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RELATIONSHIP BETWEEN CORONARY DOMINANCE AND CORONARY ARTERIAL DISEASE-AN ANGIOGRAPHIC STUDY

Anatomy

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ABSTRACT

Purpose: With ever increasing load of coronary arterial disease on population of developed as well as developing countries, it has become mandatory to have a detailed knowledge about coronary arteries. Since adequate literature regarding coronary arteries and its association with coronary artery disease in people living in and around puducherry is not available, a study of coronary arteries by coronary angiogram was undertaken.

Aims And Objectives: To study the dominance pattern of coronary arteries and its association with coronary artery disease

Materials And Methods: 200 adult coronary angiogram were studied during angiography.The origin of posterior interventricular artery was taken as the basis of dominance. coronary artery disease is considered significant if the stenosis is >70% in the luminal diameter of anterior interventricularartery, right coronary artery and circumflex artery.

Results: In this study, the right, left and co dominance were found to be 59%, 17.5%, and 23.5% respectively. Out of 200 subjects 112 had CAD ((56%).CAD was seen in 65.7% of patients with left dominance, 57.4% of patients with co dominance and 52.5% of patients with right dominance. The association was not statistically significant.

Conclusion: The majority of hearts are right dominant. CAD was more common in those with left dominance there was no statistically significant association between coronary dominance and coronary artery disease.a

KEYWORDS

Coronary Artery, Coronary Artery Disease, Coronarydominance, Right Dominant, Left Dominant

INTRODUCTION

The heart muscleneeds oxygen-rich blood to survive. Blood is supplied to the heart by its own vascular system, called coronary circulation. The aorta branches off into two main coronary blood vessels also called coronaryarteries. These coronary arteries branch off into smaller arteries, which supply oxygen-rich blood to the entire heart muscle.

The right coronary artery supplies blood mainly to the right side of the heart. The right side of the heart is smaller because it pumps blood only to the lungs. The left coronary artery, which branches into the left anterior descending artery and the circumflex artery, supplies blood to the left side of the heart. The left side of the heart is larger and more muscular because it pumps blood to the rest of the body.

Coronary artery disease (CAD) is a condition which affects the arteries that supply the heart with blood. It is usually caused by atherosclerosis which is a collection of plaque inside the artery walls. This collection causes the inside of the arteries to become narrower and slows down the flow of blood.

Arteriosclerotic disease of the coronary arteries may present in the following ways, depending on the rate of narrowing of the lumina of the arteries:

(1) **Angina pectoris** is cardiac pain that occurs on exertion and is relieved by rest. In this condition, the coronary arteries are narrow such that myocardial ischemia occurs on exertion but not at rest.
(2) **Myocardial Infarction** occurs when coronary flow is suddenly reduced or stopped and the cardiac muscle undergoes necrosis. Myocardial infarction is the major cause of death in industrialized nations **(Snell, 2008).**

Assessment of coronary artery disease is possible via a number of radiological techniques, including Magnetic Resonance Imaging (MRI), positron emission tomography, scintigraphy, ultrasound and invasively by coronary arteriography (which displays the anatomy and delineates their wide variations with regard to origin, course, termination and branching pattern **(Standring, 2008).**

The pattern of dominant vessel varies in different populations. The dominant pattern of heart has clinical significance. Though right dominance is more prevalent, Coronary Artery Disease (CAD) is more with those having left dominance circulation A detailed study of coronary arteries would be of use to cardiologists and interventional radiologists to predefine the abnormalities by invasive and non invasive studies. Since adequate literature regarding these details in people living in and around Puducherry is not available an attempt is made to study the coronary arteries in angiograms of adult patients.

AIM AND OBJECTIVES

1. To study the coronary dominance patterns by coronary angiogram in 200 adult patients of either gender.
2. To study the association of coronary artery dominance patterns in patients with coronary artery disease (CAD)

MATERIALS AND METHODS

This study was carried out after getting the approval from PIMS Institute Ethics Committee (IEC) Dated 3.2.12 No: IEC/RC/12/01

TYPE OF STUDY: Prospective Study
SAMPLE SIZE: 200 adult patients of either gender

INCLUSION CRITERIA:

All patients of either gender over 14 years of age who present to the Cath lab for coronary angiography for different indications were included in the study.

EXCLUSION CRITERIA:

1. Patients with any congenital heart defects.
2. Patients under 14 years of age
3. Patients who were not willing to give informed consent

PROCEDURE:

The study was carried out in the Cath lab of Department of Cardiology at Pondicherry Institute of Medical Sciences over a period of one year (February 2012 to January 2013). Written informed consent was

obtained from all the patients. The age, gender, occupation, socio demographic profile, height, weight, body mass index and personal history like diabetes, hypertension, use of drugs, smoking and addiction were noted.

