

# Association of Diabetes Mellitus and Hypertension with Angiographic Profile of Acute Coronary Syndrome Patients

SALIK AHMED<sup>1</sup>, UZAIR ABBAS<sup>2</sup>, SANAM KHOWAJA<sup>3</sup>, SHAHBAZ ALI SHAH<sup>4</sup>, MUHAMMAD HASHIM<sup>5</sup>, AMJAD ALI HULIO<sup>6</sup>

<sup>1,3,4</sup>Post FCPS Fellow of Intervention Cardiology, National Institute of Cardiovascular Diseases Karachi, Pakistan

<sup>2</sup>Assistant Professor of Physiology, Dow university of Health Sciences, Karachi, Pakistan

<sup>5</sup>Assistant Professor of Cardiology, Dow university Hospital, Dow University of Health Sciences, Karachi, Pakistan

<sup>6</sup>Senior Registrar of Cardiology, National Institute of Cardiovascular Diseases (NICVD) Karachi, Pakistan

Correspondence to Dr. Uzair Abbas, E-mail: [uzair.abbas@duhs.edu.pk](mailto:uzair.abbas@duhs.edu.pk), Cell: 0300-3280080

## ABSTRACT

**Background:** Cardiovascular diseases are the leading cause of death worldwide while ischemic heart disease is a major contributor of cardiovascular diseases and diabetes mellitus is one of the major risk factor for ischemic heart diseases. Cardiac involvement in diabetes commonly manifest as coronary artery disease (CAD) of different extent which has an impact on disease outcome and prognosis.

**Aim:** To compare the angiographic profiles between diabetic and non-diabetic patients with acute coronary syndrome (ACS).

**Place and duration of study:** National Institute of Cardiovascular Diseases, Karachi, Pakistan from 1<sup>st</sup> Feb. 2020 to 31<sup>st</sup> Jan. 2021.

**Methodology:** Two hundred and ninety eighty patients with acute coronary syndrome were enrolled. Demographic profile, personal and family history was taken through questionnaire. Angiography was performed to assess the angiographic profile in terms of extent of the disease, left main disease (LMD) involvement, severity of disease, and localization of disease to see the association with variables.

**Results:** The mean age was 56.38±8.90 years and 240 (81%) were males and 58 (19%) were females. The diabetic patients have higher frequency of three vessels involved, localization of left anterior descending (LAD) and right coronary artery (RCA) with significant difference ( $p<0.0001$  respectively). Left main disease was noted in 21 (25.3%) of diabetic participants and severe disease was found among 119 (56.4%) of diabetic participants with significant difference compared to non-diabetics ( $p<0.001$ ). Angiographic profile was also found to be significantly different among hypertensive and non-hypertensive participants ( $p<0.05$ )

**Conclusion:** There is higher frequency of diabetes in patients with ACS and most of them are male. While severity of disease, involvement of RCA and LAD in patients with acute coronary syndrome is quite high in patients with diabetes mellitus as compared to non-diabetic patients. Hypertension was also found to be associated with angiographic profile.

**Keywords:** Coronary artery disease, Coronary angiography, Diabetic, Non-diabetic, Acute coronary syndrome

## INTRODUCTION

Acute coronary syndrome (ACS) comprises a major portion of cardiovascular disorders, which is also an important indicator of ischemic heart disease (IHD)<sup>1,2</sup>. There are multiple pathophysiological mechanisms behind ACS among which coronary artery disease is supposed to be a major and important risk factor.<sup>3</sup> ACS is defined as the number of symptoms including ST-elevation myocardial Infarction, non-ST elevation myocardial Infarction and unstable angina arising due to hypoxia in the myocardial tissue because of obstruction in blood supply<sup>4</sup>. Acute coronary syndrome has been reported to be the cause of half of the deaths among 17 million deaths from cardiovascular diseases. Due to decreased physical activities, the prevalence of cardiovascular diseases like myocardial infarction and stroke are on rise.<sup>5</sup> Diabetes mellitus is known to be a major risk factor of heart diseases which is a worldwide epidemic too. Its prevalence is rapidly increasing in both developing and developed countries.<sup>6</sup> In Pakistan with an estimated prevalence of 16.98% and it is predicted to affect 12.8 million by 2035<sup>7</sup>. Pakistan has been ranked 7<sup>th</sup> by World Health Organization (WHO) in diabetes prevalence<sup>8</sup>.

A study conducted by Jafary et al<sup>5</sup> reported hypertension in 55.2%, smoking in 52%, diabetes in 37.2%, and hyperlipidemia in 18.2% of the patients enrolled from Coronary Care Units (CCUs) of 17 major hospitals across Pakistan which were managed by trained physicians. In a study by Shah et al<sup>9</sup> on angiographic analysis revealed 18.9% of patients had single vessel disease (SVD), 26% had double vessel disease (2VD), and 45% had three vessel disease (3VD) in which involvement of left anterior descending, circumflex, right coronary artery and left main disease was 42%, 26%, 32% and 3.2% respectively. It also reported out of the total lesions identified mild were 11%, moderate and severe disease were 13% and 76% respectively. In another study by Farooq et al<sup>10</sup> found that in diabetic patients, as compare to non-diabetics, severity of disease was significantly higher in LAD (54.7% vs. 44%), RCA (61.3% vs. 36 %) and Left Circumflex (60% vs. 36%). In another study diabetic patients were found to have more extensive disease as compared to non-diabetics, so multi vessel disease was more common in diabetics as compared to non-diabetics (54.7% vs. 21.3%).

Because diabetes patients' clinical course and results are more demanding in many ways, including the selection of the most

appropriate medicines, optimal care, including the selection of the most appropriate interventions, is more challenging, especially in older patients. The severity and anatomy of diseases are expected to vary between diabetic and non-diabetic patients in our population.

Therefore, this study is designed to explore how acute coronary syndrome (ACS) in diabetics differs from that of non-diabetics, with a special interest in their angiographic profile.

## MATERIALS AND METHODS

The study was conducted in Department of Adult Cardiology, National Institute of Cardiovascular Diseases (NICVD) - a tertiary care hospital at Karachi, Pakistan. The study was approved by IRB committee of NICVD (Approval letter No. NICVD/ERC/2019/798). Informed consent was taken from participants before including in the study. Two hundred and ninety eight patients having age between 40 to 80 years of either gender and diagnosed with ACS who were undergoing coronary angiography were included. While those patients were excluded who had a prior history of Acute Coronary Syndrome (ACS) with previous history of any cardiac related surgery.

Before participation, all participants were told about the study's goal and benefits, and verbal informed permission was obtained from all patients. The patients' age (years) and personal history (hypertension, diabetes mellitus, smoking status, and family history of coronary artery disease) were recorded (CAD). Angiography was performed and a profile in terms of the extent of the disease, left main disease (LMD) involvement, the severity of disease, and localization of disease was recorded on a predesigned questionnaire. Patient information was kept secured and available to authorized persons only. Data was entered and analyzed using SPSS-21. Univariate analysis of the demographic profile and angiographic profile was performed to compare between diabetic and non-diabetic populations. P-value <0.05 was considered as significant.

## RESULTS

The mean age was 56.38±8.90 years and majority of subjects were males (80.5%). Most of the participants were found to have age between 40 to 60 years of (59.7%). The frequency of diabetes was found in 195 (65.5%), hypertension was found in 140 (47%) and family history of coronary artery disease (CAD) was reported among 31(10.1%) participants. The majority of the participants were non-smokers (71.8%) [Table 1].

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For the angiographic profile, we looked for the extent of the disease, localization of the disease, presence of left main disease, and severity of the disease. Regarding the extent of disease, we found involvement of one vessel in 87(29.2%), two vessels in 91 (30.5%), and three vessels involvement in 120 (40.3%) participants. For localization profile, RCA was found among 85(28.6%), LAD in 159(53.4%), and the circumflex artery was found to be affected in 54(18%) participants. Left main disease (LMD) was found in 83 (28%) and 211 (70%) of participants were found to have a severe disease (Table 2).

It was showed that gender, hypertension, and family history of CAD had a statistically significant relationship with diabetic status ( $p=0.020$ ,  $<0.0001$ ,  $<0.0001$  respectively). The higher frequency of diabetes 124(69.7%) among the subjects who had an age between 40-60 years and that of gender, 165 (68.8%) of males were found to have diabetes. Among hypertensive participants, 63(45%) had diabetes. A higher frequency of diabetes was found in non-hypertensive participants (83.5%). While the relationship between diabetic status and smoking status was not statistically significant ( $p=0.136$ ) (Table 3).

While comparing angiographic profiles between diabetic and non-diabetic patients, a significant relationship was found ( $P > 0.05$ ). In the extent of disease, 77 (88.5%), 55 (60.4%), and 63 (52.5%) diabetic patients were documented with one, two, and three vessels involved respectively with a significant difference with non-diabetics. Of those who had left the main disease, 21 (25.3%) of them were diabetic patients. In the severity of disease, 119 (56.4%) were found to be diabetic patients with a significant difference with non-non-diabetics with a  $p < 0.0001$  (Table 4).

Table 1: Demographic characteristics of study subjects (n= 298)

Variable	No.	%
<b>Age (years)</b>		
40 – 60	178	59.7
> 60	120	40.3
<b>Gender</b>		
Female	58	19.5
Male	240	80.5
<b>Diabetes</b>		
No	103	34.5
Yes	195	65.5
<b>Hypertension</b>		
No	158	53.0
Yes	140	47.0
<b>Family history of CAD</b>		
No	267	89.6
Yes	31	10.4
<b>Smoking Status</b>		
No	214	71.8
Yes	84	28.2

Further analysis for any significant different angiographic profile of hypertensive and non-hypertensive participants revealed, among hypertensive, 65 (54.2%) had three vessels involved with significant difference ( $p=0.029$ ). The localization of disease was not found to be associated with hypertension ( $p=0.70$ ). And those who had LMD, 56 were found to have hypertension with a significant difference compared to non-hypertensive ( $p=0.0001$ ), and the same was found with the severity of disease in which 60% of severe diseased participants were found to be hypertensive. We found negative family history of CAD to be associated with the angiographic profile of participants. Of those who did not have a family history of CAD, 101 (84.2%) out of them

were found to have three vessels involved with significant difference ( $p= 0.027$ ), while 183 (86.7%) with severely diseased also did not have a family history of CAD ( $p=0.012$ ) [Table 5].

Table 2: Angiographic profile of participants (n=298)

Variable	No.	%
<b>Extent of Disease</b>		
One	87	29.2
Two	91	30.5
Three	120	40.3
<b>Localization of disease</b>		
RCA	85	28.6
LAD	159	53.4
CIRC	54	18.0
<b>Left main disease</b>		
No	215	72.0
Yes	83	28.0
<b>Disease severity</b>		
Moderate	87	30.0
Severe	211	70.0

Table 3: Univariate analysis of demographic characteristics with diabetic status of the study subjects (n= 298)

Variable	Diabetic	Non-Diabetic	P value
<b>Age (years)</b>			
40 – 60	124 (69.7%)	54 (30.3%)	0.064
> 60	71 (59.2%)	49 (40.8%)	
<b>Gender</b>			
Female	30 (51.7%)	28 (48.3%)	0.020
Male	165 (68.8%)	75 (31.3%)	
<b>Hypertension</b>			
No	132 (83.5%)	26 (16.5%)	0.000
Yes	63 (45%)	77 (55%)	
<b>Family history of CAD</b>			
No	185 (69.3%)	82 (30.7%)	0.000
Yes	10 (32.3%)	21 (67.7%)	
<b>Smoking status</b>			
No	146 (68.2%)	68 (31.8%)	0.136
Yes	49 (58.3%)	35 (41.7%)	

