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AHC/ACC Stenosis Morphology Classification Based Comparison of Coronary Angiographic Lesions in Patients with Acute Coronary Syndrome (ACS) and Chronic Stable Angina (CSA) in a Tertiary Care Centre

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Abstract: ***Aim: The study was designed to compare the coronary angiographic lesions in patients with acute coronary syndrome (ACS) and chronic stable angina (CSA) based on the American Heart Association/American College of Cardiology (AHC/ACC) stenosis morphology classification in a tertiary care center in Bangladesh. Methods: We studied 215 angiographic lesions in 110 patients, including 55patients with ACS and 55 with CSA, who had coronary angiogram in the University Cardiac Center, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh from January 2009 to December 2009. Results: Mean age of the study subjects was 52.2±10 years and 09 (11%) of them were female. 2 (4%) of ACS and 6 (11%) of CSA patients had normal coronary angiogram. Frequency of SVD was significantly higher (p <0.001) in patients with ACS. CSA patients had significantly higher (p<0.001) TVD with more common involvement of LM, RCA and LCX than in ACS patients. A total of 215 coronary lesions in rest 102 subjects was detected, 83 (39%) in ACS and 132 (61%) in CSA. Frequency of type A, type B and type C in ACS and CSA was 13%, 65%, 22% and 10%, 62%, 23%, respectively with significantly more prevalence of simple (A+B1) lesions in CSA (59% versus 22%) and the complex (B2+C) lesions in ACS (78% versus 41%) patients (p 0.000). The discrete, eccentric and lesion irregularity were significantly more in ACS than in CSA. On the contrary, the tubular, concentric and smooth lesions were significantly more in CSA than in ACS. Intracoronary thrombus were detected in ACS only (11%), none in CSA (p <0.001). Diffuse lesion, ostial location, moderate tortuosity, moderate angulation, calcification, total occlusion, excessive tortuosity and extremely angulation were more in CSA than in ACS with no statistical significant differences. Conclusion: Observed differences in coronary angiogram findings between the study subsets in this study based on AHC/ACC stenosis morphology classification will yield ischemic heart disease patients better and cost-effective management including PCI or CABG.***

Keywords: chronic stable angina, acute coronary syndrome, AHC/ACC stenosis morphology classification

1. Introduction

Coronary heart disease (CHD) is one of the major health problems worldwide. 30 percent of all deaths worldwide can be attributed to cardiovascular disease, of which more than half are caused by CHD, and consequence of lifestyle changes in developing countries forecasts for its rising number in future.[1] Wide population based data on the burden and pattern of coronary heart diseases in Bangladesh is scarce. However, the prevalence of CHD is increasing in Bangladesh and emerged as an important cause of mortality and morbidity.[2]

CHD represents a continuum of disease pathologies and its subsequent risks; and comprises of chronic stable angina (CSA), acute coronary syndromes (ACS), and sudden death. ACS has further been categorized into ST-elevation myocardial infarction (STEMI), non-ST-elevation myocardial infarction (NSTEMI), and unstable angina. The morphology of coronary atherosclerotic lesions varies between and within individuals with ischemic heart diseases. In chronic stable angina, diffuse atherosclerosis can progress to critical stenosis and even to occlusion without infarction or clinically apparent episodes of instability. Whereas abrupt closure of discrete atherosclerotic lesion of coronary arteries most often leads to myocardial infarction or unstable angina. Acute coronary events can occur on a background of quite limited angiographic disease, while patients with far more extensive disease remain stable for a long time. Patients with chronic stable angina may first present with acute myocardial infarction in their history and may then enter a chronic phase. Patients with an initial chronic presentation may later be punctuated by acute coronary events. Acute and chronic features thus tend to be intermingled in most patients as a history of ischemic heart disease progresses, and their initial presentation, pathogenetic and angiographic features that might be uniquely related to acute or chronic coronary events may be changed and confounded.[3,4,5]

Coronary angiography (CAG) is the gold standard to outline the morphological patterns of coronary vessels, and defines lesion-specific characteristics. In addition to identifying stenosis, it provides information about plaque rupture, intraplaque hemorrhage, and intraluminal thrombosis, and paradoxical coronary vasoconstriction linked to cardiovascular events.[3,6] The newer classification systems of lesion morphology established by a joint American College of Cardiology/American Heart Association (ACC/AHA) task force has become more useful for deciding the interventional procedures such as PTCA or CABG for patients needing coronary revascularization in term of assessing early and late outcome.[7]

We purpose to perform this study to compare the angiographic morphological findings of coronary vessels in chronic stable angina and in acute coronary syndrome of our study population, to allow them appropriate management.

