease is the leading cause of death in the world. Advancing age is a well-recognized risk factor for acute myocardial infarction (AMI). Myocardial infarction is less common in young adults. Prevalence of acute coronary syndrome in young individuals is increasing progressively. These patients have different risk profile, presentation and prognosis. Early recognition and risk factor modification in this population sub-set is of key importance. Objectives: The purpose of the present study was to determine the differences in risk factors and coronary angiographic profile of young patients with ST-segment elevated myocardial infarction (STEMI) vs. those with non-ST-segment elevated myocardial infarction (NSTEMI). Methods: In this cross sectional analytical study total 135 patients (70 STEMI and 65 NSTEMI) aged ≤45 years were enrolled to see the differences of risk factors and angiographic profile. Results: The mean age of the study population was 39.39±5.12 years and the study showed male predominance (90.40 % was male and 9.60 % was female). Smoking/tobacco consumption was significantly higher in STEMI patients, whereas diabetes mellitus and hypertension were more prevalent in NSTEMI patients. The frequency of single vessel disease and involvement of left anterior descending artery was significantly higher in young STEMI patients. In case of young NSTEMI patients frequency of triple vessel disease, noncritical coronary artery disease and involvement of left circumflex coronary was significantly higher. The frequency of double vessel disease and involvement of left main coronary artery was also non-significantly higher in young NSTEMI patients. There was no significant difference regarding involvement of right coronary artery. Conclusion: There are significant differences between young STEMI and young NSTEMI patients in respect to risk factors and angiographic profile.

Key words: Young patient, STEMI, NSTEMI, Risk factors, Coronary angiographic profile.

Introduction

Ischemic heart disease is a major public health problem associated with high morbidity and mortality. Acute coronary syndrome is a common presentation of ischemic heart disease [1]. It is also the single largest

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cause of death in developed countries as well as developing countries[2]. Risk of CAD among Asian Indians is 3–4 times higher than white Americans, 6 times higher than Chinese, and 20 times higher than Japanese counterparts[3].

Coronary artery disease (CAD) is leading cause of mortality worldwide and by the year 2020, will be first in the leading causes of disability[4]. While the death rates have been declining for the past three decades in the west, these rates are rising in India. In the last three decades, the prevalence of CAD has increased from 1.1% to about 7.5% in the urban population and from 2.1% to 3.7% in the rural population[5]. CAD tends to occur at a younger age in Indians, with more extensive angiographic involvement, contributed genetic, metabolic, conventional and nonconventional risk factors[6,7,8].

The alarming face of this eminent issue is that nearly 80% of total CV deaths occur in low and middle income countries including Bangladesh[9]. Bangladesh is experiencing steep and sustained increases in the incidence of CAD during recent decades[10]. The burden of CHD is emerging as a public health concern in developing countries like Bangladesh[11]. The exact prevalence of CAD in Bangladesh is not known. Only a limited number of small-scale epidemiological studies are available. Probably the prevalence of IHD was first reported in 1976, which was 0.33%[12]. More recent data indicates CAD prevalence to be 3.4% in rural and 19.6% in an urban sample of working professionals[13,14]. In Bangladesh, ACS is the major presenting form of CAD and accounts for 45% of all cause cardiac hospitalization[15].

Coronary artery disease (CAD) is relatively less common in subjects below 40 years of age, as it occurs in about 6–10% of them but it has grave medical, social, psychological, and economic consequences in this age group. With rapid civilization changes and increasing prevalence of conventional risk factors for CAD, premature atherosclerosis is a growing problem, occurring in even younger age groups including those in the third and fourth decade of life [16]. Although the aetiology of CAD in young subjects is related to coronary atherosclerosis in 80% of cases, a number of differences regarding both the risk factor profile and clinical and angiographic characteristics exist in comparison to older patients[17,18].

Sedentary life style and higher consumption of calories, saturated fat, tobacco and alcohol contribute to obesity, dyslipidaemia, hypertension (HTN), diabetes mellitus (DM) and hyperuricaemia and increase the risk of early onset MI in Indian population [19].

Like all other developed and developing countries, prevalence and incidence of type 2 DM is increasing in Bangladesh and this will place Bangladesh among the top seven countries in terms of the number of people living with diabetes in 2030[20].

