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Coronary Artery Ectasia in Patients with and Without Diabetes: A Study from Northern Pakistan

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ABSTRACT

Objectives: To determine the association of coronary artery ectasia in terms of its severity and vessels involved in diabetes patients and non-diabetes patients.

Study Design: Cross-sectional study.

Place and Duration of Study: Department of Cardiology, PAEC General Hospital, Islamabad Pakistan from Jun 2018 to Jun 2020.

Methodology: All patients who underwent coronary angiography were included in this study. Two hundred patients (100 patients having diabetes and 100 patients not having diabetes) who presented with chest pain and chest heaviness were diagnosed with coronary artery ectasia on coronary angiography included in this study.

Results: Two hundred patients, 100 patients had diabetes, and 100 patients had no diabetes. 71 (35.5%) of the patients were males, and 29 (14.5%) were females**.** The left anterior descending artery alone was responsible for 23% of Coronary Artery Ectasia, followed by the right coronary artery (16%) in diabetic patients. In patients with diabetes with multiple vessels, the left anterior descending artery and left circumflex artery were most frequently (21%) involved vessels, while left anterior descending and right coronary artery were observed to have Coronary artery ectasia in 16% of diabetes patients.

Conclusion: No significant difference in the severity of coronary artery ectasia was noted among diabetes and non-diabetes patients. Left anterior descending was most frequently involved vessels in diabetes patients and right coronary artery in non-diabetes patients. Left anterior descending and left circumflex artery both had coronary artery ectasia in most of the diabetes patients and non-diabetes patients.

Keywords: Coronary artery ectasia, Coronary angiography, Coronary artery disease, Diabetes mellitus.

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INTRODUCTION

Coronary artery ectasia (CAE) is characterized by disturbed coronary blood flow caused by abnormal vessel dilatation.[1] Coronary artery ectasia means dilatation of at least one coronary artery about 1.5 times or larger than the nearby normal segment of the coronary artery. It may be isolated coronary ectasia that refers to coronary artery ectasia without coronary artery stenosis.[2] Classification of coronary artery ectasia,[3] was shown in the Table-I.

Coronary artery ectasia potentially promotes thrombogenicity and inflammatory reactions.[4,5] As CAE is commonly presented with myocardial ischemia or coronary syndrome, it could be a constellation of coronary artery disease.[6,7] The major pathophysiologic process that may lead to CAE is the enzymatic degradation of the extracellular matrix of the media caused by the atherosclerotic plaque growth. Results in loss of elastic tissue and thinning of the vascular media layer. The thin wall and increased vascular wall stress result in the ecstatic artery. The prevalence of CAE ranges from 1.2% to 4.9%. It is three times more frequently observed in males as compared to female.[8] CAE is associated with 50% cases of atherosclerosis whereas 20%-30% are congenital. 10%-20% are associated with connective tissue diseases, i.e., polycystic kidney disease, polyarteritis nodosa, Ehler-Danlos, Kawasaki disease and 4%-9% are iatrogenic due to angioplasty and complications (dissection). Obesity, smoking, cocaine and hypertensive disorder are among the commonest risk factors for developing CAE.[9]

Diabetes mellitus (DM) is one of the most common public health issues around the globe, and its incidence is on the rise in low socioeconomic and developed countries. DM is a strong risk factor for developing cardiovascular diseases, but amazingly, its role in developing CAE is not yet cleared and needs further work, especially in our country. However, rarely available literature illuminated that the risk of CAE is almost double in hypertensive and smokers than in diabetic patients.[10] Diabetes mellitus is a multifactorial disease that disturbs the metabolism of carbohydrates and fats, resulting in disturbed blood glucose levels and an increase in fat deposition. The high blood glucose results in increased circulatory

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cytokines favour deposition of plaque on the walls of vessels and distort the tunica media of the arterial wall, causing occlusion or dilatation of the artery, leading to myocardial infarction or ectasia. Low-density lipoprotein (LDL) level is increased in Diabetes mellitus. Due to increased levels of blood glucose, LDL is glycosylated. It increases the half-life of LDL, which favours atherogenesis. Endothelial dysfunction boosts the incidence of atherogenicity. Diabetes is a risk factor for several adverse effects other than cardiovascular and renal diseases. The concept of risk estimation is helpful for clinicians in selecting cardiovascular patients for effective disease management. The present study would help establish the association of coronary artery ectasia in patients with diabetes in northern Pakistan, which is previously unexplored.

