


## DOMINANCE PROFILE OF THE CORONARY ARTERY IN AMAZONAS

 <https://doi.org/10.56238/arev7n10-061>

**Submission date:** 08/09/2025

**Publication date:** 08/10/2025

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### ABSTRACT

The coronary arteries, along with their branches, supply arterial blood to the heart. Therefore, we aimed to evaluate the predominant pattern of coronary dominance in the Human Anatomy Laboratory -UEA. To assess the coronary dominance pattern, analyses were performed on 41 hearts belonging to the collection of the Human Anatomy Laboratory of the State University of Amazonas ). Data obtained at the Human Anatomy Laboratory (UEA) revealed that 81.8% of a total of 22 hearts presented the right coronary dominance pattern; 9.1% had left dominance; and 9.1% had codominance. According to the studies by Puladi et al. (2022), among 134 hearts analyzed, the percentage of right dominance was 73.1%, which exceeded left dominance (6.7%) and codominance (20.1%). This knowledge not only enriches anatomical understanding but also has significant practical implications, providing a solid foundation for improving therapeutic approaches and intervention strategies in complex cardiac contexts.

**Keywords:** Coronary Arteries. Coronary Dominance. Anatomy.

## PERFIL DE DOMINÂNCIA DA ARTÉRIA CORONÁRIA NO AMAZONAS

### RESUMO

As artérias coronárias, juntamente com seus ramos, suprem o coração com sangue arterial. Portanto, objetivamos avaliar o padrão predominante de dominância coronária no Laboratório de Anatomia Humana (UEA). Para avaliar o padrão de dominância coronária, foram realizadas análises em 41 corações pertencentes ao acervo do Laboratório de Anatomia Humana da Universidade Estadual do Amazonas. Dados obtidos no Laboratório de Anatomia Humana (UEA) revelaram que 81,8% de um total de 22 corações apresentaram o padrão de dominância coronária direita; 9,1%, dominância esquerda; e 9,1%, codominância. De acordo com os estudos de Puladi et al. (2022), entre 134 corações analisados, a porcentagem de dominância direita foi de 73,1%, superando a dominância esquerda (6,7%) e a codominância (20,1%). Esse conhecimento não apenas enriquece a compreensão anatômica, mas também tem implicações práticas significativas, fornecendo uma base sólida para o aprimoramento de abordagens terapêuticas e estratégias de intervenção em contextos cardíacos complexos.

**Palavras-chave:** Artérias Coronárias. Dominância Coronária. Anatomia.

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## PERFIL DE DOMINANCIA DE LA ARTERIA CORONARIA EN AMAZONAS

### RESUMEN

Las arterias coronarias, junto con sus ramas, irrigan el corazón. Por lo tanto, nuestro objetivo fue evaluar el patrón predominante de dominancia coronaria en el Laboratorio de Anatomía Humana (UEA). Para ello, se analizaron 41 corazones pertenecientes a la colección del Laboratorio de Anatomía Humana de la Universidad Estatal de Amazonas. Los datos obtenidos en el Laboratorio de Anatomía Humana (UEA) revelaron que el 81,8% de un total de 22 corazones presentó dominancia coronaria derecha; el 9,1%, dominancia izquierda; y el 9,1%, codominancia. Según los estudios de Puladi et al. (2022), entre 134 corazones analizados, el porcentaje de dominancia derecha fue del 73,1%, superando la dominancia izquierda (6,7%) y la codominancia (20,1%). Este conocimiento no solo enriquece la comprensión anatómica, sino que también tiene importantes implicaciones prácticas, proporcionando una base sólida para mejorar los enfoques terapéuticos y las estrategias de intervención en contextos cardíacos complejos.

**Palabras clave:** Arterias Coronarias. Dominancia Coronaria. Anatomía.

## 1 INTRODUCTION

The heart, considered the central organ of the cardiovascular system, has a complex anatomical structure composed of four main chambers: the atria, responsible for receiving blood from the body and lungs, and the ventricles, responsible for pumping blood to the pulmonary and systemic systems. Furthermore, the heart is surrounded by a network of crucial blood vessels, including the coronary arteries, which emerge from the aorta to supply oxygen and nutrients to the heart muscle. This intricate anatomical structure reflects the heart's vital role in blood circulation and maintaining metabolic homeostasis throughout the body.

Cardiac anatomy instruction is commonly conducted in medical education settings through the analysis of dissected cadaveric hearts, a practice that has been maintained over time despite its well-recognized limitations (MARESKY et al., 2018). Dissection of cadaveric hearts is challenging due to the three-dimensional complexity of cardiac structures and their intricate interrelationships. It is widely recognized that anatomical knowledge acquired during the first year of medical school does not always translate into lasting understanding (SAKAMOTO et al., 2013). However, a detailed understanding of the structure and location of the various parts of the heart is essential for professionals who diagnose and treat heart disease.

The heart begins its cardiac cycles around the third week of gestation and receives its arterial supply from the right (RCA) and left coronary arteries (LCA), which are the first branches of the aorta, according to Sakini (2022). The coronary arteries, along with their branches, are responsible for supplying arterial blood to the heart. They originate from the aortic sinuses, which are natural dilations in the aortic root, located above each aortic valve cusp, in the initial portion of the ascending aorta. The right coronary artery arises from the right aortic sinus, while the left coronary artery arises from the left aortic sinus.

The LCA forms the main left trunk with an average length of 2 to 4 cm, generally bifurcating into the circumflex artery (CA) and the anterior interventricular artery (AIV), also called the anterior descending artery. The RCA, on the other hand, frequently emerges from the right aortic sinus, presenting a length of 12 to 14 cm in its path, running through the right atrioventricular groove, emitting several branches, such as the branch to the conus, the branch of the SA NO, the right marginal branch, the branch to the AV node (80% of individuals) and the posterior interventricular branch (PIR) ( SHAIKH, 2018) .

Cardiac dominance is described by the branch of the coronary artery that gives off the posterior descending artery and irrigates the inferior wall (KASTELLANOS et al., 2018; MAHADEVAN, 2018). The posterior interventricular artery receives this name because it runs through the posterior interventricular sulcus to the apex of the heart. At the cardiac apex, a significant anastomosis between the interventricular arteries is frequently observed. The posterior interventricular artery is responsible for irrigating the posterior third of the interventricular septum, including the posterior and inferior wall of the left ventricle. The vessel most commonly originates from the right coronary artery (right dominant), the left circumflex artery (left dominant), or both (codominant) (KASTELLANOS et al., 2018).

There are several reports of coronary vessel variants described in case reports, such as an origin from the left anterior descending artery, referred to as "superdominant." It is estimated that 70 to 80% of the population has a dominant right heart, with the posterior descending artery originating from the right coronary artery. Approximately 5 to 10% of the population has a dominant left heart, with the left circumflex artery originating from the left circumflex artery, and approximately 10 to 20% is codominant, with the left circumflex artery and right coronary artery supplying the left anterior descending artery. Small branches of the dominant artery perfuse the atrioventricular node. Theoretically, decreased perfusion to the atrioventricular node can result in dysfunction, further highlighting the patient's cardiac dominance ( SHAIKH, 2018) .

However, variations in the coronary artery vascular pattern can occur, for example, in cases of sudden cardiac death. However, these patients are often asymptomatic, and these coronary anomalies are discovered incidentally during coronary angiography or autopsy after sudden cardiac death (KASTELLANOS et al., 2018). Therefore, to further explore the coronary vascular pattern and its variations, this study aims to present an analysis of the coronary artery vascular profile of 41 heart specimens, considering their anatomical characteristics and clinical and surgical implications regarding the dominance pattern when considering the origin of RIP.

