RESEARCH PAPER

Anatomical Study of Coronary Arterial Dominance Patterns, Branching Variations, and Their Clinical Significance in the Management of Coronary Artery Disease: A Cadaveric Study in Uttar Pradesh, India

Khalid Musa Fadlelmula Awadlseid[1], Danish Anwer[2], Tagreed Ahmed[3], Abuzar Abdalla[4], Muntaser Mohammed Fadoul Alhassen[5], Hamid Ansari[6*]

[1,2,3,4] Assistant Professor, Department of Human Anatomy, College of Medicine, Jazan University, Jazan, Saudi Arabia

[5] Lecturer, Department of Diagnostic Radiology, College of Applied Medical Science, Jazan University, Jazan, Saudi Arabia

[6*] Associate Professor, Autonomous State Medical College, Kanpur Dehat, Uttar Pradesh, India (Corresponding Author)

Email: hamidansari78@gmail.com

Received: 12th Mar, 2026 | **Revised:** 24th Mar, 2026 | **Accepted:** 14th Apr, 2026 | **Available Online:** 30th Apr, 2026

ABSTRACT

Background and Introduction:

Coronary artery disease remains a leading cause of mortality globally, with anatomical variations in coronary arterial dominance and branching patterns playing a significant role in determining disease severity, ischemic territory, and outcomes of interventional and surgical management. Despite growing awareness of population-specific anatomical differences, cadaveric data from central India remain limited, creating a clinically relevant evidence gap.

Methods:

A descriptive, observational, cross-sectional cadaveric study was conducted over fifteen months from October 2024 to December 2025 at the Department of Anatomy, Autonomous State Medical College, Kanpur Dehat, Uttar Pradesh. A total of 50 adult cadaveric hearts, collected from medicolegal autopsies, were systematically dissected. Dominance patterns, branching variations, morphometric measurements, and coronary anomalies were recorded using a predesigned proforma and digital vernier calipers. Data were analyzed using IBM SPSS version 23 with descriptive statistics and chi-square testing.

Results:

Right coronary dominance was the most frequent pattern, observed in 76.0 percent of specimens, followed by left dominance in 14.0 percent and co-dominance in 10.0 percent. No statistically significant gender-based difference in dominance was identified. A separate conus artery ostium was present in 36.0 percent of hearts. Ramus intermedius was identified in 22.0 percent of cases. Myocardial bridging involving a LAD segment was documented in 12.0 percent, and absent left main coronary artery with separate ostia was found in 4.0 percent of specimens. Mean LMCA diameter was 4.12 ± 0.67 mm and mean RCA length was 132.6 ± 22.1 mm.

Conclusion:

This study provides regionally relevant normative data on coronary anatomy from central India, documenting clinically significant variations in dominance, branching, and morphometry that directly inform angiographic interpretation and coronary revascularization planning in the local population.

Keywords: Coronary artery dominance, branching variations, cadaveric anatomy, coronary artery disease, morphometry

How to cite this article: Awadlseid KMF, Anwer D, Ahmed T, Abdalla A, Alhassen MMF, Ansari H. Anatomical Study of Coronary Arterial Dominance Patterns, Branching Variations, and Their Clinical Significance in the Management of Coronary Artery Disease: A Cadaveric Study in Uttar Pradesh, India. Int J Drug Deliv Technol. 2026;16(4): 840-848. DOI: 10.25258/ijddt.16.4.99

Source of support: Nil.

Conflict of interest: None

Anatomical Study of Coronary Arterial Dominance Patterns, Branching Variations, and Their Clinical Significance in the Management of Coronary Artery Disease: A Cadaveric Study in Uttar Pradesh, India

Introduction

The coronary arteries are among the most studied vessels in human anatomy, and for good reason. They are the sole suppliers of oxygenated blood to the myocardium, and even minor deviations in their origin, course, or branching pattern can carry enormous consequences for cardiac function, clinical decision-making, and surgical outcomes. Coronary artery disease (CAD) remains the leading cause of morbidity and mortality worldwide, and understanding the anatomical architecture of these vessels is not merely an academic exercise — it is a clinical necessity (Villa et al., 2016).

The human heart is typically supplied by two principal coronary arteries: the right coronary artery (RCA), arising from the right aortic sinus, and the left coronary artery (LCA), arising from the left aortic sinus. The LCA promptly divides into the left anterior descending artery (LAD) and the left circumflex artery (LCX). These vessels and their branches travel through the epicardial fat, giving off perforating branches that penetrate into the myocardium. Their distribution across the anterior, lateral, inferior, and posterior surfaces of the heart determines what territory is at risk when a blockage occurs (Kini et al., 2007).

One of the most clinically meaningful concepts in coronary anatomy is that of dominance. Coronary dominance is defined by which artery gives rise to the posterior descending artery (PDA) and supplies the posterior interventricular groove, the diaphragmatic surface of the left ventricle, and the atrioventricular node. When the RCA gives rise to the PDA, the pattern is termed right dominant, which is the most common configuration, reported in approximately 65 to 85 percent of individuals. Left dominance, where the LCX gives rise to the PDA, is seen in about 7 to 15 percent, while co-dominance — where both arteries contribute — is found in the remainder (Schlesinger, 1940; Ballesteros et al., 2011). These are not trivial anatomical footnotes. A patient with left dominant circulation who develops occlusion of the LCX faces a far greater risk of complete left ventricular failure compared to someone with right dominant circulation and the same occlusion, because the left dominant LCX also perfuses the inferior wall and posterior septum.

Beyond dominance, the coronary arteries display considerable branching variation. The conus artery, which typically arises as the first branch of the RCA, may arise directly from the aorta as a separate ostium in 30 to 50 percent of individuals, forming what is sometimes described as a third coronary artery (Pejkovic & Krajnc, 2012). The sinoatrial nodal artery arises from the RCA in roughly 55 to 60 percent and from the LCX in the remaining 40 to 45 percent. The diagonal branches of the LAD, the obtuse marginal branches of the LCX, and the acute marginal branches of the RCA all show significant variation in number, size, and territory supplied (Banerjee, 1995; Lujinović et al., 2013). An intermediate artery (ramus intermedius), arising between the LAD and LCX from the left main, is another not uncommon variation, seen in approximately 20 to 37 percent of people (Villa et al., 2016).

Rare but clinically dangerous anomalies also exist. Absence of the left main coronary artery, where the LAD and LCX arise through separate ostia directly from the left aortic sinus, has been documented, and its recognition matters during catheterization to avoid inadvertent selective engagement of only one vessel (Topaz et al., 1992). Congenital anomalies including anomalous origin of a coronary artery from the opposite sinus, coronary artery fistulae, and myocardial bridging further complicate both diagnosis and management (Ogden, 1970; Kini et al., 2007).

What makes this topic particularly important in the Indian context is that CAD in India tends to present at a younger age and often involves more diffuse disease than in Western populations. Indian patients frequently show anatomical patterns that may differ from the predominantly Western-derived normative data used in textbooks and clinical guidelines. Studies conducted on Indian cadaveric specimens have noted variation in the frequency of left dominance and have documented differences in the caliber and branching angles of major coronary trunks (Joshi et al., 2010). Yet, large-scale, institution-level anatomical studies from the Indian subcontinent, particularly from regions like Uttar Pradesh, remain relatively sparse. This creates an evidence gap that has direct implications for how cardiologists and cardiac surgeons in the region interpret angiographic findings, plan percutaneous coronary interventions, and approach coronary artery bypass grafting.

Understanding these patterns is not just anatomically fascinating — it shapes real decisions. The choice of which graft conduit to use, where to place a stent, how to interpret an angiogram with unusual branch takeoffs, and how to anticipate watershed zones of ischemia all depend

on a solid grasp of coronary anatomical variability. As interventional cardiology and cardiac surgery continue to advance in India, regional anatomical data from studies like the one presented here will become increasingly important in tailoring approaches to the local population.

