

Morphological Variation and Dimensions of the Left Coronary Artery: A Cadaveric Study

Abdoulaye Kanté^{1,2*}, Tata Touré², Mamadou Diakit³, Mamadou Simpara², Demba Yatera², Mamadou Almamy Keita¹, Sadio Yena⁴, Nouhoum Ongoïba¹

¹Department of Surgery “B”, CHU du Point G, Faculty of Medicine and Odontostomatology of Bamako, Bamako, Mali

²Anatomy Laboratory of the Faculty of Medicine and Odontostomatology, University of Science, Technology and Engineering of Bamako, Bamako, Mali

³Department of Cardiology, CHU du Point G, Faculty of Medicine and Odontostomatology of Bamako, Bamako, Mali

⁴Department of Thoracic Surgery, Mali Hospital, Faculty of Medicine and Odontostomatology of Bamako, Bamako, Mali

Email: *kanteim@yahoo.fr

How to cite this paper: Kanté, A., Touré, T., Diakit, M., Simpara, M., Yatera, D., Keita, M.A., Yena, S. and Ongoïba, N. (2026) Morphological Variation and Dimensions of the Left Coronary Artery: A Cadaveric Study. *Forensic Medicine and Anatomy Research*, 14, 37-43.

<https://doi.org/10.4236/fmar.2026.143004>

Received: April 5, 2025

Accepted: June 22, 2026

Published: June 25, 2026

Copyright © 2026 by author(s) and Scientific Research Publishing Inc. This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

Abstract

Background: Coronary arteries play an important role in cardiac tissue perfusion. Variations or abnormalities of the coronary arteries can be asymptomatic, while some can be symptomatic and even lead to sudden death. Knowledge of coronary artery variations is important for the diagnosis and treatment of cardiovascular diseases. **Purpose:** To describe variations of the left coronary artery. **Materials and Methods:** We dissected and macroscopically examined 31 human hearts to describe variations in the origin and course of the left coronary artery. **Results:** The mean external diameters of the left coronary artery trunk, left anterior descending artery, and circumflex artery were 4.34 ± 2.01 mm, 4.1 ± 0.2 mm, and 3.8 ± 0.3 mm, respectively. The mean length of the left coronary artery trunk was 15 ± 1 mm, with a range of 9 and 26 mm. The mean length of the left anterior descending artery and the circumflex artery was 118.2 ± 6.4 mm and 87.2 ± 8.2 mm, respectively. The left coronary artery trunk was long in 100% of cases. The left coronary artery trunk was bifurcated in 17 cases (54.8%), trifurcated in 14 cases (45.2%). **Conclusion:** Knowledge of normal anatomy and coronary artery variants is essential and imperative for diagnosis, treatment, and stent placement during coronary angiography.

Keywords

Left Coronary Artery, Variation, Branching Pattern, Left Anterior Descending Artery, Circumflex Artery

1. Introduction

The heart is supplied by two coronary arteries (left and right) and their branches, located in the coronary sulci. The right and left coronary arteries arise from the aortic sinus, at the root of the aorta, and surround the base of the ventricles like a crown [1]. The left coronary artery is responsible for supplying most of the left ventricle and a significant portion of the right ventricle [2]. It lies between the pulmonary trunk and the left atrium, opening into the atrioventricular sulcus, where it turns to the left. Reaching the atrioventricular sulcus, the left coronary artery generally divides into two main branches: the left anterior descending (LAD) artery and the circumflex (CA) artery [3].

Knowledge of normal anatomy and variants, as well as anomalies of the coronary circulation, is an important element in the management of congenital and acquired heart diseases. This knowledge is important because these variations have anatomical, pathophysiological, diagnostic, and therapeutic implications.

The term “anomaly” refers to variations that occur in less than 1% of the general population [4] [5]. The left coronary artery exhibits great morphological variability. The study of coronary arteries is useful to cardiovascular surgeons, cardiologists, and radiologists to predefine anomalies using invasive and non-invasive examinations [5].

Extensive data on coronary artery variations in the Western population have been reported. In Mali, there is very little data on the morphological variation and dimensions of the left coronary artery and its branches. We therefore initiated this study to determine the variations of the left coronary artery and its branches in the Malian population.

2. Methodology

This was a descriptive observational study conducted in the anatomy laboratory of the Faculty of Medicine and Odontostomatology at the University of Science, Technology, and Engineering of Bamako (USTTB).

In this study, we collected thirty-one fresh cadaveric hearts, regardless of age or sex, between December 2020 and June 2024.

The thoracic cavity was opened by median sternotomy (**Figure 1**). The great vessels were ligated between two sutures and then divided between them. The parietal pericardium was incised in an inverted T shape (**Figure 2**). The heart and great vessels were removed from the pericardial cavity. The aorta and pulmonary trunk were excised above the semilunar valves. With gradual separation and retraction of the myocardial bundles, the coronary arteries and their branches were dissected from the surface of the heart, within the atrioventricular and interventricular sulci. Upon collection, the hearts were placed in plastic jars containing plain water. The epicardium was removed by microdissection, and the coronary arteries were observed. The left coronary artery was carefully dissected to avoid injury to the small branches. The number of terminal branches of the common coronary artery trunk was recorded.



Figure 1. Vertical median sternotomy.

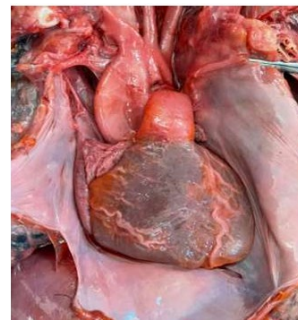


Figure 2. Anterior view of the opening of the fibrous pericardium showing the heart and large vessels.

In cadavers, in situ dissection of the left coronary artery and its branches involved careful removal of all tissue, particularly fascia, surrounding the blood vessels. Once the left coronary artery and its branches were fully exposed, the identification of the branching vessels and their relative position to key anatomical landmarks in situ were documented. Signs of vascular variations or abnormalities were recorded. The external diameters at the starting point of these branches were measured using a millimeter ruler. All data were initially recorded manually on data sheets and then transferred to Microsoft Office Excel 2007 for analysis. The dissected vessels and their branches were also photographed using a telephone camera. Graphs and tables were generated with Microsoft Office Excel 2007.

All statistical analyses were performed with the assistance of the Department of Public Health and Epidemiology, Faculty of Medicine and Odontostomatology, University of Sciences, Techniques, and Technologies of Bamako. Data are presented as mean \pm standard deviation. Statistical analysis was performed using the Statistical Package for the Social Sciences version 16.0.0 for Windows. The normality of the sample data was checked using the Shapiro-Wilk W test, with a significance level of 5%. Parametric analysis was performed on normally distributed variables.

3. Results

In all 31 hearts, the dissected left coronary artery originated from the left posterior aortic sinus of the ascending aorta (**Figure 3**). As shown in **Table 1**, the mean external diameter and trunk length of the left coronary artery were 4.34 ± 2.01 mm and 15 ± 1 mm, respectively. The mean diameter of the left anterior descending artery was 4.21 ± 0.28 mm and its mean length was 118.2 ± 6.4 mm. The mean diameter of the circumflex artery was 3.8 ± 0.3 mm and its mean length was 87.2 ± 8.2 mm.

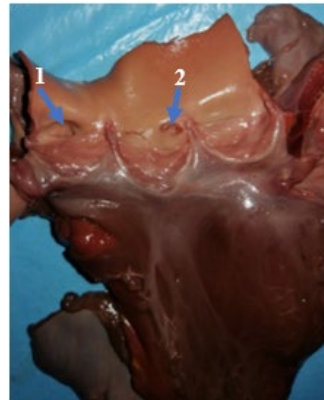


Figure 3. Anterior view showing the origin of the left coronary artery from the anterior superior aortic sinus. 1—Ostium of the left coronary artery; 2—Ostium of the right coronary artery.

Table 1. Mean diameter and mean length of the left coronary artery and its branches.

Name of the artery	Diameter (in mm)	Length (in mm)
Common trunk of the left coronary artery	4.34 ± 2.01	15 ± 1
Anterior descending artery	4.1 ± 0.2	118.2 ± 6.4
Circumflex artery	3.8 ± 0.3	87.2 ± 8.2
Total	31	31

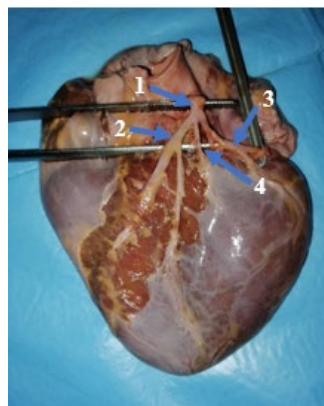


Figure 4. Anterior view of the heart showing the bifurcation of the left coronary artery into the left anterior descending artery and the circumflex artery. 1—Left coronary artery trunk; 2—Left anterior descending artery; 3—Circumflex artery.

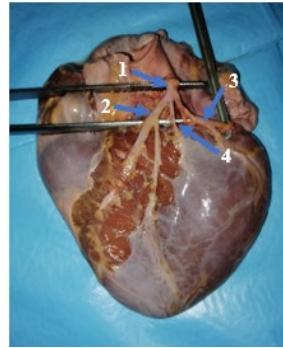


Figure 5. Anterior view of the heart showing the trifurcation of the left coronary artery trunk. LCA: Left coronary artery, LVA: Left anterior descending artery, MA: Median or diagonal artery, CXA: Circumflex artery. LV: Left ventricle. 1—Left coronary artery trunk; 2—Left anterior descending artery; 3—Circumflex artery; 4—Diagonal artery.

After its origin, the left coronary artery trunk extends for a short distance before dividing mainly into the left anterior descending (LAD) and the circumflex (Cx) arteries. The most common division is a bifurcation into two terminal branches: the LAD and the Cx (**Figure 4**). The third branch arising from the left coronary artery trunk, other than the left anterior descending (LAD) and the circumflex artery, is called the intermedius (diagonal) ramus, observed at the trifurcation of the left coronary artery (**Figure 5**). The left coronary artery trunk was bifurcated in 17 anatomical subjects (54.8%), trifurcated in 14 anatomical subjects (45.2%).

4. Discussion

Currently, with the use of advanced diagnostic imaging techniques and the development of non-aggressive treatments, a thorough knowledge of normal coronary anatomy, its variations, and its anomalies is essential. Coronary artery branches can vary in terms of origin, distribution, number, and size. Coronary artery origins show great variability, with approximately 90% of anomalies involving origin anomalies [6]. We observed in 31 hearts the presence of three semilunar valves and the origin of the left coronary artery from the left posterior aortic sinus. Similar observations were reported by Kalpana RA [7], James [8], Sahni *et al.* [9], and Kulkarni J [10]. The left coronary artery is the main source of blood supply to the heart [2] [3]. Kalbfleisch and Hort [11] conducted a study of the area supplied by each coronary artery using postmortem angiography.

They showed that the left coronary artery supplied 68.8% of the cardiac muscle mass and 79% of the left ventricular muscle mass.

Therefore, obstructive coronary artery disease can reduce coronary flow to a large portion of the ventricular myocardium, which is why arteriosclerotic disease of the left coronary artery leads to more serious complications than that of the right coronary artery [11].

Bhele *et al.* [12] reported that when the left coronary artery trunk is less than 5 mm, it is considered short, and when it is greater than 15 mm, it is long. In the present study, the left coronary artery trunk was long in 100% of cases. The mean

length of the left coronary artery trunk was 15 ± 1 mm with extremes of 9 and 26 mm.

These results differ from those reported by Reig and Petit [2] who found a mean length of 10.8 mm.

RA [7] observed that the length of the left coronary artery trunk ranged from 6 mm to 15 mm. The study conducted by Kulkarni *et al.*, [10] revealed that the length of the left coronary artery trunk was 5 mm in 76.7%, compared to 10 mm in 5% of cases. Waller and Schlant [13] observed a length of the left coronary artery trunk of 6 mm in 76% of cases and 10 mm in 3% of cases. Banchi [14] observed a length of the left coronary artery trunk less than 5 mm in 2% of cases. Fox *et al.* [15] found the length of the left coronary artery trunk to be less than 6 mm in 36% of cases and greater than 20 mm in 5% of cases in a coronary angiographic series. Reddy and Pusala [16] reported that the left coronary artery trunk measured between 1 and 25 mm before dividing into the left anterior descending artery and the circumflex artery. The circumflex artery measured between 10 and 13 cm in length and the left anterior descending artery measured between 6 and 8 cm. In the current study, the mean diameter of the left anterior descending artery and the circumflex artery was 4.1 ± 0.2 mm and 3.8 ± 0.3 mm, respectively, with extremes of 2 and 5 mm for the left anterior descending artery and 2 and 6 mm for the circumflex artery. The mean length of the left anterior descending artery and the circumflex artery was 118.2 ± 6.4 mm and 87.2 ± 8.2 mm, respectively, with extremes of 73 and 160 mm for the left anterior descending artery and 33 and 143 mm for the circumflex artery.

Dattatray D *et al.*, [17] reported that the mean length of the left anterior descending artery and the circumflex artery was 85 ± 25.2 mm and 45.6 ± 19.9 mm, respectively.

5. Conclusion

The high variability of the left coronary artery and its branches has anatomical, pathophysiological, diagnostic, and therapeutic implications. Adequate knowledge of these variations is essential for the interpretation of coronary angiograms, stenting procedures, and surgical myocardial revascularization.

Ethical Approval

Ethical approval for this research was granted by the Ethics and Research Committee of the Faculty of Medicine and Odontostomatology of the University of Sciences, Techniques, and Technologies of Bamako.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] Williams, P.L., Bannister, L.H. and Berry, M. (1995) Gray's Anatomy. 38th Edition,

- Churchill Livingstone, 1016-1018.
- [2] Reig, J. and Petit, M. (2003) Main Trunk of the Left Coronary Artery: Anatomic Study of the Parameters of Clinical Interest. *Clinical Anatomy*, **17**, 6-13.
<https://doi.org/10.1002/ca.10162>
 - [3] Gatzoulis, M.A. (2008) Heart and Great Vessels. In: Standring, S., Ed., *Gray's Anatomy: The Anatomical Basis of Clinical Practice*, 40th Edition, Churchill Livingstone, 978-980.
 - [4] Angelini, P. (1989) Normal and Anomalous Coronary Arteries: Definitions and Classification. *American Heart Journal*, **117**, 418-434.
[https://doi.org/10.1016/0002-8703\(89\)90789-8](https://doi.org/10.1016/0002-8703(89)90789-8)
 - [5] Alarming Statistics from India (2013).
<http://neocardiabcare.com/alarming-statistics-india.htm>
 - [6] Garg, N., Tewari, S., Kapoor, A., Gupta, D.K. and Sinha, N. (2000) Primary Congenital Anomalies of the Coronary Arteries: A Coronary Arteriographic Study. *International Journal of Cardiology*, **74**, 39-46.
[https://doi.org/10.1016/s0167-5273\(00\)00243-6](https://doi.org/10.1016/s0167-5273(00)00243-6)
 - [7] Kalpana, R. (2003) A Study of Principal Branches of Coronary Arteries in Humans. *Journal of the Anatomical Society of India*, **52**, 137-140.
 - [8] James, T.N. (1961) Anatomy of the Coronary Arteries. Paul B Hoeber, Inc. Medical Division of Harper and Brothers, 12-38.
 - [9] Sahni, D. and Jit, I. (1989) Origin and Size of the Coronary Arteries in the Northwest Indians. *Indian Heart Journal*, **41**, 221-228.
 - [10] Kulkarni, J. (2013) Variant Anatomy of Coronary Arteries. *Heart India*, **1**, 46-51.
<https://doi.org/10.4103/2321-449x.118582>
 - [11] Kalbfleisch, H. and Hort, W. (1977) Quantitative Study on the Size of Coronary Artery Supplying Areas Postmortem. *American Heart Journal*, **94**, 183-188.
[https://doi.org/10.1016/s0002-8703\(77\)80278-0](https://doi.org/10.1016/s0002-8703(77)80278-0)
 - [12] Bhele, A.V., Ughade, H.M., Shaikh, S., et al. (2017) A Study of Course, Branches and Variations of the Coronary Arteries in the Human Cadaveric Heart. *International Journal of Contemporary Medical Research*, **4**, 1533-1537.
 - [13] Waller, B. and Schlant, R. (2011) Anatomy of Heart. Hust's the Heart. 13th Edition, The McGraw-Hill Companies, Inc., 2500.
 - [14] Banchi, A. (1904) Morfologia delle arteriae coronariae cordis. *Archivio Italiano Di Anatomia E Di Embriologia*, **3**, 7-164.
 - [15] Fox, C., Davies, M.J. and Webb-Peploe, M.M. (1973) Length of Left Main Coronary Artery. *Heart*, **35**, 796-798. <https://doi.org/10.1136/hrt.35.8.796>
 - [16] Reddy, D.M.V. and Pusala, D.B. (2016) Anatomical Variations in Branching Pattern and Dimensions of Coronary Arteries: A Cadaveric Study from South India. *IOSR Journal of Dental and Medical Sciences*, **15**, 21-28.
<https://doi.org/10.9790/0853-1508062128>
 - [17] Dattatray, D.D., Takkallapalli, A., Purushottam, A.G., et al. (2012) Clinically Relevant Morpho-Metric Analysis of Left Coronary Artery. *International Journal of Biological & Medical Research*, **3**, 1327-1330.