In a study in Bangladesh smoking was found as the most common risk factor of acute myocardial infarction among young patients followed by dyslipidaemia, hypertension & diabetes. Single vessel coronary artery disease was the most common lesion in both male & female followed by double vessel coronary artery disease and triple vessel coronary artery disease. In case of female triple vessel coronary artery disease was more than double vessel coronary artery disease [21]. Another study also revealed the smoking as most frequent risk factor of acute myocardial infarction with majority patients having single vessel disease and most frequently involve vessel is LAD[22].

Tobacco consumption is quite common in Bangladesh: prevalence is 51.0% for any form, 26.2% for smoking and 31.7% for smokeless tobacco[23]. In a recently published study, betel quid chewing was found in 33.2% of rural population[24]. Bangladesh is one of the top 10 countries that make-up two-thirds of the world population of smokers[25].

As a result of socioeconomic transition, lifestyle, as well as, the dietary pattern are changing in Bangladesh. Increasing prevalence of obesity, tobacco use, high intake of processed foods and less physical activity accompany the transition[14]. In general, 21.5% adults (male 21%, female 22%) have body-mass index (BMI) $\geq$25 kg/m^2. Increased waist circumference is alarming, especially in women (33.7%)[23]. Visceral fat typical of android obesity has a greater association with metabolic syndrome, hyperinsulinemia and CAD in both men and women[26].

According to the KAMIR (Korea Acute Myocardial Infarction Registry) study STEMI patients were younger, more likely to be men and smokers, and had poorer left ventricular function with a higher incidence of cardiac death, compared to NSTEMI patients[27]. NSTEMI patients had a higher prevalence of 3- vessel and left main coronary artery disease with complex lesions, and were more likely to have co morbidities[28].

Comparative analysis of young patients from South India with STEMI and NSTEMI revealed that single-vessel disease was significantly more common in the STEMI group, whereas triple-vessel disease was significantly more common in the NSTEMI group. Smoking/tobacco consumption was the most significant coronary risk factor

126 Comparison of Risk Factors & Angiographic Profiles between Young Patients
Khan SR et al.

Bangladesh heart j Vol. 36, No. 2
July 2021

in both groups. On the other hand, hypertension and diabetes were common among young patients with NSTEMI [29].

It has also been noted that the clinical presentation, risk factor profile, and coronary anatomy of young patients who develop CAD differs to those who develops CAD at an older age [1, 30]. Overall, these studies have indicated that patients with early onset of CAD exhibit preponderance of single vessel disease, and dominance of coronary risk factors such as hypercholesterolemia, family history of CAD, and cigarette smoking as compared to older patients.

However, there have been very limited data to compare demographic and angiographic characteristics in young patients stratified according to the type of acute coronary syndrome. Therefore, this study aimed to identify the differences between risk factors profile and coronary angiographic characteristics of young adults presenting with ST-segment elevation myocardial infarction (STEMI) and non-ST-segment elevation myocardial infarction (NSTEMI). To define "young patient" an age cut-off of 45 years and below was taken, which was based on previous studies [31, 32, 33, 34, 35].

Materials and Methods:
This observational study was carried out in the department of cardiology, National Heart Foundation Hospital and Research Institute, Dhaka from July, 2016 to June, 2017. Patients who got admitted with the clinical diagnosis of STEMI & NSTEMI and underwent coronary angiography at the index event from July, 2016 to June, 2017 were study population. Considering inclusion & exclusion criteria 135 patients were selected having STEMI & NSTEMI. Patients were divided into two groups according to the type of myocardial infarction.

Group 1: patients who were admitted with STEMI & underwent coronary angiography (STEMI group) and

Group 2: patients who were admitted with NSTEMI & underwent coronary angiography (NSTEMI group).

Enrolment of subjects

Inclusion Criteria:
1. Both male & female patients who were admitted with STEMI or NSTEMI and underwent coronary angiography.
2. Age ≤45 years

Exclusion Criteria:
1. Age >45 years
2. Patient with history & evidence of previous ACS (STEMI/NSTEMI/UA).
3. Past History of PTCA or CABG

4. All patients of valvular heart disease and congenital heart disease.
5. Concomitant co-morbid conditions (severe liver & kidney diseases)
6. Patient who did not give consent.

Study Procedure
All patient aged ≤45 years who were admitted in the Department of cardiology, NHFH & RI, Dhaka fulfilling the inclusion and exclusion criteria were considered as study population. Meticulous history was taken regarding symptoms (chest pain, shortness of breath or other features) and detailed clinical examination was performed in each patient. Demographic and anthropometric data such as age, sex, height (cm), weight (Kg), BMI (Kg/m2) were noted. Coronary risk factors of all patients were recorded. Blood sample was taken for Troponin I, CK MB, Blood sugar, Serum creatinine and fasting lipid profile. Patient's baseline 12 lead ECG & Echocardiography were performed. Patients were divided into 2 groups according to clinical diagnosis of STEMI & NSTEMI. After coronary angiogram, findings of involved vessel, site of lesion, % of stenosis, number of vessel involvement were analyzed between the groups.