Table 4: Univariate analysis of angiographic profile and diabetic status of the study subjects

Variable	Diabetic	Non-Diabetic	P value
<b>Extent of disease</b>			
One	77 (88.5%)	10 (11.5%)	0.000
Two	55 (60.4%)	36 (39.6%)	
Three	63 (52.5%)	57 (47.5%)	
<b>Localization of disease</b>			
RCA	67 (78.8%)	18 (21.2%)	0.003
LAD	100 (62.9%)	59 (37.1%)	
CIRC	28 (51.9%)	26 (48.1%)	
<b>Left main disease</b>			
No	174 (80.9%)	41 (19.1%)	0.000
Yes	21 (25.3%)	62 (74.7%)	
<b>Disease severity</b>			
Moderate	76 (87.4%)	11 (12.6%)	0.000
Severe	119 (56.4%)	92 (43.6%)	

Table 5: Univariate analysis of angiographic profile and hypertension and family history of CAD

Variable		Hypertension		P value	CAD family history		P value
		Yes	No		Yes	No	
Extent of Disease	One	31(35.6%)	56(64.4%)	0.029	4(4.6%)	83(95.4%)	0.027
	Two	44(48.4%)	47(51.6%)		8(8.8%)	83(91.2%)	
	Three	65(54.2%)	55(45.8%)		19(15.8%)	101(84.2%)	
Localization of disease	RCA	38(44.7%)	47(55.3%)	0.70	3(3.5%)	82(96.5%)	0.016
	LAD	74(46.5%)	85(53.5%)		18(11.3%)	141(88.7%)	
	CIRC	28(51.9%)	26(48.1%)		10(18.5%)	44(81.5%)	
Left main disease	No	84(39.1%)	131(60.9%)	0.000	8(3.7%)	207(96.3%)	0.000
	Yes	56(67.5%)	27 (32.5%)		23(27.7%)	60(72.3%)	
Disease Severity	Moderate	5(5.7%)	82(94.3%)	0.000	3(3.4%)	84(96.6%)	0.012
	Severe	135(64%)	76(36%)		28(13.3%)	183(86.7%)	

## DISCUSSION

Diabetes mellitus has been a well coronary artery disease's risk factor. The clinical course and outcomes of diabetes patients are crucial in many aspects, including the selection of the most appropriate therapies, especially in older patients, optimum care, including the selection of the most appropriate interventions, is a major concern. Coronary artery disease (CAD) occurs early in the population. Even though cardiovascular risk factors are more concentrated and prevalent in women, older men had more severe coronary angiographic lesions. Multiple vascular diseases have been linked to type 2 diabetes and smoking. To reduce the prevalence and effect of CAD in communities like ours, more efforts should be devoted to preventing and managing cardiovascular risk factors in which diabetes is much common.<sup>11</sup> Coronary artery disease (CAD) has different clinical manifestations and angiographic findings in diabetic and non-diabetic individuals, as well as in people of different ages. CAD among people under the age of 45 is a unique subgroup. Clinical manifestations of CAD in young individuals with varied risk factors vary, which might affect therapeutic methods. Coronary angiography, also known as arteriography, is still the gold standard for detecting and assessing coronary artery disease<sup>12</sup>

As per our study, in the Pakistani demographic, the severity and anatomy of illnesses are predicted to differ diabetic from to non-diabetic people. As a result, the goal of our study was to see how diabetics' acute coronary syndrome (ACS) differs from non-diabetics, with a focus on their angiographic profile. Our study subjects were predominantly males (80.5%), 65.5% had diabetes, slightly less than half had hypertension. Near 90% of families had no history of coronary artery disease and 72% of subjects did not have a history of smoking. Regarding an angiographic profile, about 40% of our patients had a triple vessel disease, 53% in the Left anterior descending artery, 72% of patients did not have left the main disease, while the severity of coronary disease was high in 70 % of our patients.