2. Materials and Method

Study population: A total of 215 angiographic lesions in 110 patients (mean age ± SD = 52.2 ± 10.0 yrs) admitted for coronary angiography was enrolled in a prospective observational study in the department of Cardiology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh from January 2009 to December 2009. Based on history, clinical features and laboratory investigations patients were randomly grouped into acute coronary syndrome, ACS (Gr I; n=55) and chronic stable angina, CSA (Gr II; n=55). Among 55 ACS patients, 32 had STEMI (ST elevation in ECG and a rise in cardiac marker(s)), 15 NSTEMI (evidence of myocardial necrosis) and 08 UA (recent history of angina at rest or minimum exertion or crescendo angina not exceeding 3 months).[3] Patients with a minimum 2-year history of typical stable angina (predictable and reproducible central chest discomfort after physical exertion and or emotional stress and is relieved by rest or sublingual nitroglycerin) with positive ETT, were grouped CSA[4]. Patients having valvular heart disease, left ventricle hypertrophy, cardiomyopathy, congestive heart failure and a positive history of concomitant malignancies, liver and kidney diseases were excluded. Informed written consent was taken for all patients.

Angiographic criteria: CAG was performed using standard Judkins procedure. CAG findings were analyzed by visual estimation; ≥ 50% of luminal stenosis was considered as significant.[8] All angiographic views were observed on a X-ray screen with threefold magnification and analysis of coronary angiogram findings was focused on the following descriptive concepts:
(a) Extent of the disease: Normal, single vessel disease, double vessel disease, triple vessel disease.[8]
(b) Lesion morphology: Lesion morphology was defined according to ACC/AHA Task Force classification. [7,9]

Statistical analysis: All data for each patient were recorded using a preformed data collection sheet and analyzed using the SPSS 17.0 version. Continuous variables were expressed as mean ± SD and were compared between groups by student's 't' test. Categorical variables were expressed as number (%) and compared using a chi-square test or Fischer's exact test as appropriate. 'p' value of < 0.05 was considered as to be statistically significant at the level of 95% CI.

3. Result

Baseline characteristics of the patients are presented in table 1. Mean age of the study subjects was 52.2 years and 09 of them (11%) were female. Hypertension and diabetes mellitus were more frequently observed in CSA than ACS (p-value 0.006 and 0.026, respectively) .While the frequency of SVD was significantly higher (p <0.001) in patients with ACS (64%) than CSA (10%) and that of TVD significantly lower (<0.001) in ACS (11%) than CSA (51%), it was almost similar for DVD in both groups (p 1.0). Normal angiogram was found in 4% and 11% in ACS and CSA, respectively. Among the major coronary vessels, LAD was more frequently involved in both groups than RCA and LCX. There was more frequent involvement of LM, RCA and LCX in CSA than in ACS.

Table 1: Baseline characteristics of the study subjects

	ACS (n = 55)	**CSA (n = 55)**	**p**
Age in yrs	52.2 ± 9.9	52.2 ± 10.1	0.992
Female	06(10)	05(11)	0.751
Hypertension	25(45)	40(73)	0.006
Diabetes mellitus	8(15)	19(35)	0.026
Extent of Disease			
SVD	35(64)	10(18)	0.001
DVD	12(22)	11(20)	1.000
TVD	06(11)	28(51)	0.001
Normal	02(04)	06(11)	
Major coronary artery Involvement			
RCA	23(43)	37(75)	0.001
LAD	38(72)	39(79)	0.354
LCX	15(30)	37(76)	0.000
LM	01(2)	06(12)	0.000

Data are mean±(SD) for continuous and n (%) for categorical variables.

Table II shows the type and lesion complexity of 215 angiographic lesions in study population. In both groups, type B lesion was more common than type A and type C. B1 in CSA (p 0.000) and B2 in ACS (p 0.000) were significantly more common. No significant difference for type A, type B and type C between them was found. The simple versus complex lesions in ACS and CSA were 22% versus 59% and 78% versus 41% with significantly more (p 0.000) complex lesion in ACS patient.

