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Original Article

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

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Abstract

Background: Coronary artery anomalies (CAA) are anatomical variations in coronary vessels associated with various symptoms such as angina, dyspnea on exertion, myocardial infarction (MI), and ventricular tachycardia. Primary congenital anomalies are rare. Lack of suspicion for these rare anomalies is a reason for the delay in proper management.

Aim: The aim of this study is to estimate the incidence of CAA.

Materials and Methods: This was a prospective, observational study conducted in Government Rajaji Hospital, Chennai for 1 year in patients undergoing coronary angiography.

Results: Incidence of coronary anomaly was 2.06% (32 cases) among 1547 patients. Common anomalies found were the anomalous origin of right coronary artery (RCA) from left coronary sinus (LCS) seen in 0.078% (12 cases), separate origin of left anterior descending (LAD), and left coronary artery from LCS is 0.71% (11 cases). Clinical presentation was acute segment elevation MI in 1.55 (24 cases), chronic stable angina in 0.13% 2 (cases), and unstable angina in 0.06% (1 case). In most cases, coronaries were cannulated with routine Judkins right (JR) and Judkins left (JL) catheters. Percutaneous coronary intervention was done in 7 anomalous coronary artery patients.

Conclusion: Incidence of coronary anomalies in patients undergoing angiography in our study was 2.06%. The most common anomaly found was anomalous origin of RCA from LCS followed by separate origin of LAD and left circumflex artery. For selective cannulation and intervention routine, JR and JL catheter can be used in most of the patients.

Key words: Coronary artery anomalies, Incidence, Intervention

INTRODUCTION

Coronary artery anomalies (CAAs) reflect a range of anatomical variations including the origin, course, and termination of coronary vessels, which are not associated with complex congenital heart disease. CAA have been associated with numerous symptoms, such as angina, dyspnea on exertion, ventricular tachycardia, and myocardial infarction (MI).[1-3] After hypertrophic cardiomyopathy, CAAs are considered to be the second major cause of death in young athletes.[4-8]

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Coronary angiography has led to a better understanding of CAAs, since they are frequently detected as incidental findings. However, all CAAs neither do they produce symptoms, nor do they all lead to sudden cardiac death. Nevertheless, identification of these anatomical variants is important for the appropriate management of cardiac patients.

Primary congenital coronary anomalies present with a rate of approximately 1% (range: 0.6-5.6%) in various series.

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The lack of suspicion for these rare anomalies is responsible for prolonged catheterization procedures and potential mismanagement of patients with acute cardiac disease.[9] Angioplasty in such complex lesions poses a technical challenge.[10] There have been reported cases of accidental ligation of an anomalous coronary artery during valve replacement procedures.[11-13] In the era of biventricular pacing, the electrophysiologist must be aware of the coronary anatomy, as these anomalies could be related to variations in the venous system.

In India, apart from some case reports,[14] there are no published data. Thus, the aim of the present study was to assess the incidence of CAA in patients undergoing coronary angiography and to also decide the appropriate choice of coronary catheter selection in the various common CAA that are seen in our population so as to reduce the unwanted prolongation of the procedural time, thereby reducing the amount of radiation exposure to the patient, Cath Lab Team, and the environment as a whole.

MATERIALS AND METHODS

Aim and Objectives

1. To assess the incidence of CAA in patients undergoing coronary angiography in 1 year.
2. To study clinical presentation of patients with CAA.
3. To describe the catheters that were useful in successful cannulation of the anomalous coronary arteries in relation to their origin.

Study Population

Consecutive adult patients >18 years of age undergoing coronary angiography in the Department of Cardiology, Government Rajaji Hospital, for 1 year.

Inclusion Criteria

1. Age ≥ 18 years
2. Patients for whom CAG was planned in our department, which includes acute coronary syndromes, chronic stable angina, and rheumatic heart disease (RHD) patients in 1 year.

Exclusion Criteria

1. Age < 18 years
2. Pre-existing cardiomyopathies
3. Pre-existing arrhythmias
4. Concomitant acute or chronic kidney disease.

RESULTS

In our study, incidence of coronary anomaly was found to be 2.06% (32 cases) among 1547 patients who have undergone coronary angiogram over 1 year. Various coronary anomalies found in our study is shown in Table 1 below. The most common anomalies found were:

1. Anomalous origin of right coronary artery (RCA) from left coronary sinus (LCS) in about 0.0.78% (12 cases),
2. Separate origin of left anterior descending (LAD) artery and left circumflex artery from LCS in about 0.71% (11 cases).
3. Other common anomalies found were:
   - Anomalous RCA from posterior midline 0.13% (2 cases),
   - Coronary arteriovenous fistula 0.06% (1 case),
   - Myocardial bridging 0.13% (2 cases),
   - Dual RCA 0.06% (1 case),
   - Both RCA and left coronary artery arising from common trunk from right coronary sinus 0.06% (1 case)
   - Anomalous origin of LMCA from midline 0.06% (1 case) and high origin of RCA 0.06% (1 case).
   - Clinical presentation in anomalous coronary artery patients varied.

The presentation was:

1. Acute segment elevation MI in 1.55 (24 cases),
2. Chronic stable angina in 0.13% (2 cases), and
3. Unstable angina 0.06% (1 case).

Anomalous coronary artery was present in about 0.19% (3 cases) in RHD patients as an incidental finding.

In most cases, coronaries were cannulated with routine Judkins right (JR) and Judkins left (JL) catheters. In patients with anomalous origin of coronary artery, selective engagement with Amplatz left (AL) or Amplatz right (AR) catheter was done (e.g., in patients with anomalous origin of RCA from LCS), followed by non-selective pigtail contrast injection.

Percutaneous coronary intervention was done in 7 anomalous coronary artery patients. Extra backup (EBU) catheter was used for separate origin of LAD and left circumflex artery (LCX) for PCI to LAD in 4 anterior wall MI patients, JR was used in 2 patients with inferior wall MI with anomalous right coronary from LCS and in one patient, we used EBU catheter for PCI to RCA in a patient with anomalous origin of RCA from LCS.

DISCUSSION

Variation in the origin, course, or distribution of the epicardial coronary arteries is found in 1-2% of the population. Certain types of these anomalies-including osteal lesions, passage of a major artery between the walls

Table 1: Age, sex wise distribution of coronary anomalies and catheters used for Intervention

S. No.	Age/Sex	Diagnosis	Anomaly	Catheter used	CAG	Intervention
1	54/Male	AWMI	Dominant RCA from LCS	AR 1	SVD - LAD	
2	57/Male	IWMI	Dominant RCA from LCS	Pigtail	TVD	
3	65/Male	AWMI	Separate origin of LAD and LCX from LCS	3.5 JL	TVD/SP CABG	
4	60/Male	IWMI	Dominant RCA from LCS	Tiger radial	TVD	
5	64/Male	IWMI	Dominant RCA from LCS	AL 1	SVD - RCA	PCI done with EBU
6	47/Male	AWMI	Dominant RCA from LCS	Pig tail	SVD - LAD	
7	48/Male	AWMI	Separate origin of LAD and LCX from LCS	3.5 JL	SVD - LAD	PCI done with EBU
8	52/Male	IWMI	High ostial RCA origin anteriorly	3.5 JR	SVD - RCA	
9	54/Male	RHD/MS	Separate origin of LAD and LCX from LCS and RCA AV malformation	3.5 JL	Normal	
10	40/Male	IWMI	Separate origin of LAD and LCX from LCS	Tiger radial	SVD - RCA	
11	39/Male	IWMI	Dominant RCA from LCS	3.5 JR	TVD	
12	47/Female	AWMI	Dominant RCA from LCS	3.5 JR	Min CAD	
13	43/Male	IWMI	Non Dom RCA from LCS	3.5 AL 1	SVD - LCX	
14	45/Male	AWMI	Dual RCA from RCC	3.5 JR	SVD - LAD	
15	46/Male	AWMI	Both RCA and LCA from common trunk originating in right anterior aortic sinus	3.5 JR, pig tail	Minimal CAD	
16	43/Male	UA	Dominant RCA from LCS	4 JR	DVD - LAD and RCA	PCI done with 4 JR
17	57/Male	AWMI	Separate origin of LAD and LCX from LCS	Tiger radial	TVD	
18	52/Male	Atypical pain	Separate origin of LAD and LCX from LCS	Tiger radial	Normal	
19	45/Male	CSA	LAD - Mid myo bridge	3.5 JL	Normal	
20	58/Male	RHD	Separate origin of LAD and LCX from LCS	3.5 JL	D1 - Mild disease	
21	45/Female	CSA	RSOV - NCC to RV	Pig tail	normal	
22	75/Male	IWMI	Anomalous origin from posterior and close to midline of aorta	3.5 JR	DVD - LAD and RCA	PCI done with 3.5 JR
23	44/Male	IWMI	Separate origin of LAD and LCX from LCS	3.5 JR	Normal	
24	45/Male	AWMI	Anomalous origin, posterior near midline of aorta	3.5 JR	SVD - LAD	
25	55/Female	RHD	Conus branch - Coronary artery fistula present	3.5 JR	Normal	
26	26//Male	AWMI	Anamolous origin of LM rom mid line	3.5 JR	Recanalised LAD	
27	60/Female	AWMI	Separate origin of LAD and LCX from LCS	3.5 JL	TVD	
28	45/Male	AP/WPW	Codominant RCA from LCS	5F tiger	Normal	
29	52/Male	IWMI	Dominant RCA from LCS	Pig tail	SVD - RCA	
30	24/Male	IWMI	Dominant RCA from LCS	5F tiger	SVD - RCA	PCI done with JR
31	56/Female	AWMI	Separate origin of LAD and LCX from LCS	3.5 JL	SVD - LAD	PCI done with EBU
32	46/Male	AWMI	Separate origin of LAD and LCX from LCS	3.5 JL	SVD - LAD	PCI done with EBU

AWMI: Anterior wall myocardial infarctio, IWMI: Inferior wall myocardial infarction, UA: Urinalysis, CSA: Central sleep apnea, RHD: Rheumatic heart disease, RCA: Right coronary artery, LCS: Left coronary sinus, LAD: Left anterior descending, LCX: Left circumflex artery, RSOV: Rupture of the sinus of Valsalva, JR: Judkins right, JL: Judkins left, AR: Amplatz right, AL: Amplatz left, PCI: Percutaneous coronary intervention, EBU: Extra backup, SVD: Single-vessel disease, AP/WPW: Accessory pathway/Wolf-Parkinson-White Syndrom, NCC: Non-coronary sinus, RV: Right ventricle

of the pulmonary trunk, a major coronary artery originating from the pulmonary trunk, or myocardial bridges-may produce ischemia with subsequent MI.

The incidence of coronary anomalies at routine autopsy series varies from 0.3% to 0.6%, whereas the incidence of major coronary anomalies, causing acute MI at autopsy (<35 years of age) has been reported as 4%.

Angiographically, the incidence of coronary arterial anomalies range from 0.6% to 1.55%.[15]

CONCLUSION

Incidence of coronary anomalies in patients undergoing angiography in our study was 2.06%. The most common anomaly found was anomalous origin of RCA from LCS followed by separate origin of LAD and LCX. For selective cannulation and intervention, routine JR and JL catheter can be used in most of the patients. If not possible, then either AL or AR can be used for anomalous origin of RCA from LCS. EBU catheter may also be useful in such circumstance.

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