

A CROSS SECTIONAL STUDY OF CORONARY ARTERY ANOMALIES IN CORONARY ANGIOGRAPHY PATIENTS

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ABSTRACT

Background: Coronary Artery Anomalies (CAAs) presenting in adulthood is rare and associated with adverse cardiac events, including sudden cardiac death. CAA is the second most common cause of Sudden Cardiac Death (SCD) in young athletes. Invasive coronary angiography (ICA) is a ideal diagnostic modality for CAAs.

Aim: To evaluate the incidence and pattern of coronary artery anomalies in patients undergoing Invasive coronary angiography (ICA).

Methods: This was a descriptive study design, enrolled 390 patients who underwent invasive coronary angiography during the study period. Coronary artery anatomy was evaluated for identification of coronary anomalies to predefined criteria (origin, course and termination) according to international recommendations.

Results: Out of total most of the participants were 50-60 years age group. Majority of the patients were right dominance (77%), mean value of RCA variance is 75 and the LCA variance 13.75. Incidence of coronary artery anomalies was 3.33% (13/390), "Anomalous origin RCA from left coronary sinus and Anomalous origin LCX from right coronary sinus" were the common anomalies found in our study

Conclusions: Proper knowledge of the anomalies and their clinical significance is highly important in planning treatment and easing hardships of cardiologists in dealing with them

Keywords: Invasive coronary angiography, Coronary artery anomalies (CAAs), RCA, LCA,

INTRODUCTION

Coronary artery anomalies (CAAs) are defined as a coronary pattern that is very rare among the general population. In summary, we can divide the coronary feature in two groups: (1) normal coronary anatomy, defined as any morphological characteristics seen in > 1% of unselected sample. This group also includes normal anatomical variants, defined as alternative and relatively unusual morphological feature observed in > 1% of the population; and (2) anomalous coronary anatomy, defined as morphological features found in < 1% of the population [1-2]. CAAs are a diverse group of congenital disorders, the manifestations and Pathophysiological mechanisms of which are highly variable. They are present at birth, but relatively few are symptomatic. Although generally benign in character, some coronary artery anomalies are associated with more serious clinical outcomes such as congestive heart failure, arrhythmia, myocardial infarction, syncope and sudden death [3-4]. Coronary artery anomalies include abnormalities in the origin, course or structure of the epicardial coronary arteries. Most coronary artery anomalies are discovered incidentally during coronary angiography or autopsy [5-6]. Better knowledge and early detection of coronary anomalies seems pertinent in view of the fact that they represent the underlying disease in approximately 19% of sudden cardiac death (SCD) in young athletes [7]. About 26% of coronary anomalies involve some kind of aortic root abnormality (such as bicuspid aortic valve), at least asymmetry of the aortic sinuses [8]. The commonest CAA is a separate

origin of the LAD and LCX, with an incidence of 0.41%, followed by LCX arising from the RCA, with an incidence of 0.37% [9]. Invasive Coronary Angiography (ICA) is an invasive, slightly expensive, but ideal method for assessment of CAAs because it provided adequate information about the abnormal coronary anatomy [10]. Multi-detector row CT is an alternative modality to conventional angiography in defining the ostial origin and proximal path of anomalous coronary branches [11].

Aims & objectives: In the present study, we analyzed coronary angiograms to determine the frequency and types of coronary artery origination and course anomalies in our centre.

MATERIAL AND METHODS

This descriptive study was carried out in the department of cardiology, at Ramakrishna Mission Sevashram Charitable Hospital, Vrindaban Dist. Mathura and Agra Heart Centre Hospital, Agra, India. All patients who underwent coronary angiography during the study period were enrolled in our study.

The indications for ICA were an equivocal, or non-diagnostic stress test, atypical chest pain, suspected anomalous coronary, as well as the evaluation of cardiac cause of syncope.

All patients 20-90 years of age with both genders, who provide consent for the study were included. Patients < 20 or >90 year of age, high serum creatinine level >2.0mg/dl, history of contrast allergy

and pregnant women and not willing for study were excluded

Wide ranges of data were collected as well as evaluation of medical reports in order to distinguish perception over this “Coronary Artery Variations and Anomalies”

Invasive coronary angiography (ICA) was performed by experts according to standard technique. The anomalous origin and course of coronary arteries were assessed in all patients; the angiograph were reassessed by experienced cardiologist.

Coronary artery anomalies were divided into 3 groups: anomalies of origin, anomalies of course and anomalies of termination,

By the help of coronary angiography this study evaluates the coronary artery variations and various coronary anomalies in our area.

The use of a quantitative data analysis technique will help in providing specialized training and a team-

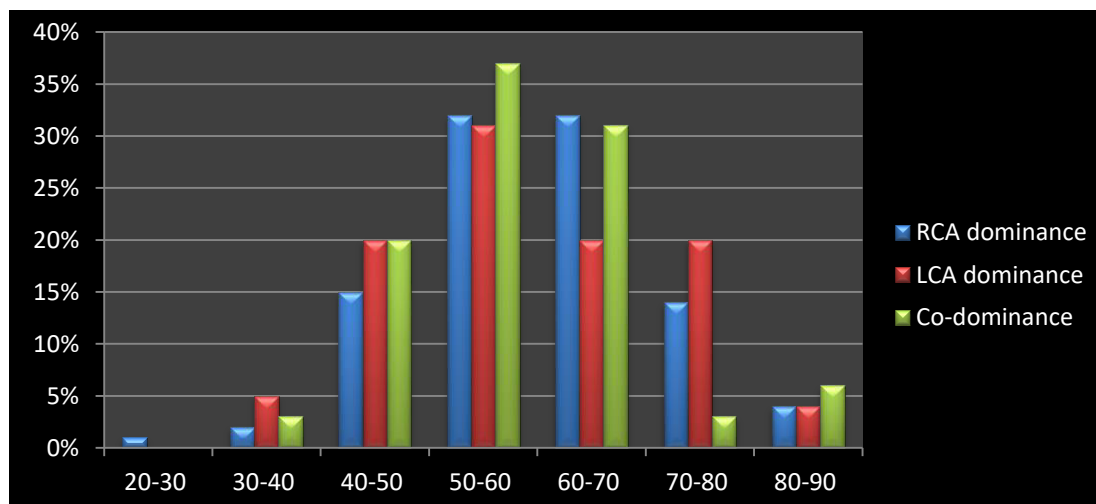
based approach that will help in performing surgical treatment of the abnormalities associated with invasive Coronary angiography

Statistical analysis: All data were analyzed by using SPSS software version 20. Frequency, percentage, Categorical values were presented with absolute and relative frequencies (%) and continuous values with mean. P value <0.05 considered statistically significant.

RESULTS

A total of 390 patients were analysed for coronary artery anomalies, out of that 32% were 50-60 year of age group. Most of them (77%) had right coronary artery dominant, mean value of RCA variance is 75 and the LCA variance 13.75 [figure: 1]. Type of dominance is decided by the origin of posterior descending artery.

Figure 1: Distribution of coronary artery dominance according to the age group



A total 13 patients are falls in the anomaly of “Coronary Artery” in this survey data. According to the first anatomy prevalence of “Anomalous origin RCA from left coronary sinus” is 53.85%, LAD & LCX the number of anatomy prevalence is around 15.38% as well as the anatomy prevalence of “Anomalous Origin RCA from Left Main Artery” variance is around 7.69%. On the other hand, the prevalence of anatomy for the first variance of “Coronary Artery” is around 1.79% among 390 patients. For the second and third variance the “prevalence of anatomy’s” value is 0.77% and 0.51% respectively. In the last variance of “coronary artery” the prevalence anatomy of 390 patients is around 0.26%.

Table 1: types of coronary anomalies seen in the study participants

Type of Coronary Anomaly	N (13)	Anatomy prevalence	Prevalence anatomy of all patients
“Anomalous origin RCA from left coronary sinus”	7	53.85%	1.79%
“Anomalous origin LCX from right coronary sinus”	3	23.08%	0.77%
“Separate origin of lad & LCX from left sinus Valsalva with absence of left main coronary artery”	2	15.38%	0.51%
“Anomalous Origin RCA From Left Main Artery”	1	7.69%	0.26%

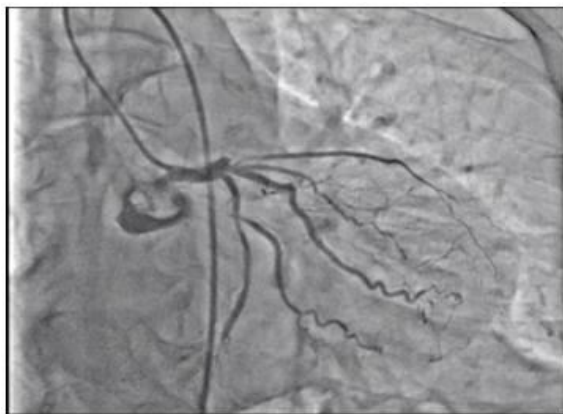


Figure 2: image showing some coronary anomalies

DISCUSSION

There are various types of coronary angiogram anomalies that people have to suffer; there are basically two types of clues that should raise suspicion in coronary anomaly. The first coronary anomaly is the “unperfused myocardium”. It is myocardial region that has not been supplied by visualized vessel. On the other hand, the aortic root sign is also a major issue. In this time a vessel that appears to cross the aorta as well as pulmonary artery at the level of the aortic root [12].

In our study majority of the participant was found right coronary artery dominance, our finding correlate with the other researchers: Mohammed Ali et al [13], brother JA et al [14] and Rafiq S et al [15] reported right coronary dominance in their study.

Present study found most of the participants were 50-60 years of age, concordance to the S. Yuksel et al [16] and Garg N et al [17].

The incidence of coronary artery anomalies in this study was 3.33%, our results comparable with other studies: Ziegler et al [18] and Narumol et al [19], reported incidence of CAAs was 3.2% and 3.7% respectively. This is much higher than earlier studies like Aydar Y, et al [20] and Pillai SB et al [21], whereas much lower than study conducted by Ghadri et al [22] and Zhang LJ et al [23], these variations may be due to possibly two factors first is inclusion of myocardial bridging in prevalence of coronary anomalies in this study and performing invasive coronary angiography allows imaging of the coronary arteries and their anomalies with very high precision. Anomalies of the coronary arteries are divided into anomalies of origin and course, anomalies of intrinsic coronary arterial anatomy. Some authors consider the multiple ostia or absent LM as normal variants, while others include it under the category of anomalous origin [24-25].

In this study, most common anomalies found were Anomalous origin RCA from left coronary sinus and Anomalous origin LCX from right coronary sinus, consistent observation seen by Villa ADM et al [26] and Filippo et al [27].

CONCLUSION:

The incidence of coronary artery anomalies was estimated at the 3.33%, predominantly patients were right coronary dominant. Invasive coronary angiography is currently regarded as the diagnostic standard for the identification and visualization of coronary artery anomalies.

Conflicts of interest: Nil

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REFERENCES

1. Angelini P, Velasco JA, Flamm S. Coronary anomalies: incidence, pathophysiology, and clinical relevance. *Circulation* 2002; 105: 2449-2454 [PMID: 12021235 DOI: 10.1161/01.CIR.0000016175.49835.57]
2. Angelini P. Coronary artery anomalies: an entity in search of an identity. *Circulation* 2007; 115: 1296-1305 [PMID: 17353457 DOI: 10.1161/CIRCULATIONAHA.106.618082].
3. Namgung J, Kim JA. The prevalence of coronary anomalies in a single center of Korea: origination, course, and termination anomalies of aberrant coronary arteries detected by ECG-gated cardiac MDCT. *BMC Cardiovasc Disord* 2014; 14:48.
4. Yamanaka O, Hobbs RE. Coronary artery anomalies in 126,595 patients undergoing coronary arteriography. *Cathet Cardiovasc Diagn* 1990;21:28-40
5. Aydar Y, Yazici HU, Birdane A, et al. Gender differences in the types and frequency of coronary artery anomalies. *Tohoku J Exp Med* 2011;225:239-47.
6. Yildiz A, Okcun B, Peker T, Arslan C, Olcay A, Bulent VM. Prevalence of coronary artery anomalies in 12,457 adult patients who underwent coronary angiography. *Clin Cardiol* 2010; 33:E60-4.
7. Maron BJ: Sudden death in young athletes. *N Engl J Med* 2003;349:1064-75
8. Young PM, Gerber TC, Williamson EE, Julsrud PR, Herfkens RJ. Cardiac imaging: Part 2, normal, variant, and anomalous configurations of the coronary vasculature. *AJR Am J*

- Roentgenol* 2011; 197: 816-826 [PMID: 21940568 DOI: 10.2214/AJR.10.7249]
9. Yurtdaş M, Gülen O. Anomalous origin of the right coronary artery from the left anterior descending artery: review of the literature. *Cardiol J* 2012; 19: 122-129 [PMID: 22461044 DOI: 10.5603/CJ.2012.0023]
 10. Hoffmann MH, Shi H, Mancke R, Schmid FT, De Vries L, Grass M, et al. Noninvasive coronary angiography with 16-detector row CT: effect of heart rate. *Radiol.* 2005 Jan; 234(1):86-97.
 11. Shi H, Aschoff AJ, Brambs HJ, Hoffmann MH. Multislice CT imaging of anomalous coronary arteries. *Eur Radiol.* 2004 Dec 1; 14(12):2172-81.
 12. Pruthi, A., Rahalkar, A. M., & Rahalkar, M. (2019). To Study Coronary Artery Stenosis on CT in Comparison with Catheter Angiography. *IJCMS*, 4, 118-23. DOI: <http://dx.doi.org/10.21276/ijcmsr.2019.4.3.27>
 13. Mohammed Ali,1 Alan Hanley,1 Eugene P McFadden,1,2 Carl J Vaughan, Coronary artery anomalies: a practical approach to diagnosis and management, *Heart Asia* 2011;8e12. doi:10.1136/ha.2010.003244
 14. Brothers JA, Stephens P, Gaynor JW, et al. Anomalous aortic origin of a coronary artery with an interarterial course: should family screening be routine? *J Am Coll Cardiol* 2008;51:2062e4
 15. Rafiq S, Mohiuddin I, Nazir I, Faizan M. Coronary anomalies and anatomical variants detected by coronary computed tomographic angiography in Kashmir, India. *Int J Res Med Sci* 2020;8:584-8
 16. Serkan Yuksel, Murat Meric, Korhan Soylu, Okan Gulel, Halit Zengin, Sabri Demircan, Ozcan Yilmaz, Mahmut Sahin, The primary anomalies of coronary artery origin and course: A coronary angiographic analysis of 16,573 patients, *Exp Clin Cardiol* Vol 18 No 2 2013
 17. Garg N, Tewari S, Kapoor A, Gupta DK, Sinha N. Primary congenital anomalies of the coronary arteries: A coronary arteriographic study. *Int J Cardiol* 2000; 74:39-46
 18. Von Ziegler F, Pilla M, McMullan L, Panse P, Leber AW, Wilke N, et al. Visualization of anomalous origin and course of coronary arteries in 748 consecutive symptomatic patients by 64-slice computed tomography angiography. *BMC Cardio Dis.* 2009 Dec;9(1):54.
 19. Chaosuwannakit N. Anatomical variants and coronary anomalies detected by dual-source coronary computed tomography angiography in North-eastern Thailand. *Polish J Radiol.* 2018;83:e372.
 20. Aydar Y, Yazici HU, Birdane A, et al. Gender differences in the types and frequency of coronary artery anomalies. *Tohoku J Exp Med* 2011;225:239-47.
 21. Pillai SB, Khan MM, Diamond A, McKeown PP. The prevalence and types of coronary artery anomalies in Northern Ireland. *Ulster Med J* 2000;69:19-22
 22. Jelena R Ghadri, Egle Kazakauskaitė, Stefanie Braunschweig, Irene A Burger, Michelle Frank, Michael Fiechter, Catherine Gebhard, Tobias A Fuchs, Christian Templin, Oliver Gaemperli, Thomas F Lüscher, Christian Schmied and Philipp A Kaufmann, Congenital coronary anomalies detected by coronary computed tomography compared to invasive coronary angiography, *Cardiovascular Disorders* 2014, 14:81
 23. Zhang LJ, Yang GF, Huang W, Zhou CS, Chen P, Lu GM: Incidence of anomalous origin of coronary artery in 1879 Chinese adults on dual-source CT angiography. *Neth Hear J* 2010, 18:466–470.
 24. Young PM, Gerber TC, Williamson EE, Julsrud PR, Herfkens RJ. Cardiac imaging: Part 2, normal, variant, and anomalous configurations of the coronary vasculature. *Am J Roentgenol.* 2011 Oct;197(4):816-26.
 25. Namgung J, Kim JA. The prevalence of coronary anomalies in a single center of Korea: origination, course, and termination anomalies of aberrant coronary arteries detected by ECG-gated cardiac MDCT. *BMC Cardio Dis.* 2014 Dec;14(1):48
 26. Adriana DM Villa, Eva Sammut, Arjun Nair, Ronak Rajani, Rodolfo Bonamini, Amedeo Chiribiri, Coronary artery anomalies overview: The normal and the abnormal, *World J Radiol* 2016 June 28; 8(6): 537-555
 27. Filippo Cademartiri, Ludovico La Grutta, Roberto Malagò, Filippo Alberghina Willem B. Meijboom Francesca Pugliese, Erica Maffei, Prevalence of anatomical variants and coronary anomalies in 543 consecutive patients studied with 64-slice CT coronary angiography, *Eur Radiol* (2008) 18: 781–791