Coronary Angiographic Characteristics of Patients with First Myocardial Infarction Admitted in a Tertiary Care Cardiac Hospital in Bangladesh

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Keywords: *First MI, Coronary angiogram.*

Abstract-

Background: *Coronary artery lesion characteristics of patients with First myocardial infarction (First MI) of Indian subcontinent origin in UK, is different from indigenous white population. The present study was aimed to observe coronary angiographic profile of first MI patients, hospitalized in a tertiary care hospital, in Bangladesh and to compare the results with published data of study done home and abroad.*

Methods: *This is a prospective observational study. A total of 100 cases of First MI patients were included in this study. Clinical history, physical examination, major risk factors, relevant investigations including ECG & Echocardiogram and coronary angiogram of all patients were recorded.*

Results: *The coronary angiographic features of 100 patients revealed that 88% of the study population had significant coronary artery lesion (stenosis e"70%). Normal coronary arteriogram was found in 5 patients (5%); although they had myocardial infarction previously. Insignificant lesion (stenosis < 70%) was detected in 7 patients (7%). Left anterior descending (LAD) arteries were affected in most of the patients (78%), followed by right coronary artery (62%) and left circumflex artery (55%). Single vessel disease (33%) and triple vessel diseases were equally prevalent among the study population.*

Conclusion: *Present study observed that triple vessel disease, diffuse pattern of lesions and combined type of lesions were more prevalent among the first MI patients. Increase in the number of risk factors was associated with progressive increase in severity of disease as defined by number of significant stenosis. Comparison of results of present study population with that of study done abroad shows that single vessel disease was more prevalent among European white patients who had first MI but triple vessel disease was more prevalent among our patients.*

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Introduction:

Cardiovascular diseases are leading causes of morbidity and mortality in the industrialized countries, and they are also emerging as a prominent public health problem in the developing countries.[1] The incidence of myocardial infarction seems to be higher in Bangladesh than the developed countries among the smokers.[2] CAD is more prevalent in western countries compared to our country but incidence of the disease is showing a downward trend in those countries. In our country, incidence of the disease is on the increase.[3]

Clinical characteristics of IHD in South Asian population have drawn attention in recent years. High rates of coronary heart disease (CHD) in people of South Asian (Indian, Pakistani and Bangladeshi) origin were first reported from Singapore, South Africa and Trinidad in the 1950s; similar findings were recorded in the United Kingdom at the time of the 1971 census.[4]

There are studies done abroad on 'first myocardial infarction' in patients of Indian subcontinent and European origin. Hughes et al. studied first myocardial infarction because the changes in coronary anatomy were likely to be more easily defined in patients presenting with first myocardial infarction.[5]

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Study performed by Shaukat et al. found that patients of first MI of Indian subcontinent origin had higher prevalence of diabetes; triple vessel disease was the commonest finding in patients of Indian subcontinent origin and single-vessel disease, the commonest in Europeans. They concluded that patients of Indian subcontinent origin are at substantially higher risk of mortality and of further coronary events than Europeans after first MI. This is probably due to their higher prevalence of diffuse coronary atheroma. Their need for investigation with a view to coronary revascularization is, therefore greater.[6] Hughes et al concluded that atherogenesis arises earlier in Asians, contributing to premature first myocardial infarction.[5]

In this study, we aimed to assess the coronary angiographic characteristics of first MI patients and to compare the study results with that of done home and abroad.

Materials and Methods:

This prospective, observational study was carried out in the National Institute of Cardiovascular Diseases (NICVD), Dhaka, during the period July 1998 to October 1999. A total of 100 cases of first MI patients were selected for analysis from the patients admitted in different units of NICVD who underwent coronary angiogram (CAG). All the consecutive patients who had first MI and underwent coronary angiogram during the study period were considered as study population. First MI after PTCA/CABG, during procedure or operation, with concomitant congenital or valvular heart diseases was excluded from the study.

Diagnosis of First MI was done by attack of first time acute myocardial infarction with the presence of at least two of the following criteria: a) characteristic ischaemic chest pain; b) cardiac CK-MB enzymes >2 times of normal upper limit; c) ECG changes lasting >48 hours.

Height, weight, age, sex, religion, clinical history, physical examination, major risk factors, relevant investigations including ECG & Echocardiogram and coronary angiogram (CAG) of all patients were recorded.