Table-I: Classification of coronary artery ectasia.

Types	Classification	
Type 1	Diffuse ectasia in two or three vessel	A. Diffuse ectasia in three vessels B. Diffuse ectasia in two vessels and a localized ectasia in another vessel C. Diffuse ectasia in two vessels
Type 2	Diffuse ectasia in one vessel and localized ectasia in other vessels	A. Diffuse ectasia in one vessel and a localized ectasia in another vessel B. Diffuse ectasia in one vessel and localized ectasia in other two vessels
Type 3	Diffuse ectasia in one vessel	
Type 4	Localized or segmental ectasia	A. Localized in one vessel B. Localized in two vessels C. Localized in three vessels

METHODOLOGY

This study was conducted over two years, from June 2018 to June 2020, at the Cardiology Department of PAEC General Hospital Islamabad Pakistan. Ethical approval was taken from the Institutional Research Ethical Committee (ERC/IERB approval Certificate number RCD-06-003). WHO calculator was used for sample size calculation, taking 95% confidence level, 7% absolute precision value and population proportion of 43.46%, as determined by the Iqbal *et al*.[11] Non-probability consecutive sampling technique was used.

Inclusion Criteria: All of patients having ages between 18-75 years presented with complaints of chest pain, dyspnea or chest heaviness and were diagnosed with CAE on coronary angiography, irrespective of gender, were included in the study, of which 100 had diabetes, and 100 did not have diabetes.

Exclusion Criteria: Patients having clinical history of cardiomyopathy, valvular or congenital heart disease, hypertension and smoking history were excluded from the study.

Informed written consent for participating in the study was taken from all the enrolled subjects. CAE was defined as ectasia of the coronary artery, with a diameter greater than 1.5 times that of nearby artery segments diagnosed by coronary artery angiography.[12] Mild CAE was labelled when a single vessel was involved, while moderate and severe CAE were labelled if double and triple vessels were involved.[13] Type 2 Diabetes Mellitus (T2DM) was diagnosed as per criteria defined by American Diabetic Association, i.e., HbA1c = 6.5% or >6.5%.[14] Coronary angiography was performed for all the patients, and findings were noted.

Statistical Package for Social Sciences (SPSS) version 25.0 was used for the data analysis. Mean and standard deviation was calculated for quantitative variables like age. Frequency and percentages were calculated for qualitative variables. The chi-square test was employed to assess the significance of the observed difference between percentages of categorical variables. The *p*-value of ≤0.05 was considered significant.

RESULTS

A total of two hundred (n=200) were selected who underwent angiography procedures at our hospital. Among these, 100 patients who had diabetes were selected and compared with 100 patients who did not have diabetes of similar gender and age. 71 (35.5%) patients were males, and 29 (14.5%) were females in both diabetic and non-diabetic groups. The mean age of the diabetic patient was 57.43±8.61 years, while the mean age of non-diabetic patients was 56.58±11.55 years (*p*-value = 0.556).

Patients were further categorized into different groups based on age (Table-II).

Table-II: Distribution of Patients in Different Age Groups (N=200)

	Age Groups n (%)		
	< 50 Years (n=44)	50-60 Years (n=95)	> 60 Years (n=61)
Patients with Diabetes	17 (38.6)	54 (56.8)	29 (47.5)
Non-diabetes patients	27 (61.4)	41 (43.2)	32 (52.5)

Detailed analysis of the gathered data exposed that LAD and LCX combined were the most frequently

observed vessels (21.5%) responsible for CAE in diabetic and non-diabetic patients, followed by LAD along with RCA, which were present in 16% of study patients. LAD and RCA alone were responsible for 15% and 16% of CAE in total studied patients (Table-III). No statistically significant difference was noted for mild, moderate and severe CAE in both diabetic and non-diabetic patients (Table-IV).