## **2 CASE REPORT**

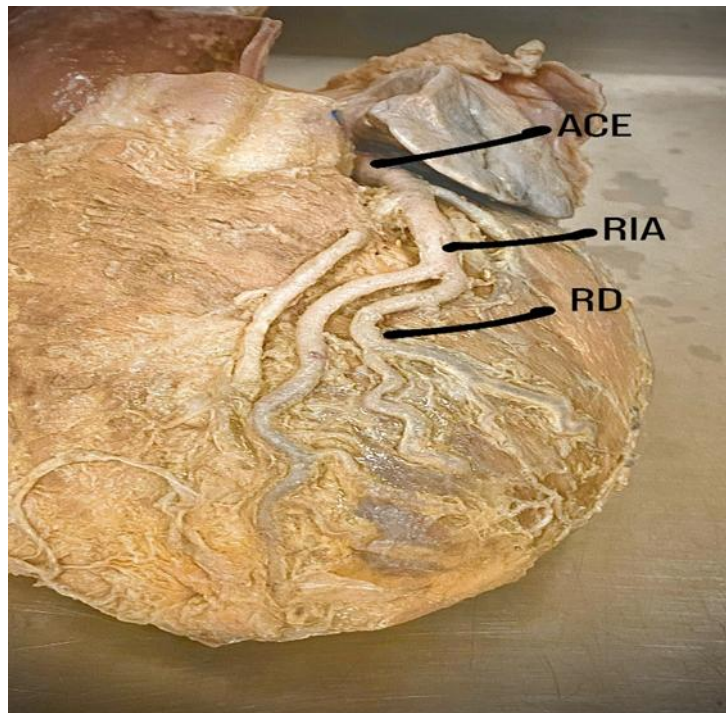
To assess the coronary dominance pattern, analyses were performed on 41 hearts from the Human Anatomy Laboratory collection at the Amazonas State University (UEA). Of this sample, 33 hearts were preserved in formaldehyde solution, and 8 hearts were plastinated. The hearts were evaluated by an experienced anatomist, and if necessary, the

coronary arteries were carefully dissected to expose their branches, with emphasis on the posterior interventricular branch (PIR).

Hearts lacking an anatomical reference for differentiation between RCA and LCA and for identification of the RIP were excluded from the study, resulting in one specimen undergoing plastination and 20 preserved in formaldehyde solution. RIP dominance was determined based on its origin from the right coronary artery (RCA) or left coronary artery (LCA), as well as cases of codominance. Thus, 18 cases of right dominance, two hearts of left dominance, and one of codominance were recorded, all of which were also formalinized.

### Figure 1

*Anterior view of the Heart and LCA.*

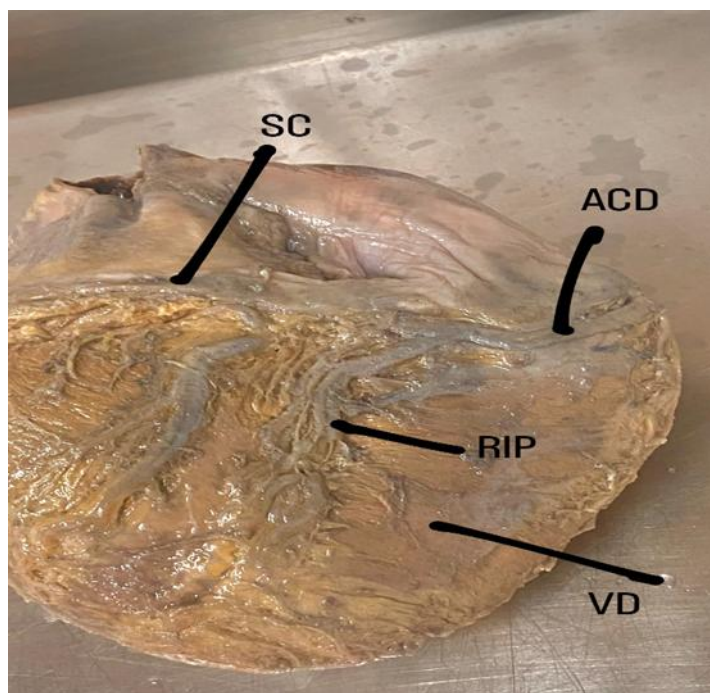


Legend: ACE- Left Coronary Artery, RIA- Anterior Interventricular Branch, RD- Diagonal Branch.  
Source: Anatomy Laboratory



**Figure 2**

*Posterior view of the Heart*



Legend: RCA- Right Coronary Artery, RIP- Posterior Interventricular Branch, RV- Right Ventricle, SC- Coronary Sinus

Source: Anatomy Laboratory

### 3 DISCUSSION

Coronary artery anomalies and variations are part of a diverse group of congenital coronary artery anatomical disorders with a significant variety of clinical manifestations. Therefore, coronary artery variants have a prevalence of at least 1% in the general population (KASTELLANOS et al., 2018).