The coronary angiographic criteria was followed according to Bogarty et al[7] & Cianflone et al.[8]

Severity-

a) Number of vessels- number of major epicardial vessels with e"70% stenosis (maximum 3). Left main stenosis e"50% = 2vessels.

b) Stenosis longer than twice the normal diameter = 2 stenosis. Maximum 3 stenosis per segment.

c) Occlusions- number of occlusion/subtotal occlusions (with delayed or incomplete antegrade flow).

Pattern- Discrete- <3 loci of diseases and all segment score <3. Diffuse- ≥3 loci of diseases and/or ≥segment score = 3.

Types of lesions (Ambrose et al[9]) -

1) Concentric- symmetric narrowing of a coronary artery. The borders of this lesion were smooth or only slightly irregular.

2) Eccentric stenosis- asymmetric narrowing of a coronary artery.

3) Multiple irregularities- three or more serial and severe (≥50%) closely spaced obstructions in a coronary artery.

4) Combined type- when there was concomitant presence of more than one type of lesion in the CAG of same patient in any combination of lesion type.

CAG were performed by the expert cardiologists of NICVD using the standard Judkins procedure.

Smoking-: current smoker- now smoking ≥5 sticks/ day.

Hypertension- blood pressure 140/90mmHg on 3 occasions or previously established hypertension.

Diabetes mellitus (DM): either prior established or at least 2 fasting plasma glucose ≥140mg/dl (In AMI, at least 1 week after AMI).

Dyslipidemia: LDL- cholesterol ≥100mg/dl or triglyceride >150 mg/dl or both. Family history: any first degree relative having history of any type of established IHD.The study protocol was approved by the institutional ethical committee. Informed written consent was taken from each patient or his/her guardian.

Collected data were compiled and appropriate analysis were done using computerized software SPSS+. A p value <0.05 was taken as significant.

Results:

The coronary angiographic features of 100 patients revealed that 88% of the study population had significant coronary artery lesion (stenosis ≥70%). Normal coronary arteriogram was found in 5 patients (5%); although they had myocardial infarction previously. Insignificant lesion (stenosis < 70%) was detected in 7 patients (7%). Left anterior descending (LAD) arteries were affected in most of the patients (78%), followed by right coronary artery (62%) and left circumflex artery (55%). Majority of the lesions were distributed in the proximal segment of all major coronary arteries. Single vessel disease (33%) and triple vessel diseases were equally prevalent among the study population (Table-I).

Table-I

Coronary angiographic profile of study population (n = 100)

Profile	Number of patients	Percentage
Normal coronaries	5	5.0
Insignificant	7	7.0
Dominancy of coronary arteries		
Right dominance	66	66.0
Left dominance	34	34.0
Significant CAD present	88	88.0
SVD	33	33.0
DVD	22	22.0
TVD	33	33.0
Location &total no of lesion:		
Left main	6	6.0
LAD	78	78.0
Proximal	47	47.0
Middle	28	28.0
Distal	4	4.0
D1	12	12.0
D2	3	3.0
LCX	55	55.0
Proximal	29	29.0
Distal	19	19.0
OM1	21	21.0
OM2	6	6.0
RCA	62	62.0
Proximal	35	35.0
Middle	31	31.0
Distal	6	6.0
PDA	4	4.0

Frequency of significant coronary artery lesion distribution (Table-II) demonstrates that most of the patients had more than one lesion (65%). Among these two lesions per patients were more prevalent (24%) followed by 1 lesion (23%), >4 lesions (17%), 3 lesions (15%), 4 lesions (9%) in the study population. Total occlusion of the coronary arteries was present in 32 patients (32%). Among these single occlusion was more prevalent (27%), followed by double occlusion (5%). None of the patient had more than two total occlusions.

Table-II

Frequency of lesion in the study population (n = 100)

Number of lesions (Per patient)	Number of patients	Percentage
No lesion	5	5.0
Insignificant lesion	7	7.0
(< 50% stenosis)		
Significant lesion present:		
1 lesion	23	23.0
2 lesions	24	24.0
3 lesions	15	15.0
4 lesions	9	9.0
> 4 lesions	17	17.0
Total occlusion:		
1 occlusion	27	27.0
2 occlusion	5	5.0
>2 occlusion	0	0.0

Distribution of the type of significant lesion (Table-III) demonstrate that total number of lesions were 278 among the study population (n=88). Combined type lesions (50%) were found most prevalent, followed in decreasing frequency, concentric type (22%), total occlusion (9%), multiple irregularity (4%), and eccentric type (3%). Among the combined type lesion, the combination of concentric and multiple irregularity type of lesions were found most common (17%), followed by combination lesion of concentric type with total occlusion (10%).

Table-III

Distribution of type of significant lesion in the study population (n = 100)

Type of lesion	Number of lesions	Number of patients	Percentage
Concentric	51	22	22.0
Eccentric	8	3	3.0
Multiple irregularity	10	4	4.0
Total occlusion	14	9	9.0
Combined	195	50	50.0
Total	278	88	88.0

Positive correlation was found between the numbers of significant lesions with frequency of risk factors (Table-IV). Patients without risk factor had lesion 1-2 (mean 1.10±0.08) and with risk factors lesion ranges 1-4 (mean 2.30±0.96), i.e. the mean severity increases proportionately with the number of risk factors (r = +0.98; P<0.01).

Table-IV

Correlation of number of significant lesion by frequency of risk factors (n=88)

Frequency of risk factors	Number of lesion per patient	Range Mean ± SD	P value
0 (n = 4)	1 - 2	1.10 ± 0.08	
1 (n = 21)	1 - 3	1.71 ± 0.62	
2-3 (n = 58)	1 - 4	1.92 ± 0.88	r = +0.98
e"(n = 17)	1 – 4	2.30 ± 0.96	p = < 0.01

Multiple coronary arteries were significantly affected among the study population with age range of 40-60 years (Table-V). Most of them were male 53 (55%), Muslim 53 (56%) and residence in urban area 47 (59%).

Significant lesions in multiple coronary arteries were found more prevalent in 34 patients (62%) with height ranges from 160-169 cm, weight ranges from 65-75kg in 24 (62%) and body mass index <25 kg/m^2 in 35 patients (54%) (Table-V).

Table-V

Clinical and angiographic profile by demographic characteristics (n=100)

Variables	MI location		Risk factor		CAG profile	
	Anterior	Inferior	Single	Multiple	SVD	MVD
Age						
<40 (n = 13)	7(54)	6(46)	5(38)	5(38)	5(38)	7(54)
40-60 (n = 69)	43(62)	26(38)	12(18)	56(81)	24(35)	41(59)
>60 (n = 18)	8(45)	10(55)	4(22)	14(78)	4(22)	7(39)
Sex						
Male(n = 96)	57(59)	39(41)	19(20)	73(76)	31(32)	53(55)
Female (n = 4)	1(25)	3(75)	2(50)	2(50)	2(50)	2(50)
Residence (%)						
Rural (n = 21)	12(57)	9(43)	6(29)	11(52)	5(24)	8(38)
Urban (n = 79)	46(58)	33(42)	15(19)	64(81)	28(35)	47(59)
Height (cm%)						
≤159 (n = 29)	14(48)	15(52)	6(21)	19(65)	13(45)	11(38)
160-169 (n = 5)	33(60)	22(40)	12(22)	43(78)	15(27)	34(62)
≥170 (n = 16)	11(69)	5(31)	3(19)	13(81)	5(31)	10(62)
Weight (kg%)						
≤55 (n = 17)	8(47)	9(53)	5(29)	9(53)	7(41)	9(53)
55-64 (n = 34)	22(65)	12(35)	5(15)	28(82)	12(35)	16(47)
65-74 (n = 39)	19(49)	20(51)	8(21)	31(79)	10(26)	24(62)
≥75 (n = 10)	9(90)	1(10)	3(30)	7(70)	4(40)	6(60)
BMI (kg/m^2)						
< 25 (n = 65)	39(60)	26(40)	8(12)	57(88)	19(29)	35(54)
≥ 25 (n = 35)	19(54)	16(46)	13(37)	18(51)	14(40)	20(57)

Table-VI

Clinical and angiographic profile by risk factors (n=96)