This study aimed to investigate and document the patterns of coronary arterial dominance, branching variations, and morphometric characteristics in human cadaveric hearts, and to analyze their clinical significance in the context of coronary artery disease diagnosis and management.

Methodology

Study Design

This study was conducted as observational cross-sectional study.

Study Site

The study was carried out in the Department of Anatomy at Autonomous State Medical College, Kanpur Dehat, Uttar Pradesh.

Study Duration

The study was conducted over a period of fifteen months, from October 2024 to December 2025.

Sampling and Sample Size

A purposive sampling method was employed to collect cadaveric hearts from adult human bodies subjected to routine medicolegal autopsies at the study site. A total of 50 hearts were collected during the study period. The sample size was determined based on feasibility within the available institutional cadaveric material while maintaining quality and rigor in dissection and data recording. Both male and female adult cadavers were included to allow gender-based comparisons, with the age range estimated from autopsy records. Only hearts obtained from adults aged 18 years and above were considered for inclusion. Sample size adequacy was considered satisfactory given that comparable cadaveric studies in the literature have worked within similar ranges (Lujinović et al., 2013; Ballesteros et al., 2011).

Inclusion and Exclusion Criteria

Included in the study were hearts obtained from adult cadavers of both sexes aged 18 years and above, where the coronary arteries were grossly intact, adequately perfused with formalin-based fixative, and morphologically suitable for detailed dissection and measurement. Hearts that showed prior surgical intervention such as coronary artery bypass grafting, significant post-mortem autolytic changes that rendered vessels indistinguishable, gross congenital malformations unrelated to coronary anatomy, or severe atherosclerotic calcification that made vessel tracing impossible were excluded from the study to ensure data accuracy and reliability.

Data Collection Tools and Techniques

Data were collected through systematic macroscopic dissection of each cadaveric heart using standard dissection instruments. The epicardial fat was carefully removed to expose the coronary arteries and their branches. Dominance pattern was determined by identifying the origin of the posterior descending artery. Branching points, number and origin of major branches, and presence of anomalies were documented. Morphometric measurements of vessel lengths and external diameters were taken using a digital vernier caliper accurate to 0.01 mm. Photographic documentation was done using a standardized digital camera setup. A predesigned proforma was used to record all observations uniformly.

Data Management and Statistical Analysis

All collected data were entered into Microsoft Excel and transferred to IBM SPSS Statistics version 23 for analysis. Descriptive statistics including frequency, percentage, mean, and standard deviation were used to summarize continuous and categorical variables. Chi-square test was applied to assess associations between dominance patterns and gender. Independent samples t-test was used for comparing morphometric measurements between groups. A p-value of less than 0.05 was considered statistically significant. Data entries were double-checked for accuracy before analysis to minimize entry errors.

Ethical Considerations

Ethical clearance for the study was obtained from the Institutional Ethics Committee of Autonomous State Medical College, Kanpur Dehat, prior to the commencement of data collection. All cadaveric material was handled with respect and dignity in accordance with institutional guidelines. No patient-identifiable data were recorded, and the study involved no human experimentation. Proper body disposal protocols were followed after specimen study.

Results

Table 1: Distribution of Coronary Arterial Dominance Patterns (n = 50)

Dominance Pattern	Number of Hearts	Percentage (%)
Right Dominant	38	76.0

Dominance Pattern	Number of Hearts	Percentage (%)
Left Dominant	7	14.0
Co-dominant	5	10.0
Total	50	100.0

Table 1: Distribution of Coronary Arterial Dominance Patterns (n=50)

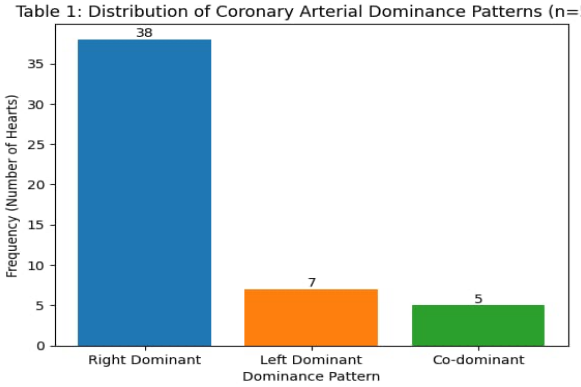


Table 2: Gender-wise Distribution of Coronary Dominance Patterns (n = 50)

Dominance Pattern	Male (n = 31)	Female (n = 19)	Chi-square	p-value
Right Dominant	23 (74.2%)	15 (78.9%)		
Left Dominant	5 (16.1%)	2 (10.5%)	0.521	0.771
Co-dominant	3 (9.7%)	2 (10.5%)		

Table 2: Gender-wise Distribution of Coronary Dominance Patterns

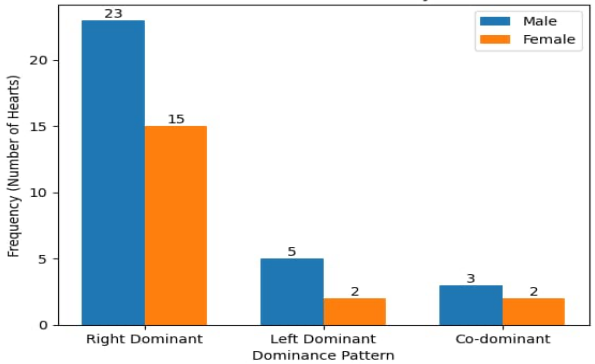


Table 3: Branching Variations of the Right Coronary Artery (n = 50)

Variable	Number of Hearts	Percentage (%)
Origin of Conus Artery		
From RCA as first branch	30	60.0
Separate ostium from aorta	18	36.0
Absent / indistinct	2	4.0
Origin of Sinoatrial Nodal Artery		
From RCA	27	54.0
From Left Circumflex (LCX)	23	46.0
Number of Acute Marginal Branches		
Single	14	28.0
Two	25	50.0
Three or more	11	22.0
AV Nodal Artery Origin		
From RCA	38	76.0
From LCX	7	14.0
Shared / co-dominant	5	10.0

Table 3: Branching Variations of the Right Coronary Artery (n=50)

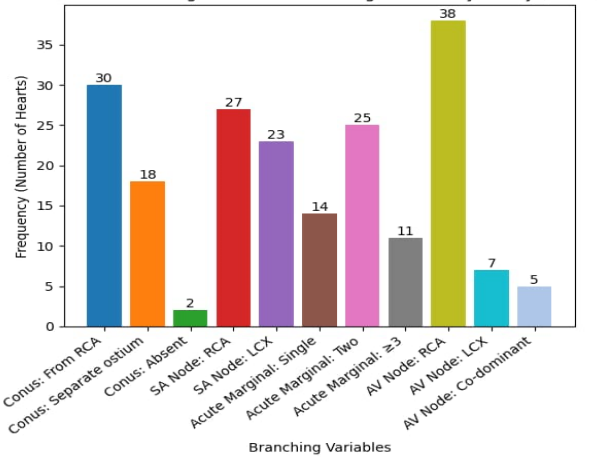


Table 4: Branching Variations of the Left Coronary Artery (n = 50)

