

Original Research Paper

A cadaveric study on variations in the branching pattern of left coronary artery

Authors:

Dr Shihash P M¹, Dr Geetha Jayachandran².^{1,2}: Assistant Professor, Department of Anatomy, Government Medical College, Kollam, Kerala.

Corresponding Author: Dr Shihash P M, Department of Anatomy, Government Medical College, Kollam, Kerala.

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ABSTRACT:

Variations in the branching pattern of left coronary artery are very common. This study aimed to determine the variations in the branching pattern of Left Coronary Artery. Variations in the branching pattern of left coronary artery (LCA) are important for the interventional cardiologist and cardiothoracic surgeons. **Materials and Methods:** The material for present study comprised of 50 hearts taken from cadavers and preserved specimens, with no sex or age discrimination. Left coronary artery was dissected in accordance with the procedure detailed in Cunningham's manual. The branching pattern of Left coronary artery was studied in detail and variations were documented. **Results:** Out of the: 50 specimens, 37(74%) cadaveric hearts showed bifurcation of Left Coronary Artery into Left Anterior Descending (LAD) and Left Circumflex (LCX) arteries. In 12(24%) specimens LCA trifurcated into LAD, LCX and Ramus intermedius. In 1(2%) specimen LCA quadrifurcated into LAD, LCX, first diagonal, and left obtuse marginal artery. **Conclusion:** Knowledge of variations in the branching pattern of left coronary artery have utmost significance in life saving interventional procedures

Keywords: Left coronary artery, Left anterior descending artery, Left circumflex artery, Ramus intermedius, First diagonal artery

INTRODUCTION:

Arterial supply of heart is performed by right and left coronary arteries. Left coronary artery arise from the left posterior aortic sinus and right coronary artery arise from the right aortic sinus of ascending aorta. After its origin left coronary artery passes between the left auricle and pulmonary trunk and usually divides into left anterior descending artery and left circumflex artery. Left anterior descending artery passes through the anterior interventricular groove along with the great cardiac vein, reaches the apex of heart, winds around the inferior border and usually ends at distal part of the posterior interventricular sulcus. It gives diagonal branches to supply anterolateral wall of left ventricle and septal branch which supply the interventricular septum. Left circumflex artery passes initially through the left anterior part of coronary sulcus, then winds the left margin of heart and reaches the posterior part of coronary sulcus, it gives 2-3 obtuse marginals and left posterolateral branch and supplies lateral and posterolateral walls of left ventricle. Variations in the branching pattern of left coronary arteries are very common. Hence this study was conducted to determine the variations in the branching pattern of left coronary artery. Knowledge on the variations of left coronary artery is very important for the interventional cardiologist and cardiovascular surgeons

Objectives

To estimate proportion of anatomical variations in the branching pattern of left coronary artery.

MATERIAL AND METHODS:

The material for the present study comprised of 50 hearts taken from cadavers and preserved specimens, with no sex or age discrimination which were used for the routine undergraduate dissection in the Department of Anatomy, Government Medical college, Kollam. Left coronary artery was dissected in accordance with the procedure detailed in Cunningham's manual. The pericardium was stripped and the subepicardial fat was removed and the left main coronary artery was exposed. The branches of the left coronary artery were dissected manually, and the variations were documented

Observations:

Left coronary artery (LCA) arose from the left posterior aortic sinus in all specimens. Then it passed between the pulmonary trunk and left auricle and divided into branches. Out of the 50 specimens (Table-1), 37(74%) cadaveric hearts showed bifurcation of Left Coronary artery into Left Anterior Descending (LAD) and Left Circumflex (LCX) arteries. Other types of bifurcation of LCA were not found. In 12(24%) specimens LCA trifurcated into LAD, LCX and Ramus intermedius (FIG-1). In 1(2%) specimen LCA quadrifurcated into LAD, LCX, first diagonal, and left obtuse marginal artery (FIG-3). In one case with Trifurcation, the Ramus intermedius bifurcated into

two branches immediately after its formation (FIG-2), one branch of Ramus intermedius had course like

the right diagonal and other had similar course as that of first obtuse marginal.

