

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

Syed Nasir Ali Shah<sup>1</sup>, Muhammad Ahmad<sup>2</sup>, Vishal Farid Raza<sup>3</sup>, Asad Riaz<sup>4</sup>, Talal Wasif<sup>5</sup>, Nabeel Younas Khan<sup>6</sup>

<sup>1</sup>Assistant professor, Department of Cardiology, Pakistan Institute of Medical Sciences, Islamabad

<sup>2,4,5,6</sup> Resident, Department of Cardiology, Pakistan Institute of Medical Sciences, Islamabad

<sup>3</sup>House Officer, Department of Cardiology, Pakistan Institute of Medical Sciences, Islamabad

## Author's Contribution

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

<sup>1</sup>Final approval of the version to be published

<sup>4,5,6</sup>Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work.

Funding Source: None

Conflict of Interest: None

Received: November 17, 2019

Accepted: January 21, 2020

## Address of Correspondent

Dr. Muhammad Ahmad  
Resident, Department of  
Cardiology, Pakistan Institute of  
Medical Sciences, Islamabad  
[Muhammad\\_Ahmad66@yahoo.com](mailto:Muhammad_Ahmad66@yahoo.com)

## 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 has 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.

**Cite this article as:** Shah SNA, Ahmad M, Raza VF, Riaz A, Wasif T, Khan NY. Patterns of coronary artery vessel disease on diagnostic angiography in a south asian population. *Ann Pak Inst Med Sci.* 2019; 15(4): 164-168.

## 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, physician at Cleveland, Sones' mistakenly injected the coronary artery ostia, creating the first coronary angiogram, the catheterisation technique was being used at the time for delineating valvular pathology. This led to visualising 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 a higher proportional mortality compared to other ethnicities; this holds true 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 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; the aim of this study was 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 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 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.

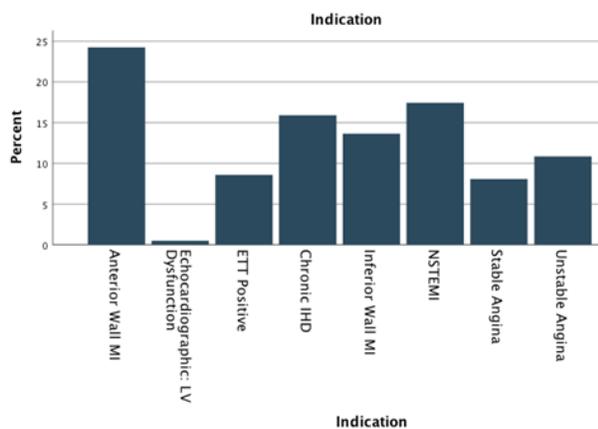
**Table I: Demographics (n=396)**

Sex	Male	Female
	359 (91%)	37 (9%)
<b>Diabetic</b>	Diabetic	Non-Diabetic
Total	179 (45.2%)	217 (54.8%)
Only diabetic	6.5% (26)	-
<b>Hypertensive</b>	Hypertensive	Normotensive
Total	319 (80.6%)	77 (19.4%)
Only hypertension	166 (41%)	
<b>Smokers</b>	Smokers	Non smokers
	99 (25%)	297 (75%)
<b>Diabetic and Hypertensive</b>	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%)
Single Vessel Disease	125 (31.6%)
Double Vessel disease	93 (23.5%)
Triple Vessel Disease	117 (29.5%)
LAD	
Total	343 (86.6%)
Significant CAD	283 (71.4%)
Ectasia	7.0 (1.8%)
LCX	
Total	230 (58.1%)
Significant CAD	187 (47.2%)
Ectasia	4.0 (1.0%)
RCA	
Total	246 (62.4%)
Significant CAD	189 (47.7%)
Ectasia	3.0 (0.8%)
LMS	
Total	9.0 (2.3%)
Significant CAD	7.0 (1.7%)
Ectasia	1.0 (0.25%)
Ectasia	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 number of vessels involved.**

Chi Square association	Value	Degrees of freedom	P-value
LAD	178.03	24	.000
LCX	157.33	27	.000
RCA	143.59	24	.000
LMS	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 for vital organs of the body like heart, kidneys and brain. So, hypertension has become main reason of 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% 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 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. Which 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 showed quite higher rates than our study.<sup>18</sup>

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 existence of comorbid diseases like diabetes mellitus and asthma decreases the chances of blood pressure control.<sup>25</sup>

Targeted intervention to improve management of hypertension in primary care setting 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. A number of diverse strategies can be used to improve blood pressure control. In 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.

## References

1. Parmet S, Glass TJ, Glass RM. JAMA patient page. Coronary artery disease. JAMA. 2004;292(20):2540.
2. Devabhaktuni S, Mercedes A, Diep J, Ahsan C. Coronary Artery Ectasia-A Review of Current Literature. *CurrCardiol Rev.* 2016;12(4):318-323.
3. Hajar R. Coronary Heart Disease: From Mummies to 21(st) Century. *Heart Views.* 2017;18(2):68-74.
4. Jafar TH, Qadri Z, Chaturvedi N. Coronary artery disease epidemic in Pakistan: more electrocardiographic evidence of ischaemia in women than in men. *Heart.* 2008;94(4):408-13.
5. Volgman AS, Palaniappan LS, Aggarwal NT, Gupta M, Khandelwal A, Krishnan AV, et al. Atherosclerotic Cardiovascular Disease in South Asians in the United States: Epidemiology, Risk Factors, and Treatments: A Scientific Statement From the American Heart Association. *Circulation.* 2018;138(1):e1-e34.
6. Nair M, Prabhakaran D. Why Do South Asians Have High Risk for CAD?. *Glob Heart.* 2012;7(4):307-14.
7. Shah A, Kanaya AM. Diabetes and associated complications in the South Asian population. *CurrCardiol Rep.* 2014;16(5):476.
8. King SB, 3rd, Marshall JJ, Tummala PE. Revascularization for coronary artery disease: stents versus bypass surgery. *Annu Rev Med.* 2010;61:199-213.

9. Lim MJ, White CJ. Coronary angiography is the gold standard for patients with significant left ventricular dysfunction. *Prog Cardiovasc Dis*. 2013;55(5):504-8.
10. Chaitman B.R., Bourassa M.G., Davis K. Angiographic prevalence of high-risk coronary artery disease in patient subsets (CASS) *Circulation*. 1981;64:360-367.
11. Ezhumalai B, Jayaraman B. Angiographic prevalence and pattern of coronary artery disease in women. *Indian Heart J*. 2014;66(4):422-6.
12. Saghir T, Qamar N, Sial J. Coronary angiographic characteristics of coronary artery disease in young adults under age forty years compare to those over age forty. *Pakistan Heart J*. 2008;41(3): 49-56
13. Soman B. Angiographic pattern of coronary artery disease in pre-menopausal Indian women: A single centre study. *Journal of Clinical & Experimental Cardiology. Scientific Abstract(20th European Cardiology Conference)*.
14. Akanda MAK, Ali SY, Islam AEMM, et al. Demographic Profile, Clinical Presentation & Angiographic Findings in 637 Patients with Coronary Heart Disease. *Faridpur Med. Coll. J*. 2011;6(2):82-85
15. Sriharibabu M, Himabindu Y, Kabir Z. Prevalence and associated risk factors of coronary artery disease in a rural South Indian population on a governmental health insurance scheme. *Journal of Indian College of Cardiology*. 2012;150-155.
16. Hertzner NR, Beven EG, Young JR, et al. Coronary artery disease in peripheral vascular patients. A classification of 1000 coronary angiograms and results of surgical management. *Ann Surg*. 1984;199(2):223-33.
17. Dodani S, Sharma GK. Presence of coronary artery disease in diabetic and non diabetic South Asian immigrants. *Indian Heart J*. 2018;70(1):50-55.
18. Kuriakose A, Nair anish TS, Soman B, et al. Rate and Risk of All Cause Mortality among People with Known Hypertension in a Rural Community of Southern Kerala, India: The Results from the Prolife Cohort. *Int J Prev Med*. 2014;5(5):596-603.
19. Gijsberts CM, Seneviratna A, De carvalho LP, et al. Ethnicity Modifies Associations between Cardiovascular Risk Factors and Disease Severity in Parallel Dutch and Singapore Coronary Cohorts. *PLoS ONE*. 2015;10(7)
20. Saqib MAN, Rafique I, Qureshi H, Munir MA, Bashir R, Arif BW, et al. Burden of Tobacco in Pakistan: Findings From Global Adult Tobacco Survey 2014. *Nicotine Tob Res*. 2018;20(9):1138-43.
21. Adam AM, Rehan A, Waseem N, Iqbal U, Saleem H, Ali MA, et al. Prevalence of Conventional Risk Factors and Evaluation of Baseline Indices Among Young and Elderly Patients with Coronary Artery Disease. *J Clin Diagn Res*. 2017;11(7):OC34-OC9.