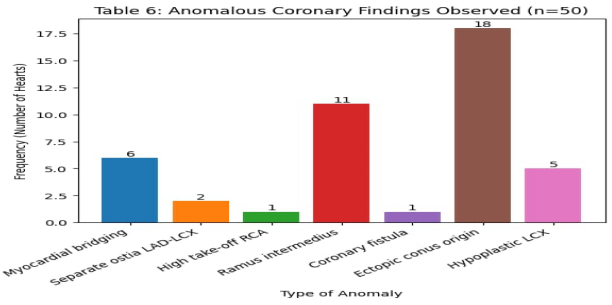
Variable	Number of Hearts	Percentage (%)
Diagonal Branches of LAD		
Single diagonal	15	30.0
Two diagonals	24	48.0
Three or more diagonals	11	22.0
Ramus Intermedius (Intermediate Artery)		
Present	11	22.0
Absent	39	78.0
Obtuse Marginal Branches of LCX		
Single	16	32.0
Two	22	44.0
Three or more	12	24.0
Left Main Coronary Artery Length		
Short (< 10 mm)	12	24.0
Moderate (10-20 mm)	32	64.0
Long (> 20 mm)	6	12.0

Table 5: Morphometric Measurements of Major Coronary Arteries (n = 50)

Coronary Artery	Mean Length (mm) ± SD	Mean External Diameter (mm) ± SD	Min Diameter (mm)	Max Diameter (mm)
Left Main Coronary Artery (LMCA)	12.4 ± 3.2	4.12 ± 0.67	2.8	5.9
Left Anterior Descending (LAD)	115.3 ± 18.6	2.89 ± 0.54	1.7	4.3
Left Circumflex Artery (LCX)	89.7 ± 16.4	2.61 ± 0.48	1.4	3.9
Right Coronary Artery (RCA)	132.6 ± 22.1	2.94 ± 0.59	1.6	4.6

Table 6: Anomalous Coronary Findings Observed (n = 50)

Anomaly / Variation	Number of Hearts	Percentage (%)
Myocardial bridging (LAD segment)	6	12.0
Separate ostia of LAD and LCX (absent LMCA)	2	4.0
High take-off of RCA above sinotubular junction	1	2.0
Ramus intermedius (intermediate artery)	11	22.0
Coronary artery fistula	1	2.0
Ectopic origin of conus artery (separate ostium)	18	36.0
Hypoplastic LCX in right dominant hearts	5	10.0



Discussion

The present study, conducted on 50 cadaveric hearts at Autonomous State Medical College, Kanpur Dehat, documented right coronary dominance in 76.0 percent of specimens, left dominance in 14.0 percent, and co-dominance in the remaining 10.0 percent (Table 1). These findings are consistent with the classical description by Schlesinger (1940), whose foundational work on dominance patterns established right dominance as the predominant configuration in the majority of human hearts. Subsequent studies have confirmed this distribution across diverse populations. Ballesteros et al. (2011) reported right dominance in approximately 72.8 percent of their specimens, which closely mirrors the current findings. Similarly, Lujinović et al. (2013) found right dominance in 77.5 percent of hearts studied, a value nearly identical to the present series. In the Indian context, Joshi et al. (2010), working on cadaveric specimens from central India, reported right dominance in approximately 70.2 percent of cases, suggesting some regional variation within the Indian subcontinent but a broadly similar trend. The left dominance rate of 14.0 percent seen in the current study is consistent with international reports and reflects population-level variation that is characteristic of the study region.

The clinical weight of dominance patterns cannot be understated. In right dominant individuals, occlusion of the RCA can compromise both the inferior wall of the left ventricle and the interventricular septum's posterior third, directly threatening AV nodal perfusion. In the 14.0 percent of hearts with left dominance seen here, a proximal LCX occlusion carries catastrophic consequences because it simultaneously jeopardizes the lateral, inferior, and posterior walls of the left ventricle — a territory that would be non-ischemic in a right dominant heart with the same occlusion. Kini et al. (2007) emphasized that failure to recognize coronary dominance before angiographic interpretation or percutaneous intervention can lead to underestimating the territory at risk, with potentially fatal outcomes.

No statistically significant gender difference in dominance pattern was observed in the present study ($p = 0.771$, Table 2), which aligns with the findings of Lujinović et al. (2013), who also found no significant gender-based variation in dominance distribution, though male and female hearts did show differences in vessel caliber and morphometric parameters.