Data Collection
Data were collected in a predesigned data collection form.

Stastistical Analysis
After processing all available data, statistical analysis of their significance were done. Obtained data were expressed in frequency, percentage, mean and standard deviation as applicable. Comparison between groups were done by Student's T-test for continuous variables. Categorical data were analyzed by chi-square test. The whole analysis was done with the help of computer based SPSS (Statistical programme for social science) programme version 23.0. P-value of <0.05 was considered as significant.

Observation and Results
The purpose of the present study was to determine the differences in risk factors and coronary angiographic profile of young patients with ST-segment elevated myocardial infarction (STEMI) vs. those with non-ST-segment elevated myocardial infarction (NSTEMI). Considering inclusion and exclusion criteria total number of 135 patients (70 STEMI and 65 NSTEMI) aged ≤45 years were studied. Observations and results are presented in different tables and diagrams.
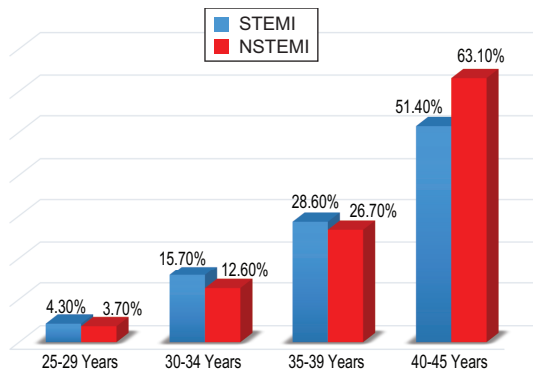
Fig.-1: *Bar diagram showing comparison of age distribution in between study groups (n=135)*

Most of the patients belong to 40-45 years age group (51.4% in STEMI and 63.1% in NSTEMI). The mean age was 39.39±5.12 years and the range was 25-45 years. There was no statistically significant difference between the study groups in terms of age (p>0.05)
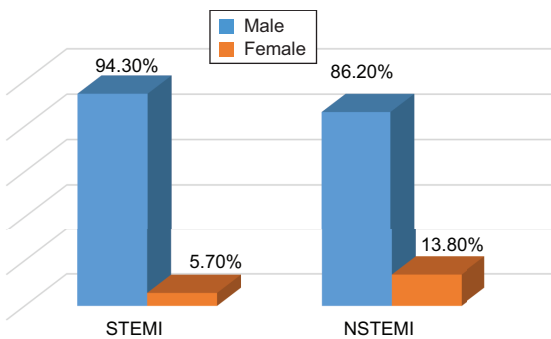

Fig.-2: *Bar diagram showing sex distribution in between study groups (n=135)*

This study shows male predominance, of all patients 90.40 % (122) was male and 9.60 % (13) was female. Analysis revealed there was no statistically significant difference between two study groups (p>0.05)
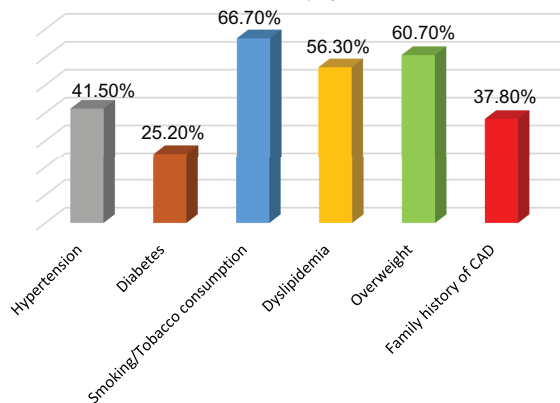

Fig.-3: *Bar diagram showing distribution of risk factors of study population (n=135)*

Smoking/tobacco consumption was 66.7%, dyslipidemia was 56.3%, hypertension was 42.5%, diabetes mellitus was 25.2%, family history of CAD was 37.8% and overweight was 60.7%.
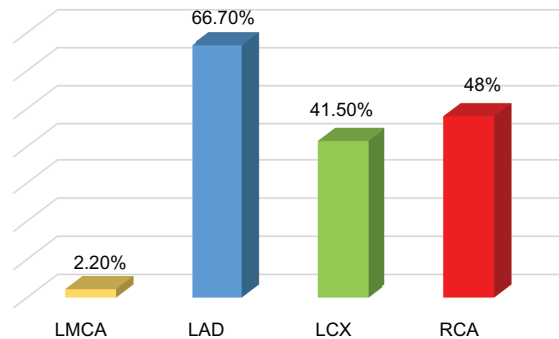

Fig.-4: *Bar diagram showing distribution of involved vessel in study population (n=135)*

LAD (66.7%) was the most commonly involved vessel followed by RCA (48%) and LCX (41.5%). LM (2.2%) was the less commonly involved vessel. Due to multivessel involvement total percentage is more than 100%.
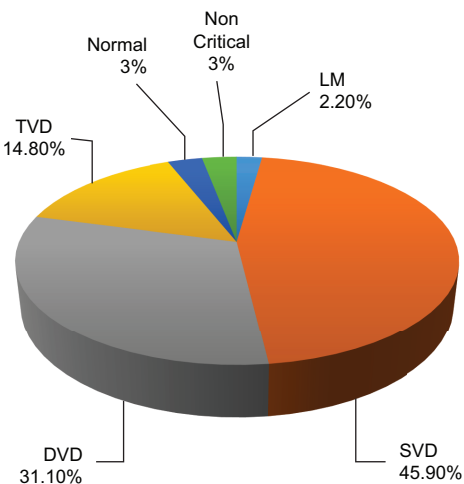

Fig.-5: *Pie chart showing distribution of number of involved vessels in study population (n=135)*

SVD was found in 45.9% cases, DVD was found in 31.1% cases, TVD was found in 14.8% cases, LMCA was found in 2.2% cases, normal coronary artery was found 3% cases and non-critical coronary artery lesion was found in 3% cases. The most common coronary lesion was SVD.

Table-I
Comparison of distribution of risk factors in between study groups (n=135)

Risk factors	STEMI(n=70)		NSTEMI(n=65)		p value*
	n	%	N	%	
Smoking/Tobacco consumption	49	70	41	63.1	0.040[S]
Dyslipidemia	44	62	32	42.1	0.134 [NS]
Diabetes mellitus	12	17.1	22	33.8	0.025 [S]
Hypertension	22	31.4	34	52.3	0.014 [S]
Family history of CAD	24	34.3	27	41.5	0.385 [NS]
Overweight (BMI ≥25.00 - 29.99)	40	57.1	42	64.6	0.374 [NS]

NS= Not significant
S= Significant
*Chi-square test was done to measure the level of significance

Table-II
Comparison of Echocardiographic findings of the study population between groups (n=135)

Ejection Fraction (%)	STEMI(n=70)		NSTEMI(n=65)		p value*
	n	%	N	%	
Normal (≥55 %)	2	2.9	35	53.8	0.001[S]
Mild (45-54 %)	33	47.1	22	33.8	
Moderate (30-44 %)	35	50	8	12.3	
Mean±SD	44.63±4.7		54.14±7.4		0.001[S]
Range	35-60		35-68		
Presence of RWMA	70	100	40	61.5	0.001 [S]

NS= Not significant
S= Significant
*Chi-square test and unpaired t-test were done to measure the level of significance

Table-III
Comparison of vessel involvement in between study groups (n=135)

Involved vessels	STEMI(n=70)		NSTEMI(n=65)		p value*
	n	%	n	%	
LMCA	0	0	3	4.6	0.069 [NS]
LAD	55	78.6	35	53.8	0.002 [S]
LCX	20	28.6	36	55.4	0.001 [S]
RCA	30	42.9	35	53.8	0.202 [NS]

NS= Not significant
S= Significant
*Chi-square test was done to measure the level of significance

Table-IV
Comparison of number of involved vessels in between study groups (n=135)

Number of involved vessels	STEMI(n=70)		NSTEMI(n=65)		P value*
	n	%	N	%	
LMCA	0	0	3	4.6	0.069 [NS]
SVD	44	62.9	18	27.7	0.001 [S]
DVD	19	27.1	23	35.4	0.301 [NS]
TVD	6	8.6	14	21.5	0.034 [S]
Normal	1	1.4	3	4.6	0.275 [NS]
Non critical	0	0	4	6.2	0.035 [S]

NS= Not significant
S= Significant
*Chi-square test was done to measure the level of significance