In all the cases the branching pattern of coronary arteries, variations if any and the dominance pattern were identified based on the origin of Posterior Interventricular Artery.

DETERMINATION OF DOMINANCE PATTERN:

In the **right coronary dominance**, the PIVA arises from the RCA and the RCA extends past the PIVA in the atrioventricular groove, giving off one or more posterolateral branches to the inferior surface of the left ventricle. In this case, the distal part of circumflex artery (CX) is very small or absent.

In the **left coronary dominance**, the PIVA and all the posterolateral branches arise from the CX artery ; the RCA is small and terminates before reaching the crux; it does not supply any blood to the left ventricular myocardium.

In the **co dominance**, the PIVA arises from both RCA and CX artery **(Standring, 2008, Moore, Dalley and Agur, 2010 and Libby et al, 2008).**

Coronary artery disease (CAD): It is considered as significant when there is >70% stenosis in the luminal diameter of any of the following vessels in angiogram **(Hussein Ali Fakir et al 2012)**

1. Anterior interventricular artery or left anterior descending artery (AIVA/LAD)
2. Circumflex artery (CX)
3. Right coronary artery (RCA).

Total coronary occlusion is identified as an abrupt termination of the pericardia lvessel. Multiple lesions are present when three and more segments had significant lesions in the same vessel.

All the findings were tabulated and correlations were made

STATISTICALANALYSIS:

1. SPSS (Statistical Package for Social Sciences) 17.0 version for windows statistical software
2. The test of significance used was Chi Square test to compare two categorical variables and also to compare categorical variables under dichotomous variable. among the groups. p value (Probability value) less than 0.05 was considered as significant.

RESULTS AND TABLES

In the present study, the right, left and co dominance were found to be 59%, 17.5%, and 23.5% respectively.(Figure 1) Out of 200 subjects 112 had CAD ((56%).CAD was seen in 65.7% of patients with left dominance, 57.4% of patients with co dominance and 52.5% of patients with right dominance (Figure 2). The association was not statistically significant.

Figure 1: Coronary Arterial Dominance Pattern In Coronary Angiogram

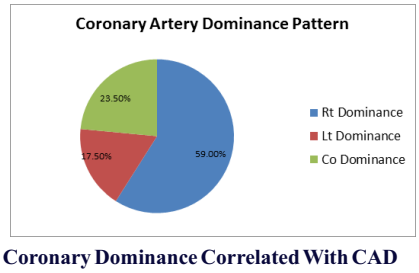
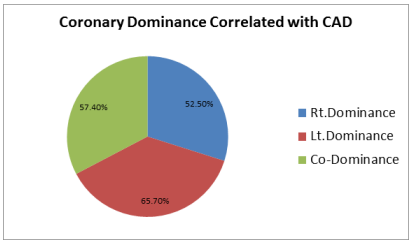


Figure 2: Coronary Dominance Correlated With CAD



Chi square test statistic=1.98; p value=0.37; statistically insignificant.

Figure 3: Coronary Angiogram Showing Stenosis Of Right Coronary Artery

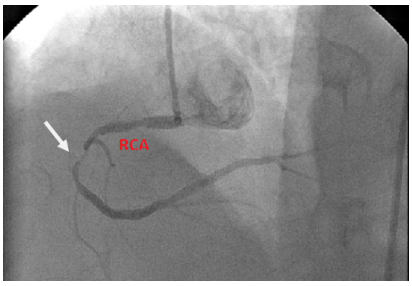


Figure 4: Coronary Angiogram Showing Stenosis Of Circumflex Artery (CX).

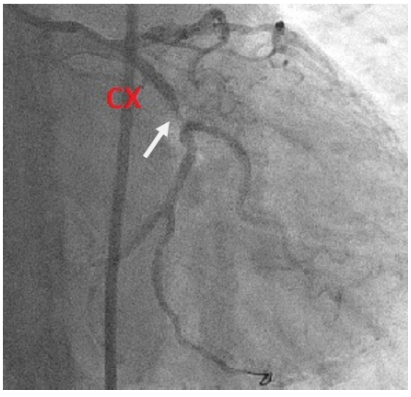
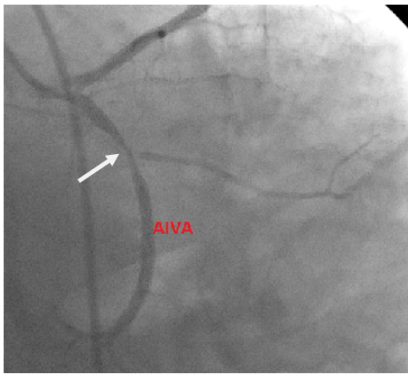


Figure 5: Coronary Angiogram Showing Stenosis Of anterior interventricular Artery(AIVA).



