Original Article

Coronary Angiographic Characteristic of Coronary Artery Disease of Young Adults Under Age Forty Years Compare to Those Over Age Forty

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Abstract

This study aimed to compare the coronary angiographic characteristics of coronary artery disease in young adults (≤40 years) and older adults (>40 years). This was a retrospective analytic study. The study was conducted at the Department of Cardiology, Rajshahi Medical College Hospital. 100 patients with coronary artery disease were included in this study. Among the 100 patients, 50% were in the ≤40 years' group (group A) and 50% were in the >40 years' group (group B). Coronary angiographic characteristics were analyzed for each group. Coronary artery disease was present in 72% of group A and 84% of group B. In group A, single vessel disease (SVD) was the most common pattern (38%, p=0.001), while in group B, double vessel disease (DVD) (36%, p=0.043), triple vessel disease (TVD) (26%, p=0.033), and left main vessel disease (LM) (8%, p=0.035) were more prevalent. Left ventricular dysfunction with hypokinesia was observed in the majority of patients. The left anterior descending (LAD) artery was most commonly involved in both groups, primarily in the mid and proximal segments. The right coronary artery (RCA) was the next commonly affected artery, with differences in involvement site between the two groups. This study highlights that SVD is more common among young adults, whereas DVD, TVD, and LM diseases are more prevalent in older individuals. Older age groups exhibited a higher prevalence of diabetes mellitus, while smoking, dyslipidemia, and hypertension were common risk factors for coronary artery disease in both age groups.

Keywords: Coronary Artery Disease (CAD), Coronary Artery Angiography (CAG).

Introduction

Coronary artery disease (CAD) is a global health concern and remains the leading cause of mortality and morbidity worldwide.[1] while the manifestation of CAD typically occurs in middle and older age groups, recent studies have reported an increasing incidence of CAD among young adults below the age of 40.[2, 3] This phenomenon is attributed to a combination of factors, including the preference for high-fat diets, unhealthy lifestyles, and the rising prevalence of metabolic syndrome, hypertension, and dyslipidemia in this population. [4] Additionally, conventional vascular risk factors observed in the middle-aged population, as documented in the Framingham study, are also present in young adults.[5, 6] The incidence of symptomatic CAD and acute coronary syndrome (ACS) in young adults under 40 years of age is

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relatively rare, accounting for approximately 0.4-19% of all ACS cases.[7, 8] Nonetheless, it is crucial to understand the coronary angiographic characteristics and patterns of CAD in this particular age group. Several studies have examined the coronary angiographic profiles of young adults with CAD and highlighted notable differences compared to their older counterparts[9]. These angiographic studies have reported a higher incidence of normal coronary arteries, mild luminal irregularities, and single vessel coronary artery disease among young adults.[9] Such findings suggest that the pathophysiology of CAD in young adults may differ from that in older individuals, possibly indicating alternative underlying mechanisms or contributing factors. In addition to atherosclerosis, other non-atherosclerotic factors have been associated with the development of CAD in young adults. These include cocaine use, high homocysteine levels, connective tissue diseases, hyper coagulopathy (such as antiphospholipid syndrome and nephrotic syndrome), and other systemic conditions.[10, 11] It is important to consider these factors when evaluating and managing CAD in young adults. Furthermore, the short-term prognosis and functional status of young patients diagnosed with CAD have been reported to be excellent.[12, 13] However, the prevalence of CAD in young adults and adolescents have been shown to increase alongside the rising prevalence of conventional risk factors, including diabetes, hypertension, smoking, dyslipidemia and obesity.[14] This emphasizes the importance of early risk factor identification, lifestyle modifications, and preventive measures in this population. Therefore, the study aimed to compare the coronary angiographic characteristics of coronary artery disease in young adults under the age of forty to those over the age of forty.

Materials and Methods

This retrospective analytic study was conducted at the Department of Cardiology, Rajshahi Medical College Hospital. The study included 100 patients with coronary artery disease who underwent coronary angiography. The patients were divided into two groups: Group A, consisting of 50 patients aged 40 years or younger, and Group B, consisting of 50 patients aged over 40 years. Demographic, clinical, and laboratory data were recorded for each patient. Coronary angiographic characteristics were analyzed for both groups. Patients admitted to the ward and outpatients were included in the study. The inclusion criteria involved patients with angina refractory to medical treatment, evidence of ischemia on non-invasive testing, symptomatic patients requiring a confirmed diagnosis, post-myocardial infarction patients with angina or evidence of left ventricular systolic dysfunction, heart failure, and signs of ischemia after a stress test. Patients with valvular heart disease, congenital heart disease, hypertrophic cardiomyopathy, and coronary artery anomalies were excluded. The Coronary Anatomy Nomenclature used was based on the CASS system. Statistical analysis was performed using SPSS version 20, with paired t-tests and chi-square tests used for comparative analysis. A significance level of p=0.05 was considered statistically significant, while p=0.001 was considered highly significant.

Results

Total 100 patients included in the study. The baseline clinical variables of patients in both the group were summarized. The patients were divided into two main groups for comparison. The patients in group A were those who were less than and equal to 40 years of age. The patients in group B were those who were greater than or equal to 41 years of age. The youngest patient was 18 years of age and the eldest was 55 years of age. Out of fifty (50%) were in group A and (50%) were in group B the predominant symptom was angina in both the groups. The patients in group A were more with angina class I (P=0.003) whereas group B patients had more severe angina. Baseline characteristics for coronary artery disease were analyzed by age groups (Table-1 and Figure-1). Table-2 shows the risk factors of CAD patients. Smoking was prevalent in both the groups. The second most common prevailing risk factor in the study is

dyslipidemia. Family history of coronary artery disease was also not uncommon. Hypertension was the third most common risk factor in the study population. Diabetes Mellitus a major risk factor for coronary artery disease was more prevalent in group B (p-0.002) (Table-2). In Table-3 patients of group A (50%) was compared to group B (50%). Balance circulation of the coronary system was seen in group A, (22%), where as in group B (26%). The rest were left dominant coronary artery patients. The 72% patients in group A revealed presence of coronary artery disease as compared to group B (84%). Out of all patients having atherosclerotic coronary artery disease most common pattern was single vessel disease in group A (38%) P=0.001). The patients in group B the most common pattern for coronary artery disease is double vessel disease, triple vessel disease and left main vessel 36% (P=0.043), 26% (P=0.033) and 8% (P=0.035) respectively. Table-4 shows the most common artery involved was left anterior descending (LAD) In the LAD artery most common site for lesion is mid segment followed by the proximal segment in both the groups. Next commonly involved artery was right coronary artery (RCA). RCA was involved equally in the proximal and distal segment in group A. But in group B most common site was proximal RCA followed by mid distal segments. In the circumflex artery the involvement by atherosclerotic artery disease was least common. The most common site of involvement in circumflex artery is proximal segment in group A. But in group B the site for involvement of coronary artery disease is equally distributed in proximal and distal segments. The length of the lesion and type of lesion as classified by Ambrose were also analyzed and no significant difference was noted.Table-5 shows the multiplicity of risk factor for coronary artery disease was also common among patients of study population.
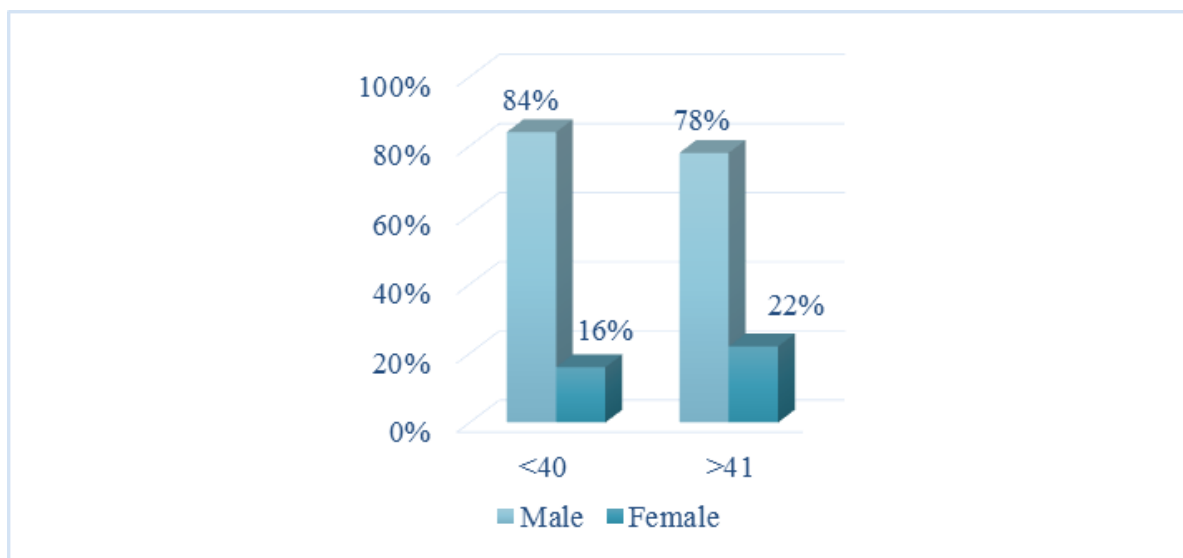

Figure I: Sex distribution of patients (N=100)

Table1: Baseline clinical variables of patients (N=100)

Clinical variables	Age<40		Age>41		P-value
	N=50	(%)	N=50	(%)	
History of MI	20	40	18	36	0.569
Angina class					
I	25	50	13	26	0.003
II	13	26	18	36	0.204
III	12	24	18	36	0.121
IV	0	0	1	2	0
Predominant Symptoms					
Typical Chest Pain	29	58	30	60	0.927
Atypical Chest Pain	13	26	9	18	0.297
Angina equivalent	1	2	3	6	0.096
No Angina	7	14	8	16	0.705
Type of Angina					
Stable	32	64	27	54	0.353
Unstable	18	36	23	46	0.275

Table-2: Distribution of Risk Factors (N=100)

Risk Factors	Age<40		Age>41		P-value
	N=50	(%)	N=50	(%)	
Smoking	31	62	30	60	0.928
Family History	15	30	13	26	0.593
HTN	32	34	21	42	0.395
Diabetes Mellitus	7	14	18	36	0.002
Dyslipidaemia	26	52	25	50	0.845
BMI					
18.5-24.9	16	32	16	32	1
25-29.9	26	50	25	50	0.922
30 or >	8	16	9	18	0.602
Risk Factor Presence in individual patients					
No Risk Factor	10	20	7	14	0.223
One Risk Factor	15	30	18	36	0.392
Two Risk Factor	16	32	16	32	1
Three or more Risk Factor	9	18	9	18	0.886

* 70% Patients had lipid profile done. Group A 24 patients and in group B 46 patients.

Table-3: Coronary Anatomy of the Patients (N=100)

Coronary Anatomy	Age<40 N=50	%	Age>41 N=50	%	P value
Dominance					
Right	29	58	25	50	
Left	10	20	12	24	
Balance	11	22	13	26	
Coronary artery disease					
Normal	14	28	8	16	0.07
Moderate CAD	28	56	22	44	0.317
Obstructive CAD	40	80	30	60	0.0016
SVD	19	38	7	14	0.001
DVD	10	20	18	36	0.043
TVD	6	12	13	26	0.033
LM	1	2	4	8	0.035

Table-4: Distribution of coronary artery disease (N=100)

Coronary artery disease	Age<40 N=50	%	Age>41 N=50	%	P value
Moderate CAD 110(20)	28	56	22	44	0.317
LAD	20	28	8	36	
CIRC	1	3	4	18	
RCA	7	25	10	45	
Obstructive CAD 40(80)	20	40	30	60	0.016
LAD	10	50	14	46	
CIRC	2	10	6	20	
RCA	8	40	9	30	
Lesion Length Distribution					
<10	19	38	21	42	0.579
Oct-20	23	46	22	44	0.75
>20	8	16	7	14	0.715
Type of Lesion(Ambrose)					
I	10	20	10	20	1
II	18	36	15	30	0.385
III	14	28	14	28	0.893
IV	8	16	11	22	0.33

Table-5: Multiplicity of Risk Factor & Severity of Coronary Artery Disease (N=100)

Risk Factor & Severity	Age<40		Age>41		P value
	N=50	%	N=50	%	
No Risk Factor	10	20%	7	14%	0.17
Normal	3	30	2	33	0.637
SVD	3	30	1	16	0.052
DVD	2	20	2	33	0.029
TVD	1	10	1	16	0.739
LM	1	10	1	16	0.405
One Risk Factor	15	30%	18	36%	0.392
Normal	5	33	4	22	0.405
SVD	6	40	3	16	0.001
DVD	2	13	6	33	0.015
TVD	2	13	4	22	0.123
LM	0	0	1	5	
Two Risk Factor	16	32%	16	32%	1
Normal	4	25	1	6	0
SVD	7	43	3	18	0.006
DVD	4	25	6	37	0.047
TVD	1	6	5	31	0.001
LM	0	0	1	6	
Three or more Risk Factor	8	16%	9	18%	0.866
Normal	1	12	1	11	0.513
SVD	3	37	1	11	0
DVD	2	25	3	33	0.189
TVD	1	12	2	22	0.063
LM	1	12	2	22	0.003

