

A Study of Coronary Dominance in North India- A Cadaveric Study**Zairah Jabeen¹, Arpita Mahajan², Syed Insha Saify³, Ghulam Mohammad Bhat⁴**^{1,3}Demonstrator, Department of Anatomy, Government Medical College Srinagar, J&K, India²Professor, Department of Anatomy, Hamdard Institute of Medical Science and Research, New Delhi, India⁴Professor, Department of Anatomy, Government Medical College Srinagar, J&K, India

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Conflict of interest: Nil

Abstract

Background: The term "coronary dominance" refers to the coronary artery that gives rise to the posterior descending artery (PDA) and supplies the posterior part of the interventricular septum. It's called "dominance" because it indicates which coronary artery has the predominant supply to the heart's inferior wall and posterior septum. In other words, the dominant coronary artery is the one that has the most significant influence or control over the blood supply to a particular area of the heart. This concept is important for understanding coronary anatomy, diagnosing coronary artery disease, and planning interventions like angioplasty or bypass surgery. Left-heart–dominant patients undergoing percutaneous coronary intervention have higher in-hospital mortality and are more likely to present with symptoms of heart failure, cardiogenic shock, or cardiac arrest.

Methods: Embalmed human cadaveric hearts were utilized for the study which was obtained from the Department of Anatomy, HIMSR, Jamia Hamdard University, New Delhi. The coronary arteries were traced through the epicardium and subepicardial adipose tissue.

Results: Out of 30 specimens studied in 27 (90%) specimens the posterior interventricular artery was arising from right coronary artery and in other 3 (10%) specimens it arose from Left circumflex artery. In none of the specimens studied the posterior interventricular artery was arising from both the coronary arteries

Conclusion: This study directs the attention towards the importance of cardiac dominance. The term "dominance" in this context doesn't imply superiority but rather anatomical and functional significance. Coronary dominance is important in ascertaining the distribution of coronary blood flow. Left dominance signifies more blood flow through the circumflex artery and PIVA, compared to RCA. Hence, the area of cardiac tissue being perfused by the separate arterial trunks varies.

Key words: Posterior descending artery; Posterior interventricular artery; Right Coronary artery, Myocardial infarctions, coronary artery disease.

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Introduction

Coronary Artery Diseases are one of the major causes of mortality and morbidity around the world. Recent trends also indicate that the disease has affected many young aged adults too. The incidence is increasing because of urbanization, sedentary life style, food habits and co-morbid conditions like hypertension and diabetes. [1,2] Normally the heart is supplied by two coronary arteries: right coronary artery (RCA) and left coronary artery (LCA). There is a wide variation with regard to origin, course, termination and branching pattern of coronary arteries as reported in literature. The term 'dominant' is used to refer to the coronary artery giving off the posterior interventricular artery (PIVA) which supplies the posterior part of the ventricular septum and often

part of the posterolateral wall of the left ventricle. Posterior interventricular artery (PIVA) describes the dominance of the heart. If it emerges from the right coronary artery, it is the right dominant, if it emerges from the circumflex branch of the left coronary artery, it is the left dominant and if it emerges from both left coronary artery and right coronary artery it is termed as co-dominance. [1] The heart's dominance pattern has significant clinical implications. The mortality rate for left dominance was found to be substantially greater than for right dominance and codominance in most of the studies. [2] Knowledge of coronary arterial circulation becomes essential for treating heart diseases to get better outcomes. [3] Myocardial infarctions that affect the inferior wall of the heart

are caused by ischemia and infarction. [4] Most people with left-dominant circulation are more likely to develop coronary artery disease. [5] When there is left coronary dominance, the left anterior descending artery (LAD) is often lengthy and wraps around the top of the heart, hence angiographic procedures have significant clinical importance. When the left heart is dominant over the right heart, the lesions in the LAD would be of greater clinical significance. [6] Left heart dominance was described to be a high-risk feature for percutaneous coronary intervention as well. Left heart dominant patients undergoing percutaneous coronary intervention have higher in-hospital mortality and are more likely to present with symptoms of heart failure, cardiogenic shock, or cardiac arrest. [7] This study directs the attention towards how cardiac dominance is important for anatomical understanding, coronary artery disease management, surgical planning, interventional procedures like stenting and angioplasty.

Material and Methods

Permission from the concerned ethical committee: Before conducting the study, permission was granted by the concerned ethical committee of Hamdard Institute Medical Science and Research, with the ethical approval number (HIMSR/IEC/0017/2023) dated: 11-10-2023. The study was conducted in the Department of Anatomy, Hamdard Institute of Medical Science and Research, New Delhi.

Inclusion Criteria: Embalmed human cadaveric hearts were utilized for the study which was

obtained from the Department of Anatomy, HIMSR, Jamia Hamdard.

Exclusive Criteria: The hearts in which we couldn't visualize coronary arteries were excluded from the study

Methodology:

Embalmed human cadaveric hearts were utilized for the study which were obtained from the Department of Anatomy, HIMSR, Jamia Hamdard University: New Delhi, India. The research was done on 30 human cadaveric hearts. The coronary arteries were traced through the epicardium and subepicardial adipose tissue.