DISCUSSION:

The branching pattern and distribution of coronary arteries have been studied by various authors acomparision of coronary arterial dominance found by different investigators in different populations withpresent study is shown in Table 1.Among these studies majority were right dominant.

In this study CAD was seen in 65.7% of patients with left dominance, 57.4% of patients with co dominance and 52.5% of patients with right dominance. AIVA or LAD was the most commonly affected vessel irrespective of the type of dominance. (50 to 75%) . This was followed by RCA and CX artery.

Variations such as absence of LCA and origin of AIVA and CX artery from the ascending aorta by one or two ostia,, trifurcation of LCA and the presence of third coronary artery were carefully looked for but they were not seen in this study. The incidence of coronary artery anomalies are rare (1%) (Yamanakka& Hobbs, 1990) such as absence of circumflex artery, single coronary artery and coronary artery fistula. Double RCA is a very rare anomaly reported by Acet H et al.(2012). No such anomalies were seen in this study.

In the study done by Parikh, Eric J.et al (2011), persons with left or co dominance compared to right had a higher unadjusted prevalence of

cardiogenic shock and congestive heart failure. Left dominance was associated with modestly elevated odds of in-hospital mortality. Co dominance was not significantly associated with in-hospital mortality. Coronary artery dominance may be important to consider when risk stratifying patients with ACS.

More than 90% of the coronary blood flow enters the left coronary artery if it is the dominant artery, producing high shear stress at its bifurcation. A short LCA main trunk would maximize this high shear stress at its bifurcation and a study has considered this anatomic variation as a risk factor in developing coronary atherosclerosis (Gazetopoulus N, 1976)

Probably the most important limitation of this study was its relatively small patient population, which results in a comparatively small group of patients with a left dominant coronary artery circulation. Because of the small patient groups among patients with significant CAD, statistically significant difference was not observed, presumably due to insufficient power. Larger studies are needed to elucidate the relationship between significant stenosis and the dominancy of the coronary circulation.

Table 1: Comparative Frequency Of The Types Of Coronary Arterial Dominance By Different Investigators

Authors	Right dominance	Left dominance	Co-dominance
Cavalcanti (1995)	88.18%	11.82%	-
Snell RS (2008)	90%	10%	-
Moore, Dalley&Agur (2010)	67%	15%	18%
Sinnatamby (2011)	90%	10%	-
Kalpana (2003)	89%	11%	Nil
Ortale JR et al (2004)	62.5%	12.5%	25%
Kaimkhani et al (2005)	60.4%	15%	24.5%
Cardemartiri F et al (2008)	86.6%	9.2%	4.2%
Abdellah et al (2009)	77%	8%	15%
Abuchaim et al(2009)	72%	20%	8%
Kosar et al (2009)	76%	9.1%	14.8%
Hirak das et al(2010)	70%	18.57%	11.43%
Fazliogullari et al(2010)	42%	14%	44%
Bhimalli et al (2011)	60%	23.3%	16.66%
Fazlul Aziz Main et al, 2011.	60.5%	19.5%	23.3%
Hussein Ali Fakhir et al (2012)	76.4%	12.6%	10%
Present study	59 %	17.5%	29.5%

The left dominance and co dominance are variously reported by different authors. In the present study both are found to be equal in cadaveric study (8% each) but in the angiographic study co dominance was more than the left dominance (17.5% and 29.5% respectively). This finding is similar to studies by Ortale JR et al (2004) Kaimkhani et al (2005 Abdellah et al (2009), Kosar et al (2009), Fazliogullari et al(2010) and Fazlul Aziz Main et al, (2011)

CONCLUSION

The present study showed that coronary arterial dominance was not significantly different from that given in the literature. Although CAD was more common in those with left dominance there was no statistically significant association between coronary dominance and coronary artery disease. Further studies on coronary arteries in more number of angiograms of patients with CAD may give more conclusive information of the association between the two entities.

CONFLICT OF INTEREST: The authors declare that they have no conflict of interest.

AUTHOR CONTRIBUTION:

Dr. M. Sivakumar – Protocol development
Dr. S. Priyadharshini – Data collection, Data analysis, Original draft Preperation
Dr. Mark Christopher Arokiaraj - Methodology
Dr. V. Nagaguhan – Writing, Reviewing & editing

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