Variables	Hypertensive	Diabetic	Smoker	Dyslipidaemia	Family history	>1 Risk factor
Age (Years)						
<40 (n = 13)	1	2	1	1	0	5
40-60 (n =69)	4	3	2	2	1	56
>60 (n = 18)	1	1	1	1	0	14
Sex						
Male (n = 96)	3	3	11	2	0	73
Female(n = 4)	1	0	0	1	0	2
Residence	2	2	2	0	0	11
Rural (n = 21)	4	5	4	2	0	64
Urban (n = 79)						
BMI (kg/m^2)						
< 25 (n = 65)	2	2	3	1	0	57
> 25 (n = 35)	3	3	2	4	1	18
Number of diseased vessel						
SVD (n = 33)	5	7	8	3	4	6
DVD (n = 22)	2	2	2	1	1	14
TVD (n = 33)	3	2	1	3	2	22

Table-VII

Comparison of clinical characteristics and coronary angiography in patients of the present study and of European origin in the UK (Shaukat et al. 1997)[6,16]

Variables	Present study	European origin	P value
Mean age (Years)	49.3	57.6	<0.05
Smoker (%)	80.0	63.0	<0.01
Known hypertension (%)	46.0	15.0	<0.01
Known diabetes (%)	34.0	9.0	<0.001
CAG:			
SVD	33.0	41.0	<0.05
DVD	22.0	35.0	<0.05
TVD	33.0	21.0	<0.01

Table-VIII

Comparison of risk factors for coronary artery disease among Asian and white patients who lives in Birmingham (Lowry et al. 1984)[17] and the present study population of Bangladesh

Risk factors (%)	Asian (a)	White (b)	Present Study (c)	P value (vs present study) (a vs c / b vs c)
Smoking	67.0	91.0	80.0	<0.05/NS
Hypertension	15.0	12.0	46.0	<0.001/<0.01
Diabetes	9.0	4.0	34.0	<0.01/<0.001
Weight (kg)	70.0	76.5	63.88	NS/NS
(Mean ± SD)	± 9.9	± 10.4	± 8.22	
BMI (kg = m2)	24.3	25.8	24.23	NS/NS
(Mean ± SD)	± 3.0	± 3.0	± 2.60	

Table-IX

Comparison of mean values of risk factors for cardiovascular diseases in Mexican-Americans (MA) and non-Hispanic whites (NHW) (Mitchell et al. 1991)[18] and the present study (PS) population of Bangladesh

Risk factors	MA (a)	NHW (b)	Present Study (c)	P value (vs present study) (a vs c / b vs c)
Age (Years)	43.0	44.8	49.30	NS/NS
Body mass index (kg/m^2)	28.0	27.3	24.23	NS/NS
Total cholesterol (mg/100 ml)	207.1	205.6	217.79	NS/NS
HDL- cholesterol (mg/100 ml)	42.7	43.2	33.39	<0.05/<0.05
Triglycerides (mg/100 ml)	149.0	137.3	213.47	<0.05/<0.01
Diabetes (%)	11.1	4.5	34.0	<0.01/<0.001
Smoking (%)	36.7	30.4	80.00	<0.01/<0.01

Table-X

ECG location of myocardial infarction (n = 100)

Location	Number of patients	Percentage
Inferior	42	42.0
Anterior	58	58.0
Anteroseptal	30	30.0
Anterolateral	22	22.0
Extensive-anterior	6	6.0

Table-XI

Left ventricular ejection fraction (EF) of the study population by two- dimensional echocardiography (Simpsons's method) (n =100)

EF %	Number of patients	Percentage
≥50	67	67.0
40-49	30	30.0
30-39	3	3.0

Discussion:

The CAG of total 100 patients with first MI reveals five (5%) patients had normal coronary arteries, although they had an acute myocardial infarction previously and insignificant lesion in 7% patients. Amanullah et al found similar results in one patient and focal lesion in two patients. They concluded that smoking can cause focal lesion in coronary artery and the lesion is reversible if the patient gave up smoking. They proposed that these lesions are thrombogenic rather than atherogenic.[10] Rahman et al. found 10.62% CAG were normal and 5.63% patients had insignificant coronary artery disease in all subsets of IHD patients.[11] Safiuddin et al. found normal coronary artery and insignificant lesion in 12% patients of unheralded acute myocardial infarction.[12] Similar result was observed in the present study.