	Branching pattern of Left Coronary Artery (LCA)	Total=50
1	Bifurcation of LCA	37 (74%)
2	Trifurcation of LCA	12(24%)
3	quadrifurcation of LCA	1(2%)
4	Pentafurcation of LCA	0

Table-1 Variations in the branching pattern of Left Coronary Artery

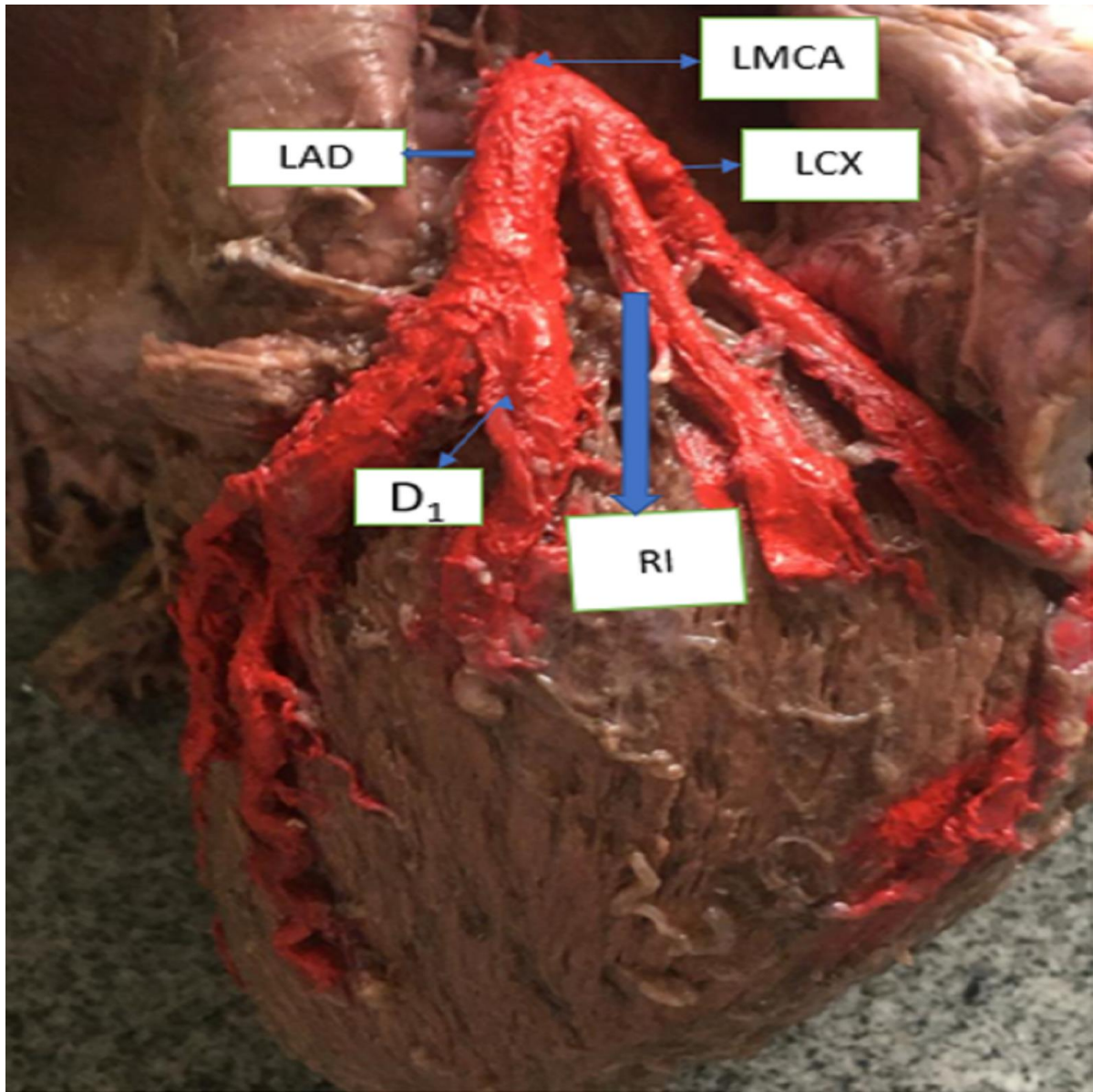


FIG-1 Photograph shows Trifurcation of Left Coronary Artery into Left anterior descending artery, Left circumflex and Ramus intermedius (LAD- Left coronary artery, LCX- Left circumflex artery, RI- Ramus intermedius, D₁-First diagonal artery)

