

# Patterns of coronary artery vessel disease on diagnostic angiography in a south asian population

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## Author's Contribution

<sup>1,2,3</sup>Drafting the work or revising it critically for important intellectual content

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## ABSTRACT

**Objective:** The objective was to establish patterns of diseased vessels amongst the study population.

**Methodology:** This retrospective descriptive study analyzed the data of 396 patients who underwent diagnostic angiographies at a large tertiary care public hospital in Islamabad, from January 2018 till October 2018. All data was coded and recorded in SPSS and was quantitatively run to find percentages and tests of significance were done.

**Results:** We found that single vessel disease was the most common at 31.6%, and that the left anterior descending was the most commonly involved vessel with the most significant coronary artery disease, 86.6% and 71.4% respectively.

**Conclusion:** Hypertension and diabetes have a great burden on our South Asian population and contribution to the development of coronary artery disease. Severe disease present in one vessel should alert physicians to the possibility of multi-vessel involvement and multi vessel progression in the disease progress. Delineation of the vessel involvement pattern in South Asians forms the basis for formulating local guidelines and strategies for tackling coronary artery disease.

**Keywords:** Angiography, CAD, Patterns.

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## Introduction

Coronary artery disease denotes a spectrum of pathology that affects the coronary vessels involving luminal narrowing sometimes with co-existent ectasia that leads to clinical effects such as myocardial ischemia and infarction.<sup>1,2</sup>

In 1958, a physician at Cleveland, Sones' mistakenly injected the coronary artery ostia, creating the first coronary angiogram, the catheterization technique was being used at the time for delineating valvular pathology. This led to visualize the anatomy of these vessels and its appearances in the diseased state; which eventually gave way to management options delineation<sup>3</sup>. In South Asian countries, with progressive urbanization, the burden of coronary artery disease is likely to have doubled in the

past two decades. The risk factors have also progressively increased in this population, such as obesity, hypertension, diabetes and smoking.<sup>4</sup> South Asians are a distinct population when it comes to coronary artery disease, as they are more likely to suffer increased morbidity and mortality. They have a higher risk of developing coronary artery disease as compared to other races. They also have higher proportional mortality compared to other ethnicities; this holds even for those South Asians that are living abroad and may enjoy better socioeconomic advantages than their native counterparts.<sup>5</sup> Due to their predilection towards coronary artery disease and worse outcomes it places a larger economic burden on this population.<sup>6</sup> Furthermore, diabetes is more likely to affect South Asians secondary to biological factors and lifestyle changes that have occurred with increased

urbanization, which further enhance the vascular complications amongst which CAD is one of the most important<sup>7</sup>. Patients with coronary artery disease are either managed medically, or revascularization is undertaken to restore the flow of blood to the heart where the pathology has created an impediment. Single vessel disease or double vessel disease can be treated with stenting. However, diffuse disease if present in single or double vessel disease or triple vessel disease are preferred to be surgically managed. However, there is much debate on going even in these situations, as surgery may provide more pain-free time from ischemia as compared to stenting, which is one of the many outcome differences that are beyond the scope of this article<sup>8</sup>. Coronary angiography, though invasive, remains the gold standard to diagnose CAD and to make decisions about interventions which may be minimally invasive or surgical.<sup>9</sup> Understanding disease pathology and its development is one of the primary steps undertaken to any scientific query; this study aimed to develop an understanding and to explore the different patterns of coronary vessel involvement in South Asians. Exploring these patterns may evolve possible methods to deal with the increased morbidity and mortality faced by this population.

## Methodology

A retrospective descriptive study was conducted at the department of cardiology, Pakistan Institute of Medical Sciences, from January 2018 till October of 2018. After ethical approval from the ethical review board, angiography reports were retrieved of 396 patients and data collected from the reports regarding age, sex, coronaries involved and their pathology and pattern, presence of left main stem disease, and co-morbidities including diabetes, hypertension and smokers were recorded. All patient information was deidentified. Convenience sampling was used. The population of South Asians was used at a confidence level of 95% and error of 5% to calculate the minimum sample size needed of 385. Indications to have undergone a diagnostic angiography were recorded for the patients and included chronic ischemic heart disease, anterior or inferior wall MI in the past, a positive exercise stress testing, non-ST-elevation myocardial infarction (NSTEMI) or ST-elevation myocardial infarction (STEMI), stable or unstable angina, and echocardiographic evidence of LV dysfunction.