DISCUSSION

CAE, also known as dilated coronopathy, was first demonstrated by the Morgagni in 1761. Subsequently, it was studied by Bougon in the early 80s, and the term "ectasis" was coined by Bjork around five decades ago.[12,13] Irrespective of the extent and severity of CAE, the prognosis, aetiology, morbidity, mortality and associated factors to this coronary artery abnormality is still inconclusive. It is still a matter of debate whether CAE is a unique clinical finding or whether it results from other clinical entities. However, previously published literature suggested that congenital, inflammatory and connective tissue disorders are among the major etiologic factors and in the majority of the cases, the atherosclerosis process is the main cause of CAE.[14]

Table-III: Vessels responsible for Coronary Artery Ectasia in both Groups (n=200)

	Patients with Diabetes Group (n=100)	Non-Diabetes Patients Group (n=100)
Left anterior descending artery	23	7
Left circumflex artery	7	13
Left main stem	0	3
Right coronary artery	16	16
Left anterior descending artery, left circumflex artery	21	22
Left anterior descending, left main stem	5	5
Left circumflex artery, left main stem	1	0
Left anterior desending, right coronary artery	16	16
Left Circumflex artery, Right coronary artery	2	2
Right coronary artery, left main stem	0	1
Left anterior descending, left circumflex artery, right coronary artery	9	15

DM is the main cause of various microvascular and macrovascular complications, especially coronary artery diseases.[15-17] unfortunately, the prevalence of diabetes in Pakistan is rising daily.[18] Endothelial dysfunction is the basis for the development of diabetic complications. The activity and aggregation of platelets are important in terms of thrombus formation during the atherogenesis process.[19]

Recently, Ali *et al.* reported that about 41.7% of patients diagnosed with CAE had diabetes.[20] Therefore, it was extremely important to study the spectrum of CAE in the diabetic population of our local population diagnosed with CAE on angiography. As per our study findings, no statistically significant difference (p-value<0.05) was shown with respect to the severity of disease in diabetic and non-diabetic patients. Among diabetic patients, LAD alone was responsible for 23% of CAE, followed by RCA, which was positive for CAE in 16% of patients. In diabetic patients having multiple vessel disease, LAD plus LCX were most frequently (21%) involved, while LAD plus RCA were the second most commonly (16%) involved vessels. Similar to our study findings, Sadhanandham *et al.* and colleagues reported that CAE of LAD was found in 41.63% of patients while RCA in 88.73% of patients.[21] However, unlike our study, their study lacks the description of multiple vessels involved in a patient. Similar results were presented in another descriptive analysis by Girgdhar *et al.*[22]

Table-IV: Severity of Coronary Artery Ectasia in both groups (n=200)

	Severity of Coronary Artery Ectasia n(%)			
	Mild (SingleVessel Disease) (n=86)	Moderate (DoubleVessel Disease) (n=91)	Severe (TripleVessel Disease) (n=23)	p-value
Patients with Diabetes	47 (54.7)	45 (49.5)	8 (34.8)	0.236
Non-diabetes patients	39 (45.3)	46 (50.5)	15 (65.2)	

They illustrated that RCA was the most commonly affected vessel (72%), followed by LAD (33.78%), and 16.54% of patients had left circumflex artery involvement. Devabhaktuni *et al.* in another study, reported that no strong association exists between CAE and DM.[23] It is worth mentioning that no past study has established the relation of severity of CAE with diabetes patients. Furthermore, our study has described the details of the most frequently observed vessels in this population. However, there are various limitations of this study. First, we have not

described the relationship between medications used by these patients. Secondly , we have not correlated the disease duration with the severity of CAE in these patients. Another limitation of our study is that there is no information on glycemic control. Therefore, it has been suggested that a large-scale study must be conducted to overcome these limitations.

CONCLUSION

No statistically significant difference exists in mild, moderate and severe CAE among patients with diabetes and patients without diabetes. LAD was most frequently involved vessels in diabetic patients, while RCA in non-diabetic patients. It was further noted that LAD and LCX combined having CAE in most of the diabetes patients and non-diabetic patients who had multiple vessel disease.

Conflict of Interest: None.

Author's contribution

QMS: Ideas drafting, article writing, AMB: Proof reading, MSM: Data interpretation and analysis, BA: Data collection.

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