In the present study, single vessel disease (SVD) (33%) and triple vessel disease (TVD) (33%) were equally prevalent. Double vessel disease (DVD) was found in 22% patients (Table-I). Safiuddin et al. found SVD in 54%, DVD in 22% and TVD in 12% patients with unheralded acute myocardial infarction of 50 cases.[12] This difference could be due to selection criteria. Akanda et al. observed TVD (42%) were more prevalent in their study, followed by DVD (33%) and SVD (25%) in all subsets of IHD patients.[13] The increased prevalence of TVD could be due to inclusion of chronic stable angina. Rahman et al. found DVD (39%) more prevalent in their study, followed by SVD (35%) and TVD (11%).[11] The difference with the present study was probably due to selection criteria. They included all subsets of IHD patients and stenosis of coronary vessel >80% were accepted as severe lesion.

An average of 2.78 lesions resulting in at least 50% luminal narrowing of major arteries was found per

patient. Akanda et al. found it as 2.16 lesions per patient and Safiuddin et al. observed it as 3.10 lesions per patient.[13,12]

The left anterior descending artery was most frequently involved (78%), followed by right coronary artery (62%), circumflex (55%) and left main coronary artery (6%). Proximal involvement of all major coronary arteries was observed more prevalent among the study group. Akanda et al. found similar results in their study.[13] Although Safiuddin et al. observed similar chronological involvement of coronary arteries, but their prevalence was lower (LAD- 64%, RCA- 38%, and LCX- 32%).[12]

These differences are in addition to the above mentioned patient selection criteria, probably due to a marked difference in the cut-off point of stenosis.

The present study revealed that diffuse pattern of lesions (56%) was more prevalent than the discrete pattern (39%). Regarding types of lesion, combined type (50%) was found more prevalent, followed by concentric type (22%). Comparable data is not available in our country.

The severity of CAG lesion correlate positively with frequency of risk factors (Table-IV). There were significant difference among patients with single risk factor and multiple risk factors. This finding is similar to that of Akanda et al. in Bangladesh.[13] Kannel et al. and Fried et al. showed similar results.[14,15]

Angiographic profile of the present study by demographic characteristics showed that multiple vessel disease was more prevalent in age group 40-60 years (59%), male (55%), urban people (59%), height 160-169cm (62%), weight 65-74kg (62%), BMI <25 kg/m^2 (54%) (Table-V). Comparable data is not found in Bangladeshi patients.

Comparison of clinical characteristics and coronary angiogram (Table- VII) between the patients of present study and that of European origin (done by Shaukat et al. 1997) revealed that there was significant difference in mean age at onset of the disease, prevalence of risk factors and coronary artery disease. The mean age (49.30 vs 57.6; P<0.05) at infarction was less in the present study than that in European patients. Prevalence of smoking (80% vs 63%; p<0.01) and diabetes (34% vs 9%; P<0.001) were found significantly higher in present study population than that in European white patients.[6]

The present study observed some striking differences in disease severity with that of European white patients (who live in Northern Europe).The extent of coronary atheroma was significantly greater in the present study. Present population had significantly higher prevalence of triple (33% vs 21%, p<0.01), but less prevalence of single- (33% vs 41%, p<0.05) and double-vessel disease (22% vs 35%, p<0.05) than the white (Table-VII).[16]

Comparison of risk factors with other published data done abroad are shown in Table-VIII & IX.[17,18]

Risk factor frequencies were significantly correlated with number of significant coronary artery lesion present per patient. The more the risk factors, the more the number of significant lesion (Table-IV, VI). Grundtvig et al concluded that First AMI occur significantly more prematurely in women smoker than in men smokers implying that twice as many years were lost by women as by men smokers.[19]

Highest percent of study patients had chest pain quality of squeezing (40%) in nature, retrosternal location (88%) with radiation toward medial aspect of left arm (70%).

Determination of site of infarction by electrocardiography reveals majority of the patients were of anterior myocardial infarction (58%) (Table-X). Echocardiographic estimation of ejection fraction ≥50% found in most of the patients (Table- XI).

Conclusion:

Present study observed that triple vessel disease, diffuse pattern of lesions and combined type of lesions were more prevalent among the first MI patients. There is steady and progressive increase in the number of risk factors which is associated with progressive increase in severity of disease as defined by number of significant stenosis. Comparison of results of present study population with that of the study done abroad shows that single vessel disease is more prevalent among European; white patients but triple vessel disease is more prevalent among present study population.

As the study was done in highly selected group of patients, comprising small cohorts in one hospital only, the study may not reflect the true picture of Bangladeshi patients. But this study will definitely serve as a soil for similar further work in this field.

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