



Anatomical Study of Branching Pattern of Main Trunk of Left Coronary Artery And Its Importance.

KEYWORDS

Ramus diagonalis, Bifurcation, Trifurcation, Left coronary artery, Pentafurcation

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ABSTRACT The left coronary artery shows a wide range of variations in its origin, course and in branching pattern which has great clinical importance. Difficulties may occur during performance of various diagnostic procedures in heart. In present study variation in branching pattern of main trunk of Left Coronary Artery and importance of its diagonal branches are observed. 50 heart specimens were collected from the cadavers in Anatomy, than by under water dissection branching pattern of main trunk of LCA were traced. It is observed that there is Bifurcation of LCA in 52%, Trifurcation in 38%, Quadrifurcation in 8% and Pentafurcation in 2% cases. The left coronary artery and its branches are responsible for the irrigation of most of the left ventricle and part of the right ventricle. In case of trifurcation, where the left diagonal artery takes origin directly from the left coronary artery, the size of infarct on occlusion of the left anterior descending artery would be reduced.

INTRODUCTION:

The left coronary artery shows wide variability in its morphology with regard to length, caliber and the number of branches of its trunk. "Richard A.", in 2007, stated that diagnosis of abnormal origin of left coronary artery is enabled by Echocardiography with color Doppler in 70% of cases¹.

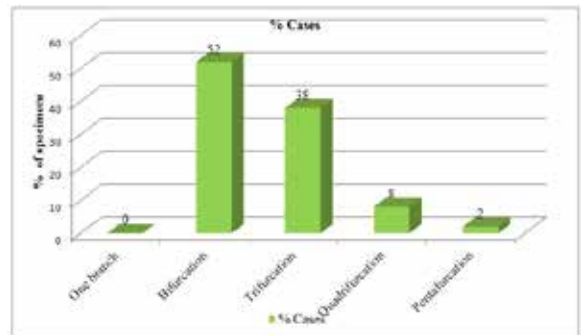
The left coronary artery trunk divides in several ways when it bifurcates, producing the anterior interventricular branch (AIB) or left descending artery (LAD) and the circumflex branch (CxB). When it trifurcates, it produces LAD, CxB and a diagonal branch or Ramus diagonalis (DB) or the median artery and when it tetrafurcates, it produces AIB, CxB and two DB and occasionally when it pentafurