



## Prevalence and Characteristics Of Atherosclerotic Involvement In Coronary Artery Anomalies In Adult Patients Who Underwent Coronary Angiography In A Tertiary Care Centre In Tamilnadu, India.

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### Abstract

**Background :** Since there are ethnical and geographical variations of the incidence of Coronary artery anomalies, so we aimed to estimate the frequency, pattern, atherosclerotic involvement of of coronary artery anomalies in our patient population.

**Methods:** The data were collected retrospectively by analyzing the angiographic data of 1502 consecutive adult patients undergoing coronary angiography between march 2019 and September 2021

**Results:** Among the 1502 coronary angiogram analyzed, Coronary artery anomalies were found in 74 patients (4.92%), 39 patients (52.70%) had origin and distribution anomalies, and 35 patients (47.29%) had coronary artery fistulae. Separate origins of left anterior descending and left circumflex coronary artery was the most common anomaly found in 18 (24.32%) patients. The right coronary artery rising from the left coronary sinus of Valsalva was second and found in 16 (21.62%) patients. Among the coronary artery fistula right coronary artery to right ventricle fistula was the most common followed by right coronary artery to right atrium. Right ventricle was the most common chamber to drain. Most fistulas occur in non dominant coronary artery (60%).the incidence of atherosclerosis in anomalous vessels was 75.67%.

**Conclusion:** The incidence of coronary artery anomalies in our patient population were slightly higher in comparison to previous studies. The patterns of coronary anomalies in our study is identical to most of the previous study. There was a significant atherosclerotic involvement of the anomalous vessels as compared to the normal vessels.

**Keywords:** coronary artery anomaly, coronary artery fistula

### Introduction

Coronary artery anomalies (CAA) are found in 0.2% to 5.64% of patients undergoing coronary angiography and 0.3% of an autopsy series. Association of CAA with atherosclerosis is not definite, but few studies have shown anomalous vessels to be more prone to atherosclerosis<sup>1</sup>. Since there are ethnical and geographical variations of the incidence of Coronary artery anomalies, so we aimed to estimate the frequency, pattern,

atherosclerotic involvement of of coronary artery anomalies in our patient population.

### Materials and Methods:

This retrospective descriptive study was conducted at the Department of Cardiology, Kilpauk medical college Chennai, India. The data were collected retrospectively by analyzing the angiographic data of 1502 consecutive adult patients undergoing coronary angiography between march 2019 and September 2021.

**Inclusion criteria**

Adult patients more than 18 years of age who underwent coronary angiography for various indications were included in the study.

**Exclusion criteria**

Patients with congenital heart disease were excluded from the study. Patients with coronary anomalies such as myocardial bridging, ectasia, and separate origin of the conus artery from the right coronary sinus were also excluded from the study.

Patients clinical characteristics were evaluated which included demographic factors, risk factors, clinical presentation, and coronary angiographic profile which included the prevalence, pattern, and atherosclerotic involvement of anomaly. The course of anomalous artery was determined according to methods described by Yamanaka and Hobbs and the “dot and eye” method<sup>2</sup>. Patients were diagnosed to have coronary artery disease (CAD) when a significant lesion (>50% luminal narrowing) was present in either one or more vessels or in a major branch. Atherosclerotic involvement of anomalous coronary arteries was compared with normal coronary arteries of the same patients, which served as the control group.

**Statistical analysis**

Statistical analysis was done using SPSS software version 16.0 (SPSS Inc., Chicago, IL, USA), and data were presented as mean, standard deviation, and percentages. Chi-square test was used to compare the presence of CAD in anomalous coronaries and normal coronaries. P < 0.05 was accepted as statistically significant.

**Results**

**Clinical characteristics [Table 1]**

During study period, 74 patients were found to have CCA, of which 55 (74.32%) were male and 19 (25.67%) were female with a mean age of 58+- 10 years (age range:25–79 years [Table 1]. Considering the risk factors, hypertension was present in 30 (40.5%) patients, diabetes mellitus in 52 (70.2%) patients, smoking in 44 (60.5%) patients, dyslipidemia in 11 (14.86%) patients, Of these,72 (97.29%) patients had undergone angiography for suspected or known ischemic heart disease with clinical presentations chronic stable angina in 23 (31.08%), unstable angina/nstemi in18 (24.32 and ST-segment elevation myocardial infarction in33 (44..59%) patients [Table 1]. two (2.7%) patients had valvular heart disease.

Table no – 2			
(INCIDENCE OF CORONARY ANOMALIES IN 1502 CORONARY ANGIOGRAAMS FROM MARCH 2019 TO SEPTEMBER 2021)			
	NO	ANGIOGRAPHIC INCIDENCE(%)	ANOMALY INCIDENCE(%)
TOTAL CORONARY ANGIOGRAMS	1502	-	-
TOTAL COROANRY ANOMALIES	74	4.92%	
ANOMLALIES OF ORIGIN AND DISTRIBUTION	39	2.59%	52.7
CORONARY FISTULA	35	2.33%	47.29

**Patterns of anomalies ( table 2 AND 3)**

During the study 1502 coronary angiogram were analyzed ,Coronary artery anomalies were found in 74 patients (4.92 % incidence).: Coronary artery anomalies were found in 74 patients (4.92 % incidence), 39 patients (52.70%) had origin and distribution anomalies, and 35 patients (47.29%) had coronary artery fistulae similar to many international studies<sup>3,4,5,6,7,8</sup>. Their mean age was 52±8 years (range, 25–79 y). Separate origins of left anterior descending and left circumflex coronary artery from the left sinus of Valsalva was the most common anomaly found in 18 (24.32%) patients . The right coronary artery rising from the left coronary sinus of Valsalva was second and found in 16 (21.62% ) patients. One case each of the following coronary anomalies was found: (i) left main coronary artery from right coronary sinus ii) left circumflex artery from right coronary sinus (iii) right coronary artery from ascending aorta (iv) single coronary artery v) origin of left circumflex artery from right coronary artery . Among the coronary artery fistula right coronary artery to right ventricle fistula was the most common followed by right coronary artery to right atrium. Right ventricle was the most common chamber to drain. Most fistulas occur in non dominant coronary coronary artery (60%).the average fluoro time taken was 7.19 minutes for coronary angiography in coronary anomalies.75.67% of the anomaly had significant coronary atherosclerotic disease.

### Discussion:

Most of the coronary artery anomalies are asymptomatic. The prevalence of CAA shows wide variation. The CAA are usually identified as a coincidental findings during coronary angiography for the other indication

CAA are classified into two categories 1.CAA of origin and distribution of coronary artery 2.coronary artery fistula (CAF). According to it in our study the prevalence CAA of origin and distribution was 39(52.70%) and that of CAF is 35( 47.29%).

### Characteristics of origin and distribution anomaly's

Prevalence of origin and distribution anomaly is 52.70%. The most common anomaly is separate origin of LAD and LCX (24.32%). second most common anomaly is RCA originating from left aortic sinus. Other anomalies are rare with prevalence of

1.35%. There were no prevalence of any of the artery originating from pulmonary artery. LMCA originating from Right sinus of valsalva was 1.35%. The course of the anomaly bears significant importance as risk factor for sudden cardiac death. The average fluoro time taken for performing CAG in these types of anomalies was 7.19 min( table no 4) , with the highest fluoro time for lcx originating from right sinus of valsalva. Second highest fluoro times was for RCA originating from left sinus of valsalva .RCA was the dominant vessel in most of these type of CAA.

Significant Coronary artery disease (CAD) was found in 69.23% of patient with CAA( table noi 7). Multivessel disease was the most prevalent.CAD was present in 71.79% of the anomalous vessels with lone anomalous vessel involvement of 17.94%.cad sparing the anomalous vessel was present in only 5.12%. so anomalous vessel is not resistant to CAD.

Table 3 Distribution of the 74 Coronary Artery Anomalies in 1502 Adult Patients Who Underwent Angiograph

	No	INCIDENCE %	ANAMOLIES %
TOTAL CORONARY ARTERY ANOMLALIES ( A+B)	74	4.92	-
<u>A.Anomalies of origin and distribution</u>	39	2.59%	52.70%
Ectopic origin from the sinuses of Valsalva of the aorta			
LMCA from RSV	1	0.06	1.35
RCA from LSV	16	1.06	21.62
Separate origins of LAD and LCX in the RSV	-	-	-
Separate origins of LAD and LCX in LSV	18	1.19	24.32
LCX from RSV	1	0.06	1.35
LAD FROM RSV	-	-	-
Ectopic origin from the ascending aorta			
LMCA from ascending aorta	-	-	-
RCA from ascending aorta	1	0.06	1.35
Ectopic origin from the pulmonary artery			
single coronary artery	1	0.06	1.35
Origin of the LAD from RCA	-	-	-
Origin of the LCX from RCA	1	0.06	1.35
Origin of the RCA from the LMCA	-	-	-
<u>B.coronary artery fistulae</u>	35	2.33%	47.29%
LAD-PA fistula	1	0.06	1.35
RCA-PA fistula	1	0.06	1.35
RCA-RV fistula	22	1.46	29.72
LCX-RV fistula	-	-	-
RCA-RA fistula	8	0.53	10.81
<u>LAD-LV AND RCA-RV</u>	1	0.06	1.35

RCA – RV AND LCX –RV	1	0.06	1.35
RCA – CORONARY	1	0.06	1.35

**Characteristic of coronary artery fistula(CAF)**

CAF are rare congenital anomalies. The incidence is 0.02% in the general population and 0.3%to 0.4% of CHD. In our study the prevalence of CAF was 2.35% (table no 2) among patients undergoing diagnostic CAG. The most common CAF is communication between RCA and RV (29.72%) (table no 3 ).The most common site of draining of CAF was right ventricle (71.42%)( table no 6). Least common was coronary sinus. The drainage to LA was not seen.

LCX was the dominant vessel in most CAF.RCA to RV fistula was more common in right dominant vessel but RCA to RA fistula was more common in left dominant system.

CAD was present in 82.85% of CAF( table no 8). CAD in fistulous vessel was 40%. CAD in lone CAF vessel was seen in 17.14%. CAD in only non fistulous vessel was present in 42.85%. So CAD can involve the fistulous vessel also.

<b>Table 4</b>	<b>FLUORO TIME</b>	<b>DOMINANCE</b>
<b><u>Anomalies of origin and distribution</u></b> <b><u>N- 39</u></b>	AVG 7.19 MIN	RCA (69.23%), LCX (17.94%) CD (12.8%)
<b>Ectopic origin from the sinuses of Valsalva of the aorta</b>		
<b>LMCA from RSV</b>	7.52 (min)	RCA (100%)
<b>RCA from LSV</b>	8.19( min)	RCA( 68%) LCX (12.5%) CD (18.75%)
<b>Separate origins of LAD and LCX</b>	5.88 (min)	RCA (61%), LCX (27.7%) CD (11.11%)

<b>in the RSV</b>			
<b>Separate origins of LAD and LCX in LSV</b>			
<b>LCX from RSV</b>	3.03 (min)	RCA(100%)	
<b>LAD FROM RSV</b>	-		
<b>Ectopic origin from the ascending aorta</b>			
<b>LMCA from ascending aorta</b>	-		
<b>RCA from ascending aorta</b>	8.32 (min)	RCA(100%)	
<b>Ectopic origin from the pulmonary artery</b>	-	-	
<b>single coronary artery LSV</b>	4.82 (min)	RCA (100 %)	
<b>Origin of the LAD from RCA</b>	-		
<b>Origin of the LCX from RCA</b>	22.04 (min)	RCA(100%)	

Origin of the RCA from the LMCA	-	-	

Table no -5 CAF and dominance	Dominant
<u>coronary artery fistulae TOTAL (N-35)</u>	RCA (40%)
	LCX (57.14%)
	ND (2.56%)
LAD-PA fistula	RCA(100%)
RCA-PA fistula	RCA(100%)
RCA-RV fistula	RCA (36%) LCX (63%)
LCX-RV fistula	-
RCA-RA fistula	RCA (37.5%) LCX (62.5)
LAD -LV AND RCA- RV	LCX(100%)
RCA - RV AND LCX -RV	RCA(100%)

<b>RCA CORONARY</b>	-	LCX(100%)
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<b>Table no – 6 SITE OF DRAINAGE</b>	<b>DRAINAGE PATEINTS</b>	<b>ANOMALY PREVELENCE</b>	<b>CAV FISTULA PREVALRNCE</b>
<b>RIGHT VENTRICLE</b>	25	33.78%	71.42%
<b>LEFT VENTRICLE</b>	1	1.35%	2.85%
<b>LEFT ATRIUM</b>	-	-	-
<b>RIGHT ATRIUM</b>	8	10.81%	22.80%
<b>PULMONARY TRUNK</b>	2	2.70%	5.71%
<b>CORONARY SINUS</b>	1	1.35%	2.85%

The limitation of the study was only the patients who under went CAG for the other indication were included, rather than general population.

Conclusion.

The CAA are incidental findings in diagnostic CAG. The site and course of the coronary vessels has clinical significance as they are the risk factors for sudden cardiac death. The anomalous vessels are not resistant to CAD.

<b>Table no -7 ( Cad in origin and distribution)</b>	<b>Total number</b>	<b>Percentage %</b>
Total patients with CAAs	39	100 %
Normal coronaries/insignificant CAD	12	30.76%
Significant CAD	27	69.23%



Single vessel disease	7	17.94%
Double vessel disease	10	25.64%
Triple vessel disease	10	25.64%
LMCA involvement	-	-
Patients with CAD in anomalous vessels	25	71.79%
Patients with CAD only in normal vessels	2	5.12%
Patients with CAD only in anomalous vessels	7	17.94%

Table no - 8 (Cad in coronary artery fistulas )	Total number	Percentage %
Total patients with CAAs	35	100
Normal coronaries/insignificant CAD	6	15.78%
Significant CAD	29	82.85%
Single vessel disease	13	37.14%
Double vessel disease	12	34.28%
Triple vessel disease	4	11.42%
LMCA involvement	1	2.85%
Patients with CAD IN fistulous vessel	14	40%
Patients with CAD only in fistulous vessel	6	17.14%
Patients with CAD only in non fistulous vessel	15	42.85%

References:

1. Angelini P, Velasco JA, Flamm S. Coronary anomalies: Incidence, pathophysiology, and clinical relevance. *Circulation* 2002;105:2449-54.
2. Yamanaka O, Hobbs RE. Coronary artery anomalies in 126,595 patients undergoing coronary arteriography. *Cathet Cardiovasc Diagn* 1990;21:28-40.
3. Yildiz A, Okcun B, Peker T, Arslan C, Olcay A, Bulent Vatan M. Prevalence of coronary artery anomalies in 12,457 adult patients who underwent coronary angiography. *Clin Cardiol* 2010;33:E60-4.
4. Sohrabi B, Habibzadeh A, Abbasov E. The incidence and pattern of coronary artery anomalies in the North-West of Iran: A coronary

- arteriographic study. Korean Circ J 2012;42:753-60.
5. Harikrishnan S, Jacob SP, Tharakan J, Titus T, Kumar VK, Bhat A, et al. Congenital coronary anomalies of origin and distribution in adults: A coronary arteriographic study. Indian Heart J 2002-Jun;54:271-5.
  6. Lingaraju S, Maurya RK, Sanghvi S. A study of incidence and pattern of coronary artery anomalies in Western Rajasthan, India. Int J Res Med Sci 2016;4:3388-93.
  7. Sivakumar GS, Selvarani G, Kumar SS, Ramesh R, Hemanath TR, Manikandan D. Incidence of coronary artery anomalies among patients undergoing coronary angiography and its relevance to appropriate choice of coronary catheter selection-a tertiary care center study. Int J Sci Study 2017;5:228-31.
  8. Somashekara G. Clinical and angiographic profile of coronary artery anomalies in patients undergoing coronary angiography. J Cardiovasc Med Surg 2017;3:167-74.