The conus artery, classically described as the first branch of the RCA, originated as a separate aortic ostium in 36.0 percent of the current specimens (Table 3). This figure falls within the range of 30 to 50 percent reported in the literature (Pejkovic & Krajnc, 2012), and has direct procedural importance. When the conus artery arises from a separate aortic ostium, it effectively constitutes a third coronary artery, and inadvertent selective cannulation during coronary angiography can give a false impression of complete left coronary visualization while this vessel remains unevaluated. Banerjee (1995) had drawn similar attention to the clinical implications of variant origins of the first RCA branch in terms of angiographic completeness.

The sinoatrial nodal artery was found to arise from the RCA in 54.0 percent and from the LCX in 46.0 percent of hearts (Table 3), which is in broad agreement with published ranges. Pejkovic and Krajnc (2012) reported a 55 to 60 percent RCA origin in their series, while other authors have reported slightly higher rates of LCX origin. This variation carries significance in cardiac surgery, particularly during mitral valve operations and posterior pericardial dissection, where inadvertent injury to an LCX-origin SA nodal artery can result in postoperative sinus node dysfunction or atrial fibrillation.

Two diagonal branches of the LAD were the most commonly observed pattern (48.0%), followed by a single diagonal (30.0%) and three or more (22.0%) (Table 4). These figures compare well with data from Loukas et al. (2010), who found two diagonal branches to be the most frequent configuration. A ramus intermedius was present in 22.0 percent of current specimens, consistent with reports ranging from 20 to 37 percent in international literature (Villa et al., 2016). This intermediate artery, when present, acts as an additional large lateral wall supplier. Its presence and size must be recognized before left heart catheterization or coronary bypass surgery, as it may represent the dominant source of supply to the high lateral wall of the left ventricle. Left main coronary artery (LMCA) length was between 10 and 20 mm in the

majority (64.0%), with a short LMCA seen in 24.0 percent. A short LMCA significantly increases the technical difficulty of left main stenting and carries higher risk of inadvertent coverage of LAD or LCX ostia during intervention (Kini et al., 2007).

Morphometric data (Table 5) revealed that the LMCA had a mean external diameter of 4.12 ± 0.67 mm and mean length of 12.4 ± 3.2 mm. The RCA was the longest vessel at 132.6 ± 22.1 mm with a mean diameter of 2.94 ± 0.59 mm, while the LCX had the smallest mean diameter at 2.61 ± 0.48 mm. These values correspond well with morphometric data reported by Lujinović et al. (2013), who found the LMCA diameter in their series to range between 3.8 and 5.2 mm. Joshi et al. (2010) similarly noted that Indian cadaveric hearts tended to show slightly smaller vessel calibers compared to Western reports, which may partly explain the greater severity and earlier onset of hemodynamic compromise in Indian CAD patients given equivalent degrees of stenosis. Vessel caliber directly influences the selection of stent diameter and graft conduit during revascularization, and anthropometric population-specific normative data such as those generated in this study are thus operationally relevant.

Table 6 documents a range of anomalous and clinically significant variations. Myocardial bridging of a LAD segment was identified in 12.0 percent of specimens, a rate consistent with cadaveric study findings ranging from 5 to 25 percent reported in the literature (Baştuğ et al., 2010; Nasr et al., 2012). Bridging causes systolic compression of the tunneled vessel segment and has been associated with exercise-induced ischemia, ventricular arrhythmia, and sudden cardiac death, particularly in younger individuals and athletes. The absence of a left main coronary artery, with separate LAD and LCX ostia, was observed in 4.0 percent of hearts. Topaz et al. (1992) reported that this anomaly is frequently unrecognized during catheterization when only one of the two separate ostia is selectively engaged, leading to an incomplete angiographic study with potentially serious consequences for management planning. A high take-off of the RCA was seen in 2.0 percent of cases, which, while rare, poses technical challenges during engagement with standard coronary catheters. Coronary artery fistulae, identified in 2.0 percent, represent connections between the coronary arteries and cardiac chambers or the pulmonary circulation, and can produce steal phenomena and myocardial ischemia even in the absence of obstructive atherosclerosis (Ogden, 1970). Hypoplastic LCX was documented in 10.0 percent of right dominant hearts, a finding that, while anatomically expected in extreme right dominance, can mislead interpreters who expect symmetrical caliber between the LAD and LCX on angiography.