Table I showing distribution of risk factors between the groups. There were statistically significant difference between the two groups in terms of smoking/tobacco consumption (70% in STEMI group and 63.1% in NSTEMI group), diabetes mellitus (17.1% in STEMI group and 33.8% in NSTEMI group) and hypertension (31.4% in STEMI group and 52.3% in NSTEMI group) (p<0.05)

Table II shows normal EF was found only 2.9% patient in STEMI group but 53.8% patents in NSTEMI group. The mean EF of STEMI group was 44.63±4.7 and 54.14±7.4 in NSTEMI group. 100% patients had RWMA in STEMI group whereas 61.5% patients had RWMA in NSTEMI group. Analysis revealed there was statistically significant difference between two study groups (p<0.05)

There was statistically significant difference in LAD (78.6% in STEMI group and 53.8% in NSTEMI group) and LCX (28.6% in STEMI group and 55.4% in NSTEMI group) involvement between the two groups (p<0.05)

Table IV shows number of involved vessels among the study groups. SVD (62.9% in STEMI group and 27.7% in NSTEMI group), TVD (8.6% in STEMI group and 21.5% in NSTEMI group) and noncritical coronary artery lesion (6.2% only in NSTEMI) had statistically significant difference between the two groups (p<0.05). In case of STEMI multivessel involvement (≥2 vessel involvement) was 35.7% and in case of NSTEMI it was 56.9%

Discussion:
This study was conducted to see the differences in risk factors and angiographic profile in young patient with STEMI and NSTEMI. Considering inclusion and exclusion criteria total number of 135 patients were studied. Study population was divided into two groups, STEMI group and NSTEMI group. There were 70 patients in STEMI group and 65 patients in NSTEMI group. This study showed marked differences in between two study group in terms of risk factors and angiographic profile.

Considering distribution of age, it was found that highest percentage was in the group of 40-45 years (51.4% in STEMI & 57% in NSTEMI) and lowest in age group of 25-29 years (4.3% in STEMI & 3.7% NSTEMI). There were no statistically significant difference in age distribution pattern between groups (p value >0.05), which was consistent with previous study[36].

Distribution of male patients in STEMI and NSTEMI group were 94.3% and 86.2% respectively and female patients were 5.7% in STEMI and 13.8% in NSTEMI group respectively. There were no statistically significant difference in sex distribution pattern between the groups (p value >0.05). 90.4% of the patients were male and 9.6% were female. This findings signify that young male have higher chance of developing MI than female. Similar result was found in a Bangladeshi study where 94.7% patients were male and 5.4% patient were female[37]. Maroszynska-Dmoch & Wozakowska-Kaplon, Haque, et al. and Deora, et al. also found similar findings[16,21,29].

Regarding distribution of risk factors in study population, smoking/tobacco consumption was 66.7%, dyslipidemia was 56.3%, hypertension was 42.5%, diabetes mellitus was 25.2%, family history of CAD was 37.8% and overweight was 60.7%. In this study smoking/tobacco consumption was the most common risk factors. These findings were similar with the previous studies of Bangladesh. Haque, et al. (2010) has shown that smoking (64%) was the most common risk factor in young patients, followed by dyslipidemia (50%) and hypertension (37.55%) [21]. In a study Malik, et al. (2016) has also shown similar findings [37]. Schoenenberger, et al. (2011) has also shown that smoking, family history of CAD, dyslipidemia and overweight were the most important cardiovascular risk factors in young patients [38]. Maroszynska-Dmoch & Wozakowska-Kaplon (2016); Tamrakar, et al. (2013) and Zimmeran, et al. (1995) also found similar findings in their studies[16,31,39].

There were statistically significant difference between the two groups in terms of smoking/tobacco consumption, diabetes mellitus and hypertension (p<0.05). Smoking/tobacco consumption was 70% in STEMI group and 63.1% in NSTEMI group. Dyslipidemia was found 62% in STEMI group and 42.1% in NSTEMI group. Diabetes mellitus was found 17.1% in STEMI group and 33.8% in NSTEMI group. Hypertension was found 31.4% in STEMI group and 52.3% in NSTEMI group. Family history of CAD was found 34.3% in STEMI group and 41.5% in NSTEMI group. Overweight was found 57.1% in STEMI group and 64.6% in NSTEMI group. Deora, et al. (2016) in their study found that hypertensive, diabetics and obese patients were significantly higher in the NSTEMI group. Smoking/tobacco consumption was identified as the most prevalent risk factor in patients in STEMI group (67.9%) and NSTEMI group (69.9%). In a study Song, et al. (2010) has found that hypertension (54.4% vs 46.1%), diabetes mellitus (31.6% vs 25.1%) and dyslipidemia (28.2% vs 18.2%) were significantly higher in NSTEMI group than STEMI group.

Regarding echocardiography, normal EF was found only 2.9% patient in STEMI group but 53.8% patents in NSTEMI group. The mean EF of STEMI group was 44.63±4.7 and 54.14±7.4 in NSTEMI group. 100% patients had RWMA

in STEMI group whereas 61.5% patients had RWMA in NSTEMI group. Analysis revealed there was statistically significant difference between two study group (p<0.05). Deora, et al. (2016) also found similar findings in their study[29].

Considering distribution of involved vessels in this study, LAD (66.7%) was the most commonly involved vessel followed by RCA (48%) and LCX (41.5%). LM (2.2%) was the less commonly involved vessel. These findings are similar with the study done by Maroszynska-Dmoch and Wozakowska-Kaplon (2016); Haque, et al. (2010); Tamrakar, et al. (2013); Malik, et al. (2016) and Sharma, et al. (2014) in young patients[16,27,31,37,40].

Regarding the involvement of vessels, Left main coronary artery disease (LMCA) was not found in STEMI group but 4.6% had LMCA disease in NSTEMI group. 78.6% and 53.8% had disease in LAD in STEMI and NSTEMI group respectively. 28.6% and 55.4% had LCX involvement in STEMI and NSTEMI group respectively. STEMI group had 42.9% and NSTEMI group had 53.8% RCA involvement. There was statistically significant difference in LAD and LCX involvement between the two groups (p<0.05). Deora, et al. (2016) has shown similar findings that LAD involvement was more common among STEMI group of patients, while LCX and LMCA involvements were more common among NSTEMI group of patients and no significant difference was observed in case of RCA involvement [29]. Study done by Song, et al. (2010) also found similar findings[27].

In this study the most common coronary lesion was SVD. Younger patients have higher prevalence of SVD (45.9%) followed by DVD (31.1%), TVD (14.8%) and LMCA (2.2%) which is similar to the study results of Maroszynska-Dmoch & Wozakowska-Kaplon (2016); Haque, et al. (2010); Tamrakar, et al. (2013); Malik, et al. (2016) and Schoeneberger, et al. (2011)[16,21,31,37,38].

Deora, et al. (2016) in their study found that SVD (56.6%) was significantly higher in the STEMI group. The NSTEMI group had significantly higher TVD (10.5%) and non-significantly higher DVD (15.3%) and normal coronary arteries[29]. In this study LMCA was not found in STEMI group but found 4.6% in NSTEMI group. SVD was found 62.9% in STEMI group and 27.7% in NSTEMI group, DVD was found 27.1% in STEMI group and 35.4% in NSTEMI group, TVD was found 8.6% in STEMI group and 21.5% in NSTEMI group. Normal coronary was found 1.4% and 3.6% in STEMI and NSTEMI group respectively. Non critical coronary lesion was found 6.2% only in NSTEMI group. SVD was significantly   higher in STEMI group, TVD and

noncritical coronary lesion were significantly higher in NSTEMI group.

Conclusion:
From this study it may be concluded that young male have higher chance of developing MI than female. Smoking/tobacco consumption is the most common risk factors in young patients, followed by overweight, dyslipidemia, hypertension, family history of CAD and diabetes mellitus. Smoking/tobacco consumption is significantly higher in STEMI patients, where as diabetes mellitus and hypertension are more common in NSTEMI patients. The frequency of SVD and involvement of LAD is significantly higher in young STEMI patients. In case of young NSTEMI patients frequency of TVD, noncritical coronary artery disease and involvement of LCX is significantly higher. The frequency of DVD and involvement of LMCA is also non-significantly higher in young NSTEMI patients. There is no significant difference regarding involvement of RCA.

Limitations of the Study
Although the result of this study is statistically significant and supports the hypothesis, there were some limiting factors which might affect the results:

• It was a single center study.

• Only traditional risk factors were included.

Recommendations
• Early identification and management of modifiable coronary risk factors are the keystone to prevent the occurrence of CAD and myocardial infarction at younger age.

• This study showed presence of more risk factors and more complex coronary artery lesion in young NSTEMI patients than young STEMI patients. So aggressive coronary risk factors modification and special attention to be taken for primary and secondary prevention of NSTEMI.

• Larger studies are required to establish specific associations between risk factors and angiographic profiles in young patients.

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