Discussion

In our study, we investigated the clinical presentation, classical risk factors, and angiographic characteristics of coronary artery disease (CAD) in young patients.[15] The majority of the enrolled patients were men, and smoking emerged as the leading risk factor. More than half of the patients presented with acute coronary syndrome (ACS), particularly ST-segment elevation myocardial infarction (STEMI). Furthermore, most patients exhibited single-vessel occlusion, primarily in the left anterior descending (LAD) artery, and did not experience any warning signs or symptoms before their heart attacks.[15] One important finding in our study was the high incidence of angiographically normal coronary arteries in young patients. This may be attributed to the inclusion of pre-operative coronary angiography in patients undergoing valve replacement surgery [15]. Limited data are available in the literature regarding the characteristics of angiographic stenosis morphologic features in young patients. However, previous studies have shown a higher percentage of young patients with significant CAD, albeit with less extensive disease compared to older age groups.[16, 17] Our study also assessed the relationship between age, smoking, and metabolic syndrome components, such as body mass index (BMI), high non-HDL levels, and low HDL levels, in relation to ACS. By employing logistic regression analysis, our study suggests that smoking is an independent predictor of ACS and occlusive CAD in young patients. Numerous studies have established the association between various risk factors and the development of CAD. For instance, the Framingham Heart Study demonstrated the multifactorial nature of coronary artery disease, with major risk factors accounting for approximately 85% of excess risk of premature CAD.[18] In our study, we found a relatively higher incidence of coronary artery disease in young patients compared to a similar age group in the Western world. [2, 16, 19] we also observed an increased percentage of patients with a history of cigarette smoking, hypertension, dyslipidemia, diabetes mellitus, and a positive family history of premature coronary artery disease. Cigarette smoking, especially at a younger age, is associated with a greater risk of CAD compared to healthy age-matched control subjects.[20] Previous studies have reported a high prevalence of CAD in young smokers, ranging from 73% to 90% of subjects with coronary artery disease under the age of 40. [21] Classical risk factors (hypertension, diabetes, smoking, dyslipidemia) contribute to coronary artery disease (CAD) in both elderly and young patients. Smoking and dyslipidemia were prevalent in both groups. Diabetes mellitus was more prevalent in group B (p=0.002). Dyslipidemia in young patients predicts future CAD. Both groups had reduced HDL levels, inversely related to CAD. Prevalence rates of diabetes mellitus in young subjects range from 10% to 15% in the Western world [22] and 13% to 28% locally.[11, 23] In our study, group A had an obesity incidence of 16% and group B had an incidence of 18%. Overweight patients accounted for 52% in both groups. The incidence of normal coronary arteries on angiography was 28% in group A and 16% in group B, consistent with previous literature (9-17% in younger population). Group A had a higher prevalence of single-vessel disease (38%) compared to group B (15%). The incidence of double-vessel disease was 20% in group A and 36% in group B, while triple-vessel disease was 12% in group A and 26% in group B. Older patients tend to have a higher predilection for multi-vessel coronary artery disease.[24] The most common angiographic findings in group A were single-vessel disease (38%) and normal coronary angiography (28%), while group B exhibited double-vessel disease (36%) and triple-vessel disease (26%). The left anterior descending artery was most frequently involved, followed by the right coronary artery and circumflex artery.[4] The distribution of coronary lesions was not dependent on age. Both groups had multiple risk factors, with smoking and dyslipidemia being the most common. Comprehensive risk factor management is crucial for preventing and managing coronary artery disease [20].

Limitation of the Study

The sample size the relatively small which could potentially compromise the generalizability and external validity of the findings.

Conclusion

Younger patients with coronary artery disease (CAD) primarily exhibit single-vessel disease (SVD), while older patients commonly have double-vessel disease (DVD), triple-vessel disease (TVD), and left main (LM) involvement. Older patients have higher rates of diabetes, smoking, and dyslipidemia. Hypertension (HTN) is the most prevalent risk factor in both age groups. Multiplicity of risk factors correlates with increased CAD severity. Smoking is a significant predictor of occlusive CAD and acute coronary syndrome (ACS) in young patients. Weight reduction, smoking cessation, and intensive lipid control are crucial for preventing ACS and occlusive CAD in the young population based on our findings, it is recommended to prioritize smoking cessation interventions and comprehensive risk factor management in young patients with coronary artery disease (CAD) to prevent future cardiovascular events

Conflict of interest: None declared

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