Taken together, the findings of this study add a regionally relevant dataset to the body of anatomical knowledge on coronary artery variations and reinforce the argument that accurate knowledge of these patterns is indispensable for safe and effective management of coronary artery disease.

Conclusion

This study of 50 cadaveric hearts at Autonomous State Medical College, Kanpur Dehat demonstrated that right coronary dominance is the predominant pattern in the regional population, with notable frequencies of left dominance and co-dominance that carry distinct clinical implications. Significant branching variations were documented across all major coronary vessels, including a high prevalence of separate conus artery ostia, ramus intermedius, and myocardial bridging. Morphometric data established regional normative values. These findings collectively underscore that a thorough understanding of coronary anatomical variability is essential for accurate angiographic interpretation and safe coronary interventions.

Recommendations

Coronary anatomy education in undergraduate and postgraduate medical curricula should incorporate regional cadaveric data to reflect population-specific variations. Cardiologists and cardiac surgeons practicing in central India should be familiar with the rates of separate conus artery origin and myocardial bridging documented in this study. Future research should expand sample sizes and incorporate imaging-based studies alongside cadaveric dissection to validate anatomical findings in living patients.

References

- Ballesteros, L. E., Ramirez, L. M., & Quintero, I. D. (2011). Right coronary artery anatomy: Anatomical and morphometric analysis. Revista Brasileira de Cirurgia Cardiovascular, 26(2), 230–238. https://doi.org/10.5935/1678-9741.20110040
- Banerjee, A. (1995). Variations in the origin of the marginal branches of the right coronary

artery. Clinical Anatomy, 8(4), 289–293. https://doi.org/10.1002/ca.980080409

- Baştuğ, S., Güneş, Y., Gümrükçüoğlu, H. A., Tuncer, M., & Guntekin, U. (2010). Myocardial bridging and its association with coronary artery disease: A review. Anadolu Kardiyoloji Dergisi, 10(6), 490–496. https://doi.org/10.5152/akd.2010.140
- Díaz-Gutiérrez, I. J., Gómez-Morales, A., Gutiérrez-Díez, J. F., Bustamante-Munguira, J., Llano-Cardenal, M., & Alocen-Villacampa, A. (2013). Anatomical and morphological study of the origin of the posterior interventricular artery in cadavers. Interactive CardioVascular and Thoracic Surgery, 17(3), 460–465. https://doi.org/10.1093/icvts/ivt228
- Gaur, S., Bezerra, H. G., Lassen, J. F., Christiansen, E. H., Tanaka, K., Jensen, J. M., & Nørgaard, B. L. (2013). Fractional flow reserve derived from coronary CT angiography: Variation of repeated analyses. Journal of Cardiovascular Computed Tomography, 8(4), 307–314. https://doi.org/10.1016/j.jcct.2014.06.002
- Joshi, S. D., Joshi, S. S., & Athavale, S. A. (2010). Origins of the coronary arteries and their significance. Clinics, 65(1), 79–84. https://doi.org/10.1590/S1807-59322010000100012
- Kini, S., Bis, K. G., & Weaver, L. (2007). Normal and variant coronary arterial and venous anatomy on high-resolution CT angiography. American Journal of Roentgenology, 188(6), 1665–1674. https://doi.org/10.2214/AJR.06.0540
- Loukas, M., Groat, C., Khangura, R., Owens, D. G., & Anderson, R. H. (2009). The normal and abnormal anatomy of the coronary arteries. Clinical Anatomy, 22(1), 114–128. https://doi.org/10.1002/ca.20761
- Loukas, M., Sharma, A., Blaak, C., Sorenson, E., & Mian, A. (2010). The clinical anatomy of the diagonal artery. Clinical Anatomy, 23(5), 597–604. https://doi.org/10.1002/ca.20979
- Lujinović, A., Kulenović, A., Kapur, E., & Prevljak, S. (2013). Differences in morphometric characteristics of the left coronary artery and its branches between the male and female heart. Medical Archives, 67(1), 10–14. https://doi.org/10.5455/medarh.2013.67.10-14
- Mishra, A., & Pandya, N. (2013). A cadaveric study of the morphology of coronary arteries in Indian hearts. Journal of Anatomical Sciences, 21(2), 13–18.
- Motwani, J. G., & Topol, E. J. (1998). Aortocoronary saphenous vein graft disease: Pathogenesis, predisposition, and prevention. Circulation, 97(9), 916–931. https://doi.org/10.1161/01.CIR.97.9.916
- Muriago, M., Sheppard, M. N., Ho, S. Y., & Anderson, R. H. (1997). Location of the coronary arterial orifices in the normal heart. Clinical Anatomy, 10(5), 297–302.
- Nasr, A. Y., Saleh, H. A., & Basyouni, A. H. (2012). Myocardial bridges and their association with coronary artery anomalies: A cadaveric study. Folia Morphologica, 71(4), 206–215.
- Ogden, J. A. (1970). Congenital anomalies of the coronary arteries. American Journal of Cardiology, 25(4), 474–479. https://doi.org/10.1016/0002-9149(70)90296-5
- Pejkovic, B., & Krajnc, I. (2012). Clinical anatomy of the conal artery. Journal of International Medical Research, 40(4), 1300–1312. https://doi.org/10.1177/147323001204000408
- Reig, J., & Petit, M. (2004). Main trunk of the left coronary artery: Anatomic study of the parameters of clinical interest. Clinical Anatomy, 17(1), 6–13. https://doi.org/10.1002/ca.10150
- Saidi, H., Ongeti, W. K., & Ogeng'o, J. (2010). Morphology of human coronary artery dominance and implications for cardiovascular disease. African Health Sciences, 10(4), 377–381.
- Schlesinger, M. J. (1940). Relation of anatomic pattern to pathologic conditions of the coronary arteries. Archives of Internal Medicine, 76(1–6), 1–10. https://doi.org/10.1001/archinte.1940.00190130009001
- Shetty, S. D., Nayak, B. S., Kumar, M. N., Abhinitha, P., Sirasanagandla, S. R., & Somayaji, S. N. (2013). Morphometric study of left coronary artery and its clinical implications.

Online Journal of Health and Allied Sciences, 12(3), 1–4.

- Topaz, O., DiSciascio, G., Cowley, M. J., Nath, A., Soffer, A., Goudreau, E., & Vetrovec, G. W. (1992). Absent left main coronary artery: Angiographic findings in 83 patients with separate ostia of the left anterior descending and circumflex arteries at the left aortic sinus. American Heart Journal, 124(3), 616–622. https://doi.org/10.1016/0002-8703(92)90266-P
- Villa, A. D. M., Sammut, E., Nair, A., Rajani, R., Bonamini, R., & Chiribiri, A. (2016). Coronary artery anomalies overview: The normal and the abnormal. World Journal of Radiology, 8(6), 537–555. https://doi.org/10.4329/wjr.v8.i6.537
- Yamanaka, O., & Hobbs, R. E. (1990). Coronary artery anomalies in 126,595 patients undergoing coronary arteriography. Catheterization and Cardiovascular Diagnosis, 21(1), 28–40. https://doi.org/10.1002/ccd.1810210110