Table 2: Type and lesion complexity of angiographic lesions according to ACC/AHA classification:

Lesion Type	*ACS No. (%)*	*CSA No. (%)*	*P value*
Type A	11 (13)	19 (10)	ns
Type B	54 (65)	82 (62)	ns
B1	17 (20)	55 (42)	0.000
B2	37 (45)	27 (20)	0.000
Type C	18 (22)	31 (23)	ns
Lesion Complexity			
Simple (A+B1)	26(22)	78(59)	0.000
Complex (B+C1)	57(78)	54(41)	
Data are n (%) for categorical variables; ns=not significant			

Table III describes the characteristics of angiographic lesions. The discrete, eccentric and lesion irregularity were significantly more in ACS than in CSA. On the contrary, the tubular, concentric and smooth lesions were significantly more in CSA than in ACS. Intracoronary thrombus were detected in ACS (10.8%) only, none in CSA (p <0.001). Although diffuse lesion, ostial location, moderate tortuosity, moderate angulation, calcification, total occlusion, excessive tortuosity and extremely angulation were more in CSA than in ACS, there were no statistical significant differences.

Table 3: Characteristics of angiographic lesions according to ACC/AHA classification:

Lesion Characteristics	ACS No. (%)	CSA No. (%)	P value
Type A			
Discrete	39 (46.9)	30 (22.7)	<0.001
Concentric	24 (28.9)	93 (70.4)	<0.001
Smooth contour	34 (40.9)	95 (71.9)	<0.001
Type B			
Tubular	33 (39.7)	75 (56.8)	0.015
Eccentric	57 (68.6)	33 (25)	<0.001
Ostial	4 (4.8)	8 (6.1)	ns†
Bifurcation	4 (4.8)	4 (3.0)	ns†
Moderate tortuosity	8 (9.6)	17 (12.9)	ns
Moderate angulation	7 (8.4)	18 (13.7)	ns
Irregularity	47 (56.6)	31 (23.5)	<0.001
Calcification	13 (15.6)	18 (13.7)	ns
Thrombus	9 (10.8)	0 (0.0)	<0.001
Type C			
Diffuse	11 (13.2)	27 (20.5)	ns
Excessive tortuosity	2 (2.4)	5 (3.8)	ns†
Extremely angulated	2 (2.4)	4 (3.0)	ns†
Total occlusion	2 (2.4)	6 (4.5)	ns†
Inability to protect side branch	5 (6.0)	2 (1.5)	ns†

Data are n (%) for categorical variables..† indicates Fisher's Exact Test; ns= not significant

4. Discussion

The mean age of ACS and CSA subjects was 52.2± 9.9 and 52.2 ± 10.1 years, respectively. Similar age distribution was mentioned by Saifuddin[10] although Paul et al[11] and Kassaian et al[12] reported higher mean age of their study subjects. The high male: female sex ratio of 10:1 of the study population, also seen in the study of Saifuddin[10], can be attributed to the gender bias and atypical presentation. Higher prevalence of hypertension and diabetes with CSA in this study is comparable to studies of Bogaty et al[5] and Safiuddin[10].

In term of extent of disease, SVD was significantly more common (p <0.001) in ACS (64%) than CSA (18%) patients, whereas TVD was significantly more common (p <0.001) in CSA (51%) than ACS (11%) patients. DVD was almost identical in all groups. Ameen et al[13] reported similar extent of vessel disease. El-Adawey et al[14] reported higher SVD in ACS patients but similar distribution of DVD and TVD in both groups. Bogaty et al[5] and Safiuddin[10] found significantly more SVD in AMI and TVD in stable angina. In this study, normal CAG was found in 04% in ACS and 11% in CSA patients. Normal angiogram in both stable angina and acute coronary syndrome with variable percentage has been mentioned in literature and may be due to other concomitant co-morbidities, false positive ETT in patients with CSA, and coronary artery spasm and spontaneous lysis of thrombus in ACS etc.[4,15]

In this study, the involvements of LAD, RCA, LCX and LM in ACS and CSA were 72%, 43%, 30% and 02%; and 79%, 75%, 76% and 12%, respectively. LM, RCA and LCX involvement was significantly more in ACS than in CSA (p <0.001) but LAD involvement was similarly distributed. The involvements of LAD, RCA and LCX in ACS and CSA in study of Kassaian et al 1[12] were 52.8%, 24.2% and 20.2%, and 52.3%, 22.2% and 23.3%, respectively with no significant difference, consistent with studies of Paul et al[11] and El-Adawey et al[14]. LM involvement was higher in CSA (12%) than in ACS (2%) and is comparable to the reports of Bernstein et al[16] who mentioned LM involvement in CSA, UA and MI as 15%, 5% and 2% respectively.

