

## ORIGINAL RESEARCH

# To investigate the vascular pattern of the coronary arteries and their branches in cadavers

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### ABSTRACT

**Aim:** The purpose of the current research was to investigate the vascular pattern of the coronary arteries and their branches in cadavers in order to get a better knowledge of coronary artery disorders. **Material and Methods:** total of 55 formalin-fixed human heart specimens were obtained from the Department of Anatomy. These specimens were gathered from adults of varying ages, genders, socioeconomic backgrounds, religious affiliations, and levels of education. In order to examine the coronary artery and its branching pattern, the visceral pericardium and subepicardial fat were both taken from the heart. **Results:** This was the case in all of the hearts studied. If the main artery went through the crux, then the PIV artery was discovered to originate as a branch off of the main artery. It is termed right predominance because the PIV artery got its start from the RCA in 32 (or 58.18%) of the hearts. In 14 of the hearts (25.46%), the PIV artery originates from the circumflex artery, which is a branch of the LCA and is also termed left predominance. In nine (16.36%) of all hearts, the PIV artery originated from both the RCA and the circumflex artery. These were referred to be balanced or co-dominance structures. **Conclusion:** Arterial pattern and its variations are important to prevent false interpretation of the arterial angiograms in management of coronary artery diseases.

**Keywords:** Arteries, Branches, Coronary, Dominance

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### INTRODUCTION

Right and left coronary arteries are formed when the ascending aorta's anterior and left posterior sinuses are penetrated by blood vessel growth. There is a range of possible levels for the coronary ostia. Those in the atrioventricular groove and the interventricular groove are often profoundly sited, in contrast to the main arteries and their branches, which are typically located subepicardially.<sup>1</sup> It has been reported that the posterior inter ventricular branch branches off from the RCA in 75% of cases (right dominance), and from the LCA in 10% of cases (left dominance). After that, it goes around the back of the anterior inter ventricular branch and creates an anastomosis with the posterior inter ventricular branch in 15% of cases as balanced circulation in humans. This is the case when the circulation is considered to be normal.<sup>2,3</sup> Atherosclerosis is more likely to affect the right coronary artery and the left circumflex artery in a right dominant heart. A substantial and independent predictor of higher long-term mortality in acute

coronary syndrome is dominance on the left side of the body.<sup>4,5</sup> The word "coronary" originates from the Latin word "corona," which literally translates to "crown." The right coronary artery (RCA) and the left coronary artery (LCA) are the two coronary arteries that ordinarily supply the heart with blood and oxygen. It's common knowledge that coronary arteries may look quite different in terms of where they start, where they go, how they end, and how they branch off. There is also a significant amount of regional variance, which the conventional publications do not devote nearly enough space to addressing. Therefore, a study of the coronary arteries that is particular to a certain location would be of use to cardiac surgeons as well as radiologists in improving their ability to treat coronary heart disease.<sup>6</sup> The word "Dominance" is used to represent the degree of variability that exists in the origin of the posterior inter-ventricular artery (PIVA). Based on the origin of the posterior inter-ventricular artery (PIVA), the term "Coronary Preponderance" or "Dominance" was used to

demonstrate which coronary artery irrigates the heart's diaphragmatic surface. This was done by referring to the coronary artery as either right or left. When the PIVA originated from the RCA, this was referred to as "right dominance," and when it originated from the circumflex artery, this was referred to as "left dominance." A balanced pattern is one that originates from both the right coronary artery and the circumflex artery. In this particular investigation, the determination of dominance was made using the same criteria.<sup>6</sup> There were many other terminology utilized, such as "right," "mixed," and "left inferior."<sup>7</sup> The purpose of the current research was to investigate the vascular pattern of the coronary arteries and their branches in cadavers in order to get a better knowledge of coronary artery disorders.

**MATERIAL AND METHODS**

After receiving clearance from the protocol review committee and the institutional ethics committee, a total of 55 formalin-fixed human heart specimens were obtained from the Department of Anatomy. These specimens were gathered from adults of varying ages, genders, socioeconomic backgrounds, religious affiliations, and levels of education. In order to examine the coronary artery and its branching pattern, the visceral pericardium and subepicardial fat were both taken from the heart. The branches were manually and painstakingly dissected right up to the point where they ended. In-depth research was

conducted on the coronary artery, which provides the PIV artery and establishes the coronary predominance.

**RESULTS**

It was discovered that in hearts in which the RCA and circumflex arteries both ended at the crux, the PIV artery made an L-shaped curve and continued along the posterior interventricular sulcus. This was the case in all of the hearts studied. If the main artery went through the crux, then the PIV artery was discovered to originate as a branch off of the main artery. It is termed right predominance because the PIV artery got its start from the RCA in 32 (or 58.18%) of the hearts. In 14 of the hearts (25.46%), the PIV artery originates from the circumflex artery, which is a branch of the LCA and is also termed left predominance. In nine (16.36%) of all hearts, the PIV artery originated from both the RCA and the circumflex artery. These were referred to be balanced or co-dominance structures.