Result:

The artery which was running in the Posterior interventricular sulcus (PIVS) was the PIVA. Whenever the RCA or LCx reached the crux it was seen that PIVA arose from the artery as L shaped terminal branch. Whenever the RCA or LCx crossed the crux then PIVA aroused as a side branch. The PIVA was seen supplying myocardium for varying distance and was in most of the cases ending by anastomosing with anterior interventricular artery.

Hence PIVA had varying course. Out of 30 hearts dissected, 27(90%) showed right dominance and 3(10%) showed left dominance. (Table 1, Figure 1,2). As the artery giving the PIVA branch decides the dominance, hence, in the present study the right dominance, left dominance and co dominance were found to be in 90%, 10%, and none of the specimens respectively.

Table 1: Dominance Pattern based on PIVA

Dominance	Number	Percentage
Right dominant	27	90%
Left dominant	3	10%
Total	30	100%



Figure 1: Showing Right Dominance (RCA: right coronary artery, PIVA: posterior interventricular artery)

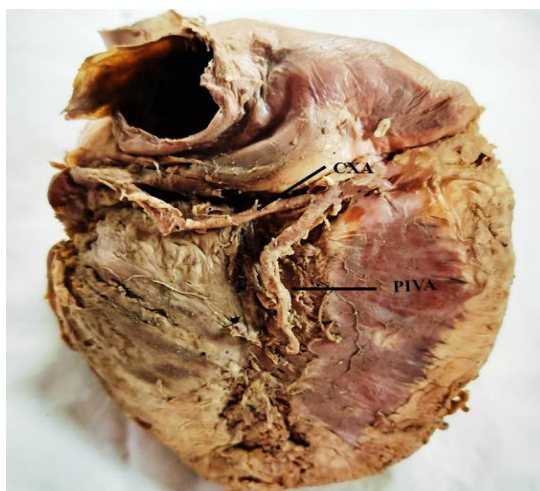


Figure 2: Showing Left Dominance (PIVA: posterior interventricular artery, CXA: circumflex artery)

Discussion

The dominance of the coronary arteries is significant clinically. It affects the left circumflex and right coronary arteries but not the left anterior descending coronary artery in terms of coronary blood flow volume. These results imply that the volume of coronary blood flow is related to the size of the myocardial perfusion region. [8] Patients with left coronary dominance have a reduced prognosis in surgical myocardial revascularization. The exact reason remains undetermined, but speculation is that there is an association with collateral circulation seen in right heart-dominant patients that is absent in left heart-dominant subjects. [9] Once a patient is diagnosed with unstable angina, non-ST elevated myocardial infarction, or ST elevated myocardial infarction, percutaneous coronary intervention (PCI) is advised. The purpose of this operation is to relieve coronary artery constriction or blockage within 90 minutes after the patient's admission to the emergency room. Angioplasty enables the localization of the coronary artery constriction and the visualization of the arteries. Once the constriction has been detected, a balloon angioplasty can be performed to expand the restricted artery and increase blood flow. [10]

The result of the present study showed that right dominance was prevalent in 27 (90%) cases and left dominance in 3 (10 %) cases among 30 cadaveric samples which was near to the studies done by Reddy, Ravi, Aricatt and Khona. [11-14] A study by Yadav et al. shows right dominance in (70%) specimens, Left dominance in (8%) specimens, and Codominance in (22%) specimens. [15] Saminathan shows Right dominance was seen in 26 (52%) hearts, left dominance in 10 (20%) hearts, and balanced or codominance was seen in 14(28%) hearts. [16] Vinitha et al. show right preponderance was seen in 31(62%) hearts, left preponderance in 11 (22%) hearts, and balanced or

codominance was seen in 8(16%) hearts. [17] Tiwari et al. revealed the right cardiac dominance was found in 42 (80.76%). [18] Barendra Kumar Raut et al. show the right coronary artery was dominant in 59.83%, with codominance in 23.14% and left dominance in 17.03%. [19] A study was done by Jegadeesh et.al, and the relation between coronary dominance, sex, and severity/type of disease was examined. 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. [20] Increasing age has also a positive correlation with severity of CAD.

Older age leads to greater chances of coronary events/atherosclerosis. Also, females are more predisposed to absent CAD and non-obstructive CAD than to severe, triple-vessel disease. [20] Though many studies by foreign authors and Indian authors show balanced co-dominance vary from 0 – 34% in present study we did not find any case with the same.

Conclusion

Coronary dominance is important in ascertaining the distribution of coronary blood flow. Left dominance signifies more blood flow through the circumflex artery and PIVA, compared to RCA. Hence, the area of cardiac tissue being perfused by the separate arterial trunks varies. Also, coronary dominance herald's coronary arterial diseases and disease outcomes. It is said that right-dominant individuals are more prone to triple vessel disease & and inferior wall myocardial infarction. Literature also states that left-dominant individuals have shown increased mortality in the post-myocardial infarction recovery period.

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Ethical consideration: IEC vide letter no. HIMSR/IEC/00172/2023 dated 11.10.2023

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