While Mahjoob et al<sup>13</sup> reported that the older patients exhibited more three-vessel disease, two-vessel disease, and involvement of the left anterior descending artery and right coronary artery. One-vessel disease, on the other hand, was more common in young individuals under 45. In another study by Sareddy et al<sup>14</sup>, evaluated the clinical risk factor and angiographic aspects of diabetic and non-diabetic individuals with coronary artery disease. They comprised 142 individuals with confirmed coronary artery disease through angiography, the equal number of cases and controls revealed female diabetics had a higher prevalence of CAD. Diabetics had a higher rate of multiple vessel involvement (47.9% vs. 18.3%). Diabetic CAD patients were shown to be more likely to have severe, widespread coronary artery involvement. Hypertension, dyslipidemia, female gender, and uncontrolled and long-term diabetes all contributed to a more severe type of CAD<sup>14</sup>.

In our study, the disease was severe in 62% of our patients while hypertension was not significantly related to the extent and severity of the disease, disease neither of the LAD nor to the left main disease. Family history and smoking were also not significantly related to the extent of coronary disease. Our male patients had significantly more prevalence of diabetes. We also found single vessel disease was more common in diabetics mainly in the RCA (right coronary artery). Left main disease was uncommon in diabetics. As per the present study's results, the severity of disease was moderate in 87.4% of patients and a minority had severe disease. Gui et al<sup>15</sup> compared the angiographic characteristics of coronary arteries in diabetic and non-diabetic CAD patients. When compared to non-diabetics, diabetics had more severe and diffuse angiographically confirmed coronary artery disease. Diabetics had a considerably higher rate of right coronary artery involvement. In this investigation, the duration of CAD, and diabetes mellitus were revealed to be independent risk factors for CAD. They discovered that diabetic individuals had less one-vessel disease (28.8% vs. 46.2%) and more three-vessel disease (35.2% vs. 24%). A study by Hegde et al<sup>16</sup> was conducted to determine how the acute coronary syndrome (ACS) in diabetics differs from that of non-diabetics, with a focus on their angiographic profile. When compared to non-diabetics with ACS, diabetic patients' ACS manifested substantially earlier in life, and the severity and breadth of CAD, as well as the incidence of triple/multivessel disease, were much higher in diabetics. In their study, 44% of DM patients had triple-vessel disease compared to (16%) non-diabetics. According to Mahboob et al<sup>13</sup>, the risk profile and angiographic results in young patients with CAD differed from those in older individuals.

Shakya et al<sup>17</sup> conducted retrospective research to determine the prevalence of risk factors, angiographic distribution, and degree of coronary artery stenosis in patients with the acute coronary syndrome. The variables identified were smoking (57.5%), hypertension (50.6%), diabetes (34.4%) and dyslipidemia (34.4%). Butt et al<sup>18</sup> examined the prevalence of triple-vessel coronary artery disease (triple-vessel CAD) among adult type 2 diabetes with non-diabetics in coronary artery disease (CAD) patients.

Bettamer et al<sup>19</sup> included 340 individuals, 175 of whom (51.4%) were diabetics and 165 (48.5%) were non-diabetics and he found to have higher frequency of triple vessel disease in diabetic (73%) as compared to non-diabetics. Few other studies have revealed that diabetic individuals had more severe kinds of coronary artery lesions than non-diabetic patients<sup>20,21</sup>.

## CONCLUSION

As diabetes increases the risk of micro vascular and macro vascular complications and when it comes to coronary angiography diagnosis, it is found that diabetes individuals had more severe kinds of coronary artery lesions than non-diabetic patients with difference in angiographic profile in different population.

**Conflict of interest:** Nil

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