The RCA was shown to end at the right border in five of the hearts, between the right border and the crux in 12, at the crux in eight of the hearts, between the crux and the left border in thirty of the hearts, and at the left border in none of the hearts.

The circumflex artery also terminated at the right border in none of the hearts, between the right border and the crux in five, at the crux in twelve, between the crux and the left border in thirty, and at the left border in eight of the hearts.

**Table 1: Dominance pattern**

Dominance	No of Hearts=55	Percentage (%)
Right dominance	32	58.18
Left dominance	14	25.46
Balanced	9	16.36

**Table 2: Showing comparisons of dominance pattern**

Authors	Right preponderance	Left preponderance	Balanced
Schelesinger(1940) [15]	48%	18%	34%
James (1961)	90%	10%	-
Cavalcanti (1995)	69.09%	11.82%	19.09%
Bezbaruah (2003)	76%	20%	4%
Kalpna (2003) [16]	89%	11%	-
Das (2010)[14]	70%	18.57%	11.43%
Present study	58.18%	25.46%	16.36%

**DISCUSSION**

Numerous researchers in the past have looked at the branching pattern of coronary arteries as well as their distribution throughout the body. In developing nations like India, one of the most prevalent causes of mortality is coronary artery disease, which is mostly attributable to changing food choices, sedentary behaviors, smoking, and other factors. As a result of advancements in medical technology, an increased number of patients are undergoing coronary angiography as well as coronary bypass operations, balloon angioplasty, and other procedures.

The dominance of the coronary artery has significant implications for clinical practice. It has an effect on the amount of blood flow via the coronary arteries in the left circumflex and right coronary arteries, but it does not have any effect on the coronary artery in the left anterior descendent position. According to these data, the magnitude of the myocardial perfusion region seems to have a correlation with the amount of coronary blood flow.<sup>8</sup>

In situations with left coronary dominance, the left anterior descending artery (LAD) is often lengthy and wraps around the apex of the heart, feeding the majority of the myocardium. Angiographic

procedures in these kinds of cases have substantial therapeutic relevance. According to the findings of Ilija and colleagues' research, lesions in the left anterior descending (LAD) artery would have a more significant impact on clinical significance in left-dominant hearts than in right-dominant hearts.<sup>9</sup>

According to the findings of a research that was carried out by Eren and colleagues, persons who have left dominating circulation are more likely to suffer from coronary illnesses and coronary artery variants, despite the fact that right dominating circulation is more prevalent in the general population.<sup>10</sup> The research that was carried out by Vasheghani-Farahani and colleagues shows that there is a connection between the severity of angiographical CAD and the implicated vascular area as well as the dominance patterns. Those with a right-dominant heart rhythm are more likely than those with a left-dominant heart rhythm to develop three-vessel disease, which is defined as stenosis of more than 50 percent in the territories of the right coronary artery and the left circumflex artery.<sup>11</sup> According to Makarovic et al., a number of research have proven the significance of left coronary artery dominance in determining the outcome and prognosis of obstructive coronary artery disease (CAD). Therefore, it is plausible that the type of coronary artery dominance also has a role in the development of non-obstructive coronary artery disease as well as the outcomes of cases of the condition.<sup>12</sup>

According to research done by Goldberg and colleagues, the presence of left dominance is a substantial and independent predictor of higher long-term mortality in individuals who have acute coronary syndrome.<sup>13</sup> Individuals who had left dominance were shown to have a left major coronary artery that is much shorter than individuals who had right dominance in the research conducted by Murphy et al. A dominant left coronary artery system may be part of a developmental complex, as shown by the greater occurrence of aortic stenosis in patients with dominant left coronary arterial systems. If the patient additionally has concomitant coronary artery disease that is obstructive, they have an increased chance of having a myocardial infarction while undergoing surgery.<sup>14</sup> According to Loukas et al., the existence of bridges seems to be connected to coronary dominance, particularly in the left coronary circulation.<sup>15</sup> According to a research that was published by Veltman et al., having a left-dominant coronary artery system is associated with a greater risk of 30-day death and early reinfarction in patients who have had an ST-segment elevation myocardial infarction (STEMI). This is in comparison to having a right-dominant coronary artery system.<sup>16</sup> According to Das et al.'s research from 2010, the right dominant RCA often feeds the AV node. Because of this, any inferior wall infarct that is brought on by the obstruction of the RCA will have a greater risk of AV block.<sup>17</sup> In the past, a great number of studies have

been carried out by both Indian and international writers, and domination has played a role in many of these research. The majority of the investigations, including the one that we are now doing, have indicated a larger rate of right predominance. However, the research that was done by Schelesinger<sup>18</sup> in 1940 demonstrates that there is only 48% right dominance, which is lower than the results of previous studies. The current research demonstrates that the PIV artery had its start in the RCA in 32 (or 58.18%) of the hearts, thus the term "right preponderance." In 14 of the hearts (25.46%), the PIV artery came from the circumflex artery, which is a branch of the LCA and is also termed left predominance. In nine (16.36%) of all hearts, the PIV artery originated from both the RCA and the circumflex artery. The term "balanced" or "co-dominance" was used to describe them. The present study was compared to other research that had been conducted in a similar manner (Table 2). In contrast, the right dominance was found to be statistically insignificant ( $z = 0.78$ ,  $p = 0.32$ ), the left dominance was found to be statistically unimportant ( $z = 0.31$ ,  $p = 0.62$ ), and the balanced pattern was found to be statistically insignificant ( $z = 0.67$ ,  $p = 0.46$ ).

## CONCLUSION

In the treatment of coronary artery illnesses, an understanding of the arterial pattern and the changes that might occur within it is essential for avoiding errors in interpretation of arterial angiograms.

## REFERENCE

1. Williams P, Bannister LH, Berry MM, Collins P, Dyson M, Dussek JE. cardiovascular system- The arterial system. Glabella G, editor. Gray's Anatomy. The Anatomical Basis of Medicine and Surgery. 38th ed. Edinburgh, London: Churchill Livingstone. 1995;1505-10.
2. Zhou F-F, Liu Y-H, Ge P-C, Chen Z-H, Ding X-Q, Liu J-Y, et al. Coronary artery diameter is inversely associated with the severity of coronary lesions in patients undergoing coronary angiography. *Cell Physiol Biochem*. 2017;43(3):1247-57.
3. Dhobale M.R., Puranik M.G., Mudiraj N.R. Anatomical study of Right Coronary Artery and its Variations in Adult Human Cadavers: Developmental Basis and Clinical significance. *International Journal of Anatomy, Radiology and Surgery*. 2018, Oct, Vol-7(4): AO35-AO40
4. Vasheghani- Farahani A, Kassaian SE, Yaminisharif A, Davoodi G, Salarifar M. The association between coronary arterial dominance and extent of CAD in angioplasty and paraclinical studies. *Clin Anat*. 2008;519- 523.
5. Goldberg A., Southern D. Galbraith P.D., Traboulise M., Knudtson ML, Ghali WA. Coronary dominance and prognosis of patient with acute coronary syndrome. *Am Heart J*. 2007;154(6):1116-22.
6. James TN. Anatomy of the coronary arteries. New York. Paul B Hoeber. 1961;12-150

7. Hirak Das et al. A Study of Coronary Dominance in the Population of Assam. *J. Anat. Soc. India*(2010); 59(2) 187-191.
8. WVR, Alpert JS, Hagan AD. Origin of the sinu-atrial node and atrio-ventricular node arteries in right, mixed and left inferior emphasis systems. *Cathet Cardiovasc Diagn.*1975; 1(4): 361-373
9. Sakamoto, Takahashi S, Coskun AU, Papafaklis MI, Takahashi A, Saito S et al. Relation of distribution of coronary blood flow volume to coronary artery dominance: *American Journal of cardiology.* May 2013;111(10):1420-4
10. Ilija R, Rosenshtein G, Marc W J, Cafri C, Abu – Ful A, Gueron M. Left anterior descending artery length in left and right coronary artery dominance. *Coronary Artery Diseases* 2001;12(1):77-78.
11. Eren, Bayram E, Fil F, Koplay M, Sirvanci M, Duran C et al. An investigation of association between coronary artery dominance and coronary artery variations with coronary arterial disease by multidetection CT coronary angiography. *Journal of computer assisted tomography* Dec 2008: 32(6): 929-33.
12. Vasheghani-Farahani, Kassaian SE, Yaminisharif A, Davoodi G, Salarifar M, Amirzadegan A et al. The association between coronary arterial dominance and extent of coronary artery disease in angiography and paraclinical studies: *Clin Anat.* 2008 Sep;21(6):519-23.
13. Makarovic Z, Sandra Makarovic, Ines Bilic-Curcic. Sex-dependent association between coronary vessel dominance and cardiac syndrome X: a case- control study: *BMC Cardiovasc Disord.* Oct 2014:m14:142.
14. Goldberg A, Southern D, Galbraith P.D, Traboulsi M, Knudtson M.L, Ghali W A. Coronary dominance and prognosis of patients with acute coronary syndrome. *American Heart Journal* Dec 2007; 154(6): 1116- 1122.
15. Murphy ES, Rösch J, Rahimtoola SH. Frequency and significance of coronary arterial dominance in isolated aortic stenosis. *J Cardiol.* April 1977;39(4):505-9.
16. Loukas M, Brian Curry, Maggi Bowers, Robert, Louis Jr, Artur Bartzczak et al. The relationship of myocardial bridges to coronary artery dominance in the adult human heart. *Journal of Anatomy* July; 2006;209(1):43–50.
17. Veltman CE, Van der Hoeven BL, Hoogslag GE. Influence of coronary vessel dominance on short- and long-term outcome in patients after ST-segment elevation myocardial infarction. *Eur Heart J.* 2014; doi:10.1093/eurheartj/ehu236.
18. Das H, Das G, Chandradas D, Talukdar K : A Study of Coronary Dominance in the population of Assam : *Journal of Anatomical Society of India* 2010; 59(2) 187-191.
19. Schlesinger MJ. Relation of anatomic pattern to pathologic conditions of the coronary arteries. *Arch Path.* 1940;30: 403-415.