In the presenting study, the Type A, Type B and Type C lesions were similarly distributed in both ACS and CSA patients although subtype B1 in CSA (p 0.000) and subtype B2 in ACS (p 0.000) was significantly more prevalent. Kastrati et al[9] and Zaacks et al[17] mention similar distribution of type A, B (B1, B2) and C lesions in his study subjects. Complex lesion (type B2-C) in ACS and simple lesion (type A-B1) in CSA were was significantly more than their counterpart (p 0.000). Kassiain et al[12] found similar complex lesion (type B2-C) more significantly in ACS than in SA group. Kastrati et al[9] mentioned significantly more complex lesion than simple lesion in unstable angina subjects (p <0.001).

The distribution of concentric lesions in ACS and CSA were 28.9% and 70.3%, and that of eccentric lesion 68.6% and 25%, respectively, with significantly more concentric lesion in CSA (p <0.001) and eccentric lesion in ACS (p <0.001) patients. Kassaian et al[12] mentioned significantly more eccentric lesion in ACS than in SA (p 0.043). The concentric lesion in AMI and SA of Bogaty et al[5] study was 25.6% and 21.5%, respectively. Ross et al[18] reported eccentric lesion 66.5% in ACS patients and 64.5% in stable angina patients.

The discrete lesion was significantly more in ACS than CSA patients (p <0.001). Conversely, tubular lesion was significantly more in CSA than ACS patients (p 0.015). Although diffuse lesion was more in CSA patients, there was no significant difference between them. Ross et al [18] found similar distribution of length lesion in all subjects but no difference of their distribution in ACS, UA, non-Q wave MI, Q wave MI and SA subjects. Kassaian et al[12] also found similar distribution of length lesions with no significant difference between ACS and SA patients. In the presenting study, smooth lesion was significantly more in CSA (p <0.001), whereas irregular lesion was significantly more in ACS (p <0.001) patients. El-Adawey et al[14] and Tan et al[19] mentioned similar distribution of smooth and irregular lesions in their studies.

The prevalence of ostial, bifurcation lesion, moderate tortuosity, moderate angulation, total occlusion, excessive tortuosity, extreme angulation, inability to protect side branch of this study is similar to that of studies of Zaacks et al[17] and Kassaian et al[12]. Although the calcification in ACS and CSA was similar, comparable to El-Adawey et al[14], overall calcification (14.4%) of this study differs from that

of Kassaian et al[12] (1.1%) and Zaacks et al[17] (22.2%). Kassaian et al[12] also mentioned no significant difference of ostial, bifurcation lesion, total occlusion and calcification between ACS and SA patients.

In this study, 9 lesions had been detected with intracoronary thrombus, all present in ACS patients (10.8%) and none in CSA patients (p <0.001) consistent with the study of Kassaian et al[12] and El-Adawey et al[14]. The prevalence of intracoronary thrombus varies between 3.4- 38% in different studies. Angiography has low sensitivity but relatively high specificity (80%-90%) for the detection of a thrombus or a complex lesion. Small thrombi or mural thrombi that do not cause luminal irregularity probably cannot be detected angiographically.[20]

Several limitations to our study includes smaller size of highly selected groups of patients in a tertiary care centre, demographic differences at baseline and interobserver variability of angiographic findings, may not reflect the true picture of our larger population.

5. Conclusion

In this observational study differences in coronary angiogram findings between the study subsets were observed. In acute coronary syndrome subjects, angiogram revealed more complex lesions with fewer numbers of diseased vessels and lesions. Eccentric, irregular, discrete lesions and thrombus are more common among patients with acute coronary syndrome. On the other hand, patients with chronic stable angina had more simple lesions with higher number of diseased vessels and lesions. They had significantly more concentric, smooth and tubular lesions than in acute coronary syndrome patients.

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