In the meantime, there is cardiac dominance, which is described by which coronary artery gives off the posterior interventricular artery, which is also known as the posterior descending artery (PDA), since its course is along the posterior interventricular sulcus to the apex of the heart. Estimates suggest that 70 to 80% of the population has a dominant right heart, with the RIP originating from the right coronary artery (SHAHOUD et al., 2022). According to the studies by Puladi et al. (2022), among 134 hearts analyzed, it was observed that the percentage of the right-hand dominance type was 73.1%, which exceeded left-hand dominance, with 6.7%, and co-dominance, with 20.1%. Concomitantly, it is evident that the location of a possible infarction or the mitigation of perfusion depend on the subject's cardiac dominance. Patients with codominant circulation, despite presenting a stenotic lesion in the proximal left main coronary artery, still receive vascular supply from the right coronary artery,

which would reduce the risk of infarction. Therefore, it is noted that the cardiac dominance profile plays a fundamental role, not only clinically but also surgically, specifically in coronary artery bypass grafting (SHAHOUD et al., 2022).

A study conducted in northeastern Brazil showed that 52.6% of a total population of 57 cadaveric hearts had right coronary dominance; 43.6% had left coronary dominance, and only 3.5% had codominance (CLAUDINO et. al, 2023). Another study conducted in Asia, where 4,000 Indians underwent angiography, revealed that 85.5% had right coronary dominance, while 9.7% had left coronary dominance, and only 4.8% had arterial codominance (ARICATT et. al, 2023). Data obtained at the Human Anatomy Laboratory-UEA revealed that 81.8% of a total of 22 hearts had the right coronary dominance pattern; 9.1% had left dominance, and 9.1% had codominance.

An epidemiological study conducted in 2021 revealed that in Brazil, from January 2011 to January 2021, the number of hospitalizations for cardiovascular surgeries was 1,322,133, with the North region accounting for only 44,085, the lowest rate compared to other regions. (FERNANDES et. al, 2023). Several factors indicate surgery, which are based on the SYNTAX SCORE. One of the factors that generates a higher score and, consequently, a more frequent indication for surgery, is the left-hand dominance pattern. (HOLLAS et. al, 2023). The lower incidence of hearts with the left-hand dominance pattern in cadavers at the Human Anatomy Laboratory-UEA correlates closely with the low rates of cardiovascular surgery hospitalizations in the region. The high incidence of atherosclerosis and high mortality rates from acute myocardial infarction (AMI) are commonly related to the left coronary dominance pattern. (KNUUTI et. al, 2020). This fact is reflected in the mortality rates from AMI in Brazil. The northern region has the lowest percentage of deaths related to cardiovascular diseases, contributing only 8% of the national figure. (MEDEIROS et. al, 2018)

#### **4 CONCLUSION**

In summary, the detailed analysis of the coronary artery vascular profile in 20 hearts provided a deeper understanding of the organ's anatomical complexities. The identified variations, such as anomalous origins, atresia, and coronary fistulas, highlight the need for a cautious approach in clinical practice, especially in cases of sudden cardiac death. The discussion of cardiac dominance, with RIP originating predominantly from the right coronary artery, stands out as a crucial point in clinical and surgical assessment, influencing decisions in procedures such as coronary artery bypass grafting. This knowledge not only enriches

anatomical understanding but also has significant practical implications, providing a solid foundation for improving therapeutic approaches and intervention strategies in complex cardiac contexts. This study thus contributes to the continuous improvement of medical practice by offering a comprehensive view of cardiac variations and their clinical ramifications, potentially benefiting patient management and the advancement of cardiovascular research.

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