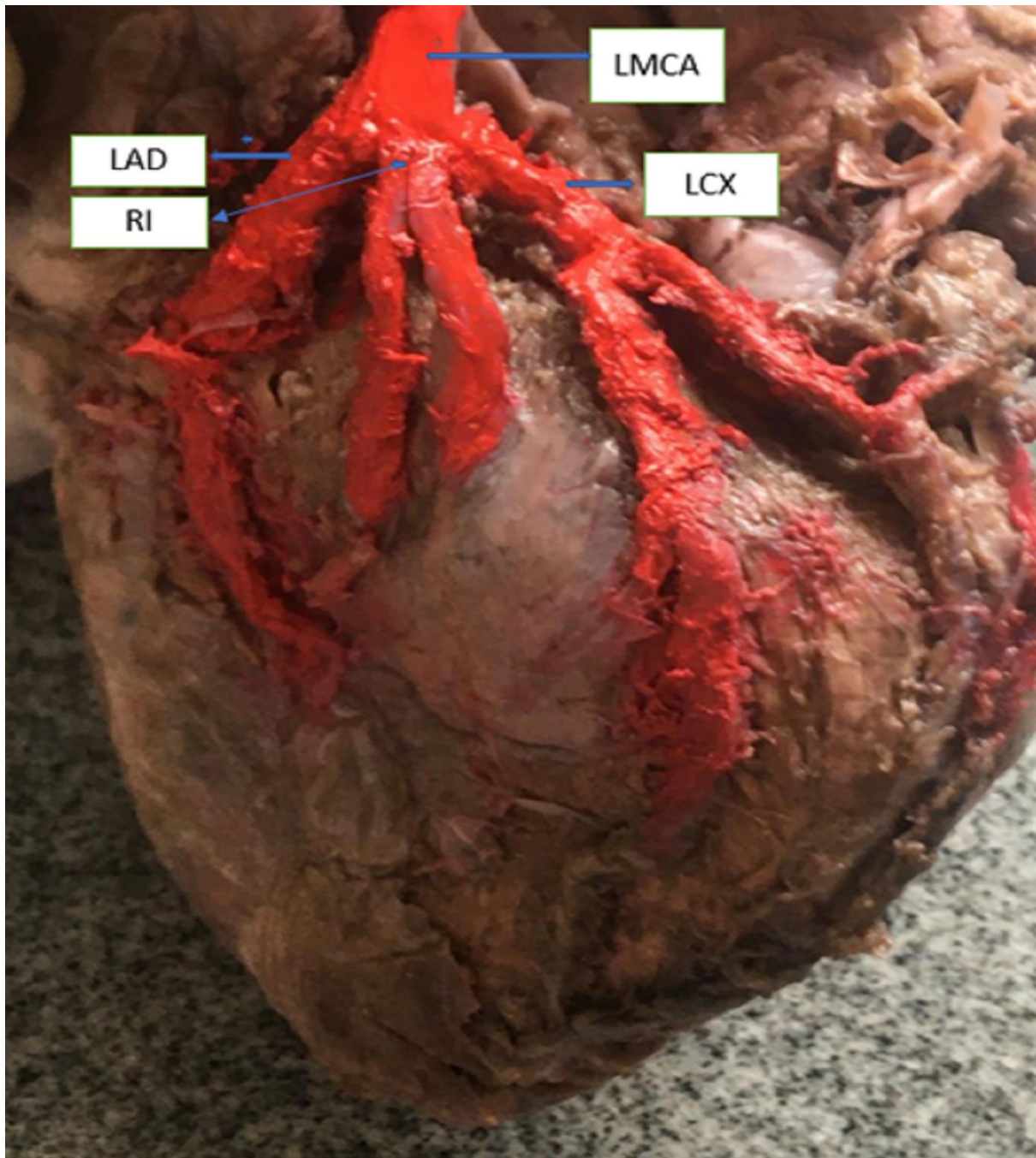


FIG-2 Photograph shows Trifurcation of Left Coronary Artery into LAD, LCX and RI with the Ramus Intermedius immediately bifurcating. (LAD- Left coronary artery, LCX- Left circumflex artery, RI- Ramus intermedius, D₁-First diagonal artery)

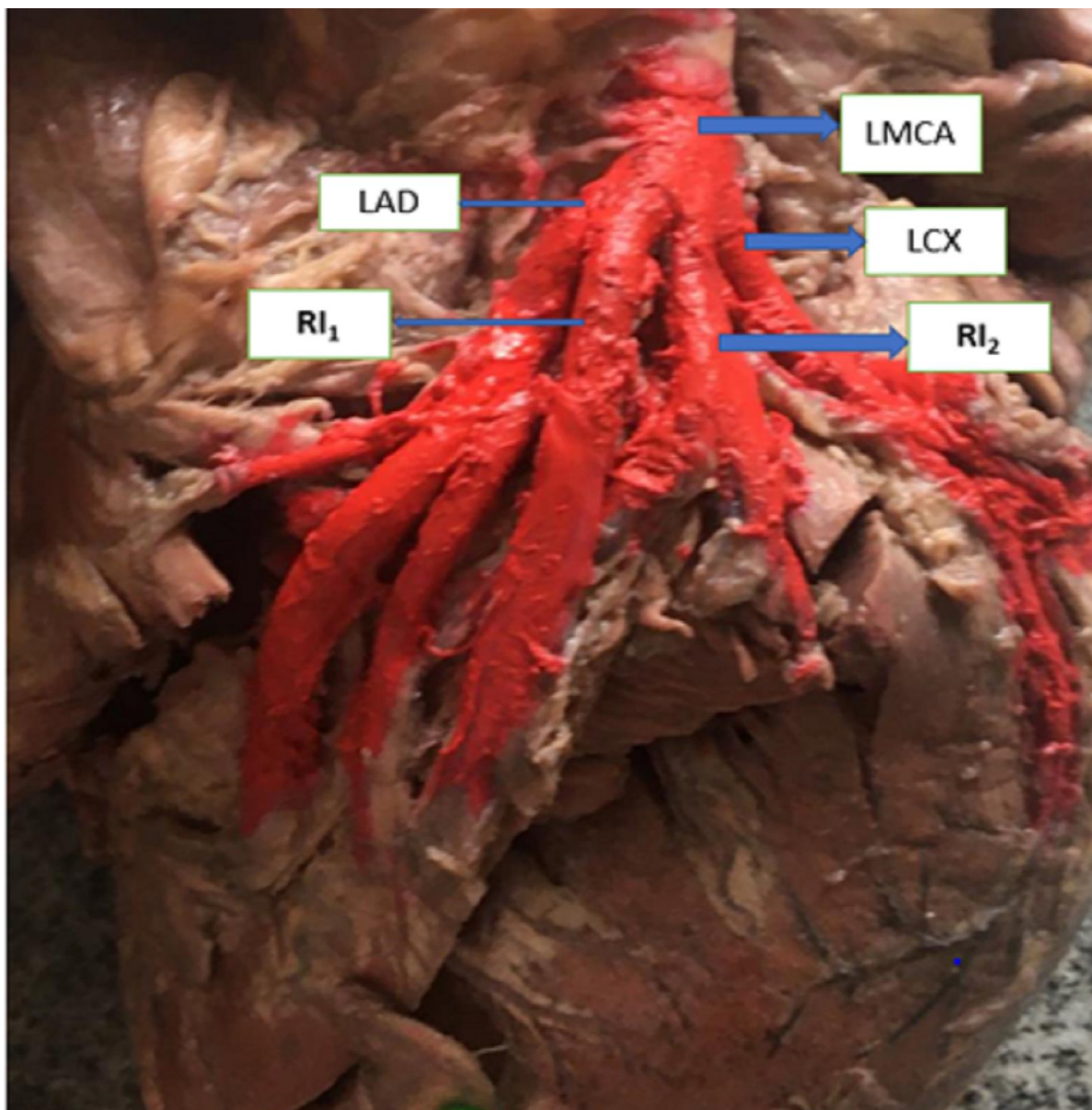


FIG-3 Photograph shows Quadrifurcation of Left Coronary Artery into Left anterior descending artery, Left circumflex, Ramus intermedius-1 and Ramus intermedius-2 (LAD- Left coronary artery, LCX- Left circumflex artery, RI- Ramus intermedius)

DISCUSSION:

The variations in the branching pattern of left coronary artery are numerous. In the present study we came across three types of branching pattern of left coronary artery-Bifurcation, trifurcation and quadrifurcation. Previous studies have shown in addition to these, penta-furcation also. Left coronary artery is one of the main arteries of heart, which supplies most of the left ventricle, left atrium, anterior 2/3rd of the interventricular septum. Left coronary artery after its origin from the left posterior aortic sinus of ascending aorta, passes between the left auricle and the pulmonary trunk then usually bifurcate into left anterior descending artery and left circumflex artery. In our study also we observed bifurcation of Left coronary artery into Left anterior descending artery and left circumflex artery(74%), which is concordant with studies conducted by Udhayakumar¹ et

al(75%), Patel² J P et al(74%) and Sultana Ruma Alam³ et al. The prevalence of bifurcation is higher in our study as compared to the studies conducted by Kalpana⁴ R A et al(47%), Baptista⁵ et al(54.7%), Das Hira⁶ et al(60%), Lujinovic⁷ et al(65%), Lo⁸ et al(69.3%), LE Ballesteros⁹ et al (70%). In contrast bifurcation was found to be lower in our study compared to studies conducted by Vandana¹⁰ et al, Reddy¹¹ et al(86%), Benter¹² et al(89%), Hosapatna¹³ et al(93.3%). The left anterior descending artery passes through the anterior interventricular sulcus and supplies the anterior wall of the left ventricle, apex and anterior 2/3rd of interventricular septum. It also supplies the right and left bundle of His of the conducting system of heart. Left circumflex artery passes through the left anterior part of coronary sulcus and supplies lateral wall of left ventricle and left atrium. Bosco G A¹⁴ et al (1935) and

Benther et al (1976) observed that in 2% of the specimens, there was no division of main left coronary artery. Spindola-Franco H¹⁵ et al found dual LAD which is characterized by a short LAD that terminates proximally in the anterior interventricular groove and a long LAD that has a proximal course outside the anterior interventricular groove and returns to the groove in its distal course. These variations were not found in our study. Another variation found in our study is trifurcation of left coronary into left anterior descending, left circumflex and an additional branch called Ramus intermedius. Course of ramus intermedius is similar to either the course of first diagonal from LAD or Obtuse marginal from LCX. Thus, it can supply either the anterior or lateral aspect of left ventricle. The uniqueness of this artery is that it does not run along an anatomical groove and lies over the free surface of left ventricle. In our study trifurcation of LCA with an additional branch called ramus intermedius was found in 24%. The prevalence of trifurcation is similar to studies conducted by Udhayakumar et al (22.5%), Mallashetty NS¹⁶ et al (23.3%), Bhele¹⁷ et al (24%). But studies conducted by Lo et al (36.6%), Baptista et al (38.7%), Kalpana et al (40%), Kalbfleish¹⁸ et al (44.4%), Surucu¹⁹ et al (47.5%) showed higher prevalence of trifurcation of LCA. With the advent of CT angiography and improved detection, the prevalence rate of ramus intermedius has increased. For the interventional cardiologist, occlusion of ramus is a challenging opportunity. When the ramus is involved adjacent LAD and LCX may also be involved, hence there is a need to do complex angioplasty. As the ramus intermedius is not within any anatomical groove, stenting of this vessel will be difficult because it is prone for mobilisation and migration. In one of the cases with trifurcation, the ramus intermedius bifurcates into two branches immediately after its formation. One of them had the course similar to the right diagonal and other had similar course as that of first obtuse marginal. The occurrence of such ramus intermedius is not well documented in literature. In quadrifurcation, in addition to LAD and LCX the other two branches are named as ramus intermedius-1 and ramus intermedius-2, which follow the course of left diagonal and left marginal artery respectively. In our study we found one case with quadrifurcation of LCA (2.9%), which is concordant with studies conducted by Udhayakumar et al (2.5%), Surucu et al (2.5%), Vandana et al (3.3%) and Ortale et al (4%). In our study we found one case with quadrifurcation of LCA (2.9%), which is concordant with studies conducted by Udhayakumar¹ et al (2.5%), Surucu¹⁹ et al (2.5%), Vandana¹⁰ et al (3.3%), Ortale²⁰ et al (4%). Atherosclerotic involvement of branches of quadrifurcation of LCA makes percutaneous coronary intervention difficult, hence coronary artery bypass grafting (CABG) is preferable.

In our study there was no penta-furcation of left coronary artery. But there were few authors who documented penta-furcation, like Ogeng'o²¹ et al (3.4%), Surucu¹⁹ et al (2.5%), Kalpana⁴ et al (1%) and Bhimalli²² et al (1%).

CONCLUSION:

Variations of branching pattern of left coronary artery are numerous. With the advent of new imaging modalities more and more variations are being discovered now, this has been advantageous for interventional procedures and cardiothoracic surgeons.

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