Epicardial vessels were defined as left anterior descending (LAD), left circumflex artery (LCX) and right coronary artery (RCA). As per the 2011 Guidelines for Percutaneous Coronary Intervention of the American College of Cardiology Foundation and the American Heart Association narrowing was considered significant if it was more than 70% in the epicardial arteries and more than 50% in the left main stem. Disease in epicardial vessels ranging from 30-70% was considered mild to moderate coronary artery disease. Depending on significant CAD in epicardial vessels, it was denoted as single, double or triple vessel disease depending on how many were involved, with or without left main stem disease. Zero vessel disease was denoted by vessels with ectasia; those where mild to moderate CAD was present or a normal coronary angiogram was recorded. All data was coded and recorded in SPSS and was quantitatively run to find percentages and tests of significance were done.

## Results

The mean age of our sample was 57 years, with the youngest being 34 years old and the eldest was 86 years old. Most participants had ages ranging between 56-66 years old.

The LAD was involved in 40% of all diabetics, and 70% of all hypertensives. The LCX was involved in 29% of all diabetics, and 46% of all hypertensives. The RCA was involved in 30% of all diabetics, and 50% of all hypertensives.

Separating our data by indication for undergoing an angiography, we found that anterior wall MI was present in 24.2%, inferior wall MI in 13.6%, NSTEMI in 17.4%, chronic IHD in 15.9% being the most common reasons for having had a diagnostic angiography done. Of those who had had an MI, 4.3% had received streptokinase in the past.

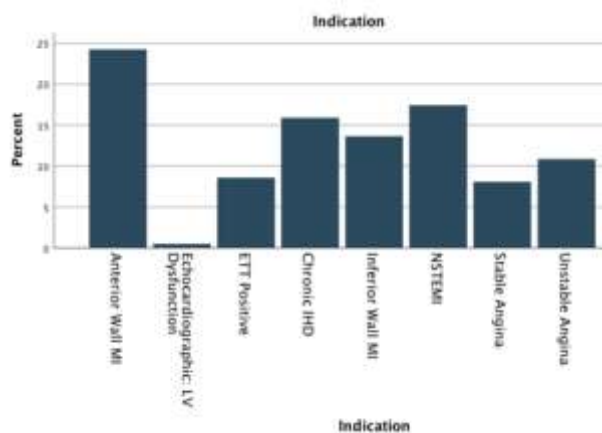
**Table I: Demographics (n=396)**

Sex	Male	Female
	359 (91%)	37 (9%)
Diabetic	Diabetic	Non-Diabetic
Total	179 (45.2%)	217 (54.8%)
Only diabetic	6.5% (26)	-
Hypertensive	Hypertensive	Normotensive
Total	319 (80.6%)	77 (19.4%)
Only hypertension	166 (41%)	
Smokers	Smokers	Non smokers
	99 (25%)	297 (75%)
Diabetic and Hypertensive	Both present	Normotensive, non-diabetic
	152 (38.3%)	49 (12%)

**Table II: Patterns of Coronary Artery Disease**

Zero Vessel Disease	(n) Percentage
Total	61 (15.4%)
Normal coronaries	20 (5%)
CAD Present	41 (10.4%)
<b>Single Vessel Disease</b>	125 (31.6%)
<b>Double Vessel disease</b>	93 (23.5%)
<b>Triple Vessel Disease</b>	117 (29.5%)
<b>LAD</b>	
Total	343 (86.6%)
Significant CAD	283 (71.4%)
Ectasia	7.0 (1.8%)
<b>LCX</b>	
Total	230 (58.1%)
Significant CAD	187 (47.2%)
Ectasia	4.0 (1.0%)
<b>RCA</b>	
Total	246 (62.4%)
Significant CAD	189 (47.7%)
Ectasia	3.0 (0.8%)
<b>LMS</b>	
Total	9.0 (2.3%)
Significant CAD	7.0 (1.7%)
Ectasia	1.0 (0.25%)
<b>Ectasia</b>	15 (3.7%)

A linear regression analysis was done to see if there was significance between the severity of coronary artery disease denoted by the number of vessels involved against the identified risk factors of hypertension, diabetes and smoking. (Figure 1)



**Figure 1. Indications for undergoing coronary angiography**

We further ran a chi-square test for percentage of occlusion of the LAD, RCA, LCX and LMS against the number of vessels involved at angiography, to see if there was a correlation between increasing occlusion in each vessel and the severity of disease. (Table IV)

**Table IV: Chi square association between percentage occlusion of vessel and the number of vessels involved.**

Chi-Square association	Value	Degrees of freedom	P-value
<b>LAD</b>	178.03	24	.000
<b>LCX</b>	157.33	27	.000
<b>RCA</b>	143.59	24	.000
<b>LMS</b>	14.00	10	.173

## Discussion

Hypertension being a cardiovascular ailment is a result of many interrelated etiologies. It may originate functional and structural abnormalities of cardiovascular system, if not controlled and treated. These abnormalities are harmful to vital organs of the body like heart, kidneys, and brain. So, hypertension has become the main reason for disability and mortality all over the world.<sup>11</sup> Hypertension and its related complications cause 9.4 million deaths every year. South Asia is a populous area having almost 25% of people residing in this area and half of the disease burden is attributed to non-communicable diseases. In this area hypertension and its related diseases are a major contributor to death and disability.<sup>12,13</sup>

The results of this study showed that 92 (47.67%) patients had blood pressure controlled and 101 (52.33%) patients whose blood pressure was not in required normal limits. This is similar to some studies like Muleta et al, who found 43.51%<sup>14</sup>, and Shelley D with 49.8%.<sup>15</sup> But some studies from Chilean (59.7%)<sup>16</sup>, Greece (55.6%)<sup>17</sup>, and South Africa (57%) have shown quite higher rates than our study.<sup>18</sup>

The main cause of morbidity and mortality due to cardiovascular disease is high blood pressure or hypertension worldwide. A very important and preventable risk factor contributing to 13% deaths is hypertension, which has become a major public health problem globally.<sup>19</sup> There are many health benefits of keeping the blood pressure lower than normal or optimal levels for long time. For instance, effective and sustained lowering of the BP of hypertensive patients by 2 mmHg reduces the risk of CVD events by up to 10%. Similarly, if systolic blood pressure is managed to be lowered by 20 mmHg the risk of dying from a stroke and coronary heart disease will decrease by 50%.<sup>20</sup>

The analysis showed that age is a significant (p-value < 0.05) contributor for hypertension control but only patients having age > 60 years had 2.81 times more chance of blood pressure to be in normal limits as

compared to patients of age < 40 years. Many studies support this result of age being a significant contributor for blood pressure control. Studies also have shown that gender has significant relationship with gender but our study did not show any relationship of gender with blood pressure.<sup>10, 21</sup>

The educational level and Physical activity showed a very strong relationship with hypertension control, the patients whose education was matric had 10.49 times, graduate and post graduate had 6.24 and 6.59 more chance of blood pressure to be in acceptable limits respectively as compared to illiterate patients and patients having low level of physical activity had 8 times more chances of blood pressure to be in normal limits as compared to patients with no physical activity. Similar results have been shown in the literature.<sup>22</sup>

The use of vegetables increases the chances of blood pressure control significantly (p-value < 0.05) with odds ratio of 2.26. The patient who were not using top added salt had 7.22 times more chance of blood pressure to be in normal limits as compared to patients who had habit of top adding salt. These results are in very much agreement with other studies showing eating foods high in vegetables reduces blood pressure of hypertensive patients and added salt being a significant contributor for uncontrolled blood pressure.<sup>23, 24</sup>

The patients without comorbidities of diabetes mellitus and asthma had significantly (p-value < 0.05) higher chance of blood pressure control with odds ratios of 4.19 and 4.32. The patients who were using less than 3 drugs per day and good adherent patients to drug showed 2.20 and 2.91 times more chances of blood pressure to be in normal limits as compared to their counterparts. Previous studies also support the results that the existence of comorbid diseases like diabetes mellitus and asthma decreases the chances of blood pressure control.<sup>25</sup>

Targeted intervention to improve the management of hypertension in primary care settings could make a substantial difference in the improvement of hypertensive patient prognosis. Measures can be taken to assess the level of medication adherence and to investigate predictors of medication. Several diverse strategies can be used to improve blood pressure control. In the majority of the patients, blood pressure control is achieved with combination therapy; but low adherence rate is observed in patients taking multiple pills. Interventions designed to meet patient's requirements are necessary to achieve sufficient adherence to drug

regimens. Achieving satisfactory adherence may have far greater impact than any other plan to improve antihypertensive treatments.

## Conclusion

Coronary artery disease leads to a great morbidity and mortality in South Asian populations, and is augmented by hypertension and diabetes. This study showed that single vessel disease seems to be more common, that the LAD is the most commonly involved vessel and that anterior wall myocardial infarction was the chief indication for a diagnostic angiography. Smoking though an important cause of coronary artery disease seems to have a static role in the population rather than a dynamically changing one in the recent past. Severe disease present in one vessel should alert physicians to the possibility of multi-vessel involvement and multi vessel progression in the disease progress. Diabetes remains the centerfold challenge for South Asians to control if coronary artery disease and its morbidity is to be curbed in this population and greater national movement and emphasis should be placed on this. Delineation of the vessel involvement pattern in South Asians forms the basis for formulating local guidelines and strategies for tackling coronary artery disease.

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