Section: Cardiology

Original Research Article

A STUDY OF ASSOCIATION OF CORONARY DOMINANCE WITH THE SEVERITY OF CORONARY ARTERY DISEASE

J. Jegadeesh[1], J. Nambirajan[2], D. Chakkravarthy[3], A.N. Senthil[4], D. Manikandan[5], K. Sathesh Kumar[6], P. Adhikesavan[7]

[1]Assistant Professor, Department of Cardiology, Coimbatore Medical College and hospital, Tamil Nadu, India.
[2]Professor & HOD, Department of Cardiology, Coimbatore Medical College and hospital, Tamil Nadu, India.
[3]Assistant Professor, Department of Cardiology, Coimbatore Medical College and hospital, Tamil Nadu, India.
[4]Assistant Professor, Department of Cardiology, Coimbatore Medical College and hospital, Tamil Nadu, India.
[5]Assistant Professor, Department of Cardiology, Coimbatore Medical College and hospital, Tamil Nadu, India.
[6]Assistant Professor, Department of Cardiology, Coimbatore Medical College and hospital, Tamil Nadu, India.
[7]Senior Resident, Department of Cardiology, Coimbatore Medical College and hospital, Tamil Nadu, India.

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Corresponding Author:
Dr. P. Adhikesavan,
Email: adhik72@gmail.com

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ABSTRACT

Background: In cardiac anatomy, the term "dominance" refers to the supply of the posterior descending artery (PDA). Therefore, the PDA might arise from the left circumflex artery (LCX), the right coronary artery (RCA), or both, resulting in left dominant (LD), right dominant (RD), or co-dominant (CD) anatomy, respectively. Few studies have examined the relationship between coronary dominance and coronary artery disease (CAD) severity. CAD severity is defined as single, double, or triple vessel disease based on degree of stenosis. Our study intends to identify coronary dominance trends and show a correlation between coronary dominance and the severity of CAD. **Aim:** The purpose of the study was to assess the severity of coronary artery disease based on the dominance of the coronary system. To study the relationship between the Coronary dominance pattern and its significance on patient outcome. **Methodology:** This was an observational cross-sectional study conducted based on the data obtained from the coronary angiography reports of a total of 100 patients between October 2023 and October 2024 who presented to the Department of Cardiology, Coimbatore Medical College and Hospital, Coimbatore. Patients were classified as LD (Left dominant), RD (Right dominant), or CD (Co-Dominant) as reported in the results of coronary angiograms. **Result:** Patients were 62% Right Dominant, 18% Left Dominant, and 20% Co-Dominant. A significant relation between dominance and severity of CAD was noted. Individuals with right dominance had a greater chance of developing triple-vessel disease than single-vessel and two-vessel disease. **Conclusion:** In our study, right dominance has a positive correlation with severity of coronary artery disease.

INTRODUCTION

Coronary artery disease (CAD) is one of the most common types of diseases around the world.[1] It is recognised that obesity, blood pressure, smoking, diabetes, exercise, diet, cholesterol and depression were associated with the incidence of CAD.[2] In clinical practice, the severity of coronary artery stenosis is usually evaluated by the SYNergy between percutaneous coronary intervention with TAXus and cardiac surgery (SYNTAX) score.[3] Several studies have shown that coronary artery dominance is associated with cardiovascular prognosis in patients with acute coronary syndrome.[4-7] Variation of coronary dominance includes left dominance (LD), right dominance (RD) and codominance (CD) based on the vascular supply of the posterior interventricular septum (IVS).[8,9] In the general population, RD is the most prevalent, found in approximately 70% of the population, while

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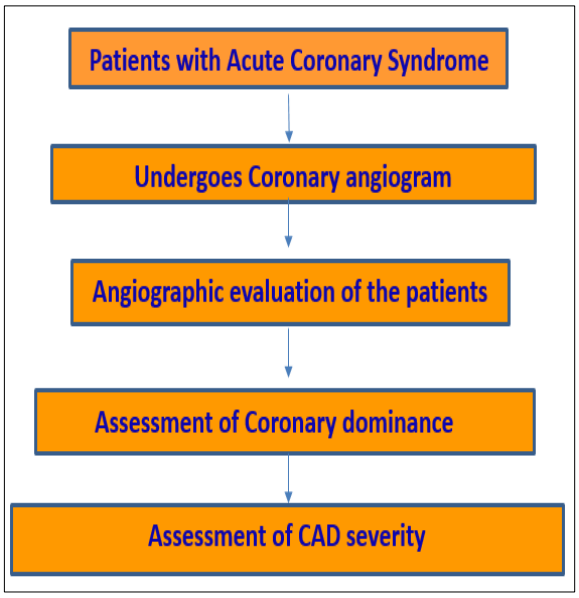
LD occurs in about 10% of cases and CD is present in 20% of cases.10 LD was found to be associated with increased long-term mortality in patients with CAD.[11,12] However, little is known about the role of RD in CAD. RD, LD and CD have a prevalence of approximately 82%–89%, 5%–12%and 3%–7%, respectively, in a hospital population.[4,13-15] There seems to have different distributions of coronary dominance between the general population and patients with CAD. Therefore, we conducted this study to investigate whether right coronary dominance was associated with CAD and its severity.

Objectives

To investigate whether coronary artery dominance is associated with the severity of coronary artery disease (CAD).

MATERIALS AND METHODS

Study Design: This was an obsevational cross-sectional study conducted based on the data obtained from the coronary angiography reports of a total of 100 patients between October 2023 and October 2024 who presented to the Department of Cardiology, Coimbatore Medical College and Hospital, Coimbatore. Patients were classified as LD (Left dominant), RD (Right dominant), or CD (Co-Dominant) as reported in the results of coronary angiograms.



Definitions

Coronary Artery Dominance: The term 'dominance' when considering coronary anatomy refers to the supply of the PDA. The PDA supplies blood to the inferior one-third of the interventricular septum and the inferior part of the left ventricle.[14] Patterns of coronary dominance were recorded as left dominant, right dominant, or co-dominant.

Coronary Artery Disease (CAD): Presence of CAD was determined by the interventional cardiologist carrying out the angiographic procedure. CAD was denoted by findings of stenosis in any of the three main coronary arteries. Stenosis less than 50% was reported as non-obstructive CAD. Obstructive CAD, however, was further categorized as a single-, double-, or triple vessel disease. Degree of obstructive occlusion as reported by at least two interventional cardiologists via visual estimation was noted as total occlusion being 100% stenosis of vessel, subtotal occlusion as 90-99% stenosis, severe stenosis as 70-89% occlusion, and moderate stenosis as 50-69% occlusion.

Study Setting: The study was conducted at the Department of Cardiology, Coimbatore Medical College and Hospital, spanning from October 2023 to October 2024.

Sample Size: A total of 100 patients were included in the study based on the inclusion and exclusion criteria.

Sampling Technique: Purposive sampling was employed to select patients meeting the inclusion criteria and excluding those with predefined exclusion criteria.

Study Population

The selection criteria included 100 patients who presented for angiographies at our tertiary care hospital between October 2023 and October 2024. Demographic and clinical data was extracted from patient reports from the cardiac catheterization laboratory. The demographic variables included sex categorized as male or female, and age at the time of angiography.

Inclusion Criteria: Patients with history, examination and ECG changes suggestive of Acute Coronary Syndrome.

Exclusion Criteria

- Patients with prior CABG
- Patients with incomplete CAG reports

Data Collection: After informed consent coronary angiogram was performed in the study population is a standard access site was either radial or femoral. The standard view of coronary angiogram study AP, RAO, LAO, caudal and cranial. The clinical data was obtained from the results of coronary angiography. It included coronary artery dominance, presence of CAD for each patient as single-, double-, or triple-vessel disease. Disease (both obstructive and non-obstructive) in the middle and proximal segments of LAD, LCX, and proximal segments of PDA and Posterior Left Ventricular Artery was included in the study, as was disease in good sized first- third Obtuse Marginal arteries (OM1, OM2, OM3), and first-third Diagonal arteries (D1, D2, D3). Patients with disease in the distal segments of LAD, LCX, small-, and fair-sized OM1, OM2, OM3, D1, D2, D3 were excluded from this study. The information collected regarding all the selected cases were recorded in a master chart.

Statistical Analysis: All statistical tests were executed via SPSS Version 23.0. A p-value of <0.05 was determined to be statistically significant. A chi-squared test of independence was computed for dominance and severity of CAD, age and severity, and sex and severity. Multinomial logistic regression

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analysis was carried out to examine a correlation between the severity of CAD with sex, age, and coronary artery dominance. The categorical variables were shown as percentages and numbers while quantitative variables were recorded as mean ± Standard Deviation (SD).

RESULTS

100 patients were studied, of which 70% were male and 30% were female. The patients ranging in age from 23 years to 85 years (interquartile range = 15) were included in the study with a mean age of roughly 53.3 years and an SD of 10.7 years. Among the patients that underwent coronary angiography, 62% were right dominant, 18% were left dominant and 20% were co-dominant. This data is detailed in Table 1. [Table 1]

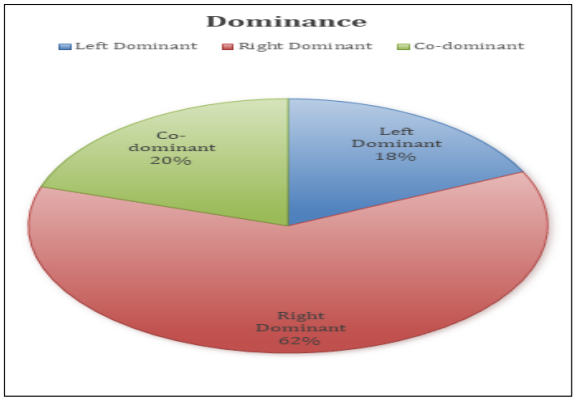

Figure 1: Distribution of Coronary artery dominance

A total of 4% of patient angiography reports showed absence of CAD. 5% had non-obstructive CAD (e.g., coronary artery ectasia, arterial wall thickening), 31% had triple-vessel disease, 24% had two-vessel disease and 36% had single-vessel disease. Details of the severity of disease in individual arteries are tabulated with percentages in Table 2. [Table 2]

To examine the relation between coronary dominance, sex, and severity/type of disease in our cohort of patients a chi-square test of independence analysis was conducted. A significant correlation between dominance and severity of disease in patients was found. Moreover, we found a significant association between sex and type (severity) of disease.

To examine the effect of the independent variables (dominance, age, and sex) on the dependent variable (type/severity of disease), a multinomial logistic regression test was utilized. The regression model was identified with triple-vessel disease as the reference category. Regression analysis showed that individuals with right dominance were less likely to develop single vessel and two vessel disease compared to triple vessel disease. Moreover, the chances of developing triple-vessel disease increased significantly with age as compared to other types of diseases. A significant relation between sex and type of disease was also found, whereby patients were more prone to mild disease such as non-obstructive CAD and absent CAD than three-vessel disease if they were female. [Table 3]

Table 1: Variables Used in the Study with their Mean Value

SEX n (%)	
Male	**70**
Female	**30**
DOMINANCE n(%)	
Left dominance	**18**
Right dominance	**62**
Co-dominance	**20**
TYPE OF DISEASE n(%)	
CAD absent	**4**
Single-vessel Disease	**36**
Double-vessel Disease	**24**
Triple-vessel Disease	**31**
Non Obstructive CAD	**5**

Table 2: Severity of Disease in Left Anterior Descending Artery (LAD), Right Coronary Artery (RCA), Left Circumflex Artery (LCX), and Ramus Intermedius, described as either Absent, Mild, Moderate, or Severe Disease, Based on Percentage Occlusion in the Respective Arteries

Vessel Name	Absent disease	Mild disease	Moderate disease	Severe disease	Subtotal Occlusion	Total Occlusion
Left Anterior descending	**27**	**3**	**13**	**41**	**3**	**13**
Left Circumflex	**47**	**3**	**13**	**26**	**5**	**6**
Right Coronary	**45**	**2**	**9**	**30**	**2**	**12**
Ramus Intermedius	**96**	**0**	**1**	**2**	**0**	**1**

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Table 3: Distribution of Obstructive (Single-, Double- and TripleVessel Disease) and Non-Obstructive Coronary Artery Disease Among Patients with Left, Right and Co-dominance.

	Severity of disease					
Dominance	**CAD absent**	**Single Vessel disease**	**Double vessel disease**	**Triple vessel disease**	**Non Obstructive CAD**	**Total**
Left Dominance	1	9	3	2	2	18
Right Dominance	2	20	14	25	2	62
Co-dominance	1	7	7	4	1	20
Total	4	36	24	31	5	100

DISCUSSION

Coronary dominance is divided into RD, LD and CD on the basis of the artery supplying the posterior descending artery. Coronary artery dominance patterns vary with different geographical areas. The coronary artery dominance pattern that we observed in our population sample was 62% right dominant, 18% Left dominant and 20% Co-dominant, with sex having no significant effect on the pattern of dominance. This is significantly different from previous literature whereby RD and LD have a general prevalence of 82-89% and 5-12% respectively, while CD is reported to have a prevalence of 3-7%.[16-18]

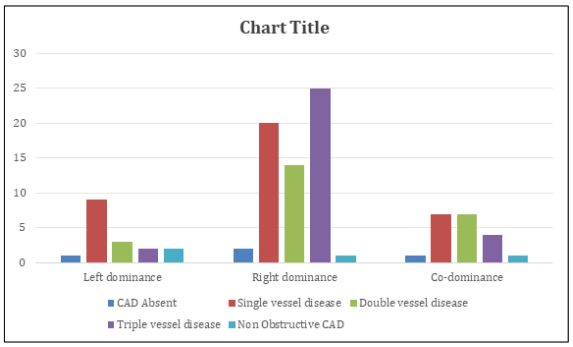

Figure 2: Coronary artery dominance and severity of CAD

In a study conducted in Islamabad, Pakistan in 2011 by Mian et al, it was found that the percentage of RD, LD and CD patients was 0.5%,19.5%, and 20%, respectively.[21] The results of our study is comparable with the above mentioned study. In another study conducted in 2020 among the Kashmiri population by Samoon et al, the pattern of dominance was 86.67%, 10% and 3.33% for RD, LD, and CD respectively.[19] Another study conducted in Nepal in 2017 reported RD, LD, and CD circulation in 85.5%, 10%, 4.5% patients, respectively.[20] The differences in patterns of coronary artery dominance may be due to a number of reasons. First, prevalence of artery dominance is likely to vary among different regions owing to differences in population characteristics including sex and ethnicity. Secondly, differences may be attributable to factors determining what proportion of the general population presents to the hospital and undergoes angiographic evaluation. However, one thing that can be said with certainty is that RD is more prevalent than either LD or CD in all reported studies.[16-18] This is in accordance with our results as well. A large-scale multi-institution research could be carried out to ascertain the differences in coronary dominance between the hospital and general population, and to map the differences in patterns among different communities as well. Our study demonstrates that increasing age has a positive correlation with severity of CAD, as would make sense, considering older age leads to greater chances of coronary events/atherosclerosis. Moreover, the present study also concluded that females are more predisposed to absent CAD and non-obstructive CAD than to severe, triple-vessel disease. This finding is in accordance with previous literature.[22]

CONCLUSION

This study showed that the prevalence of coronary dominance of the population presenting to a large tertiary hospital in the state of Tamilnadu, India. The study shows a correlation between right sided coronary artery dominance and severity of disease. The cause of this difference and association is yet to be ascertained and warrants further investigation. We further note a strong relationship between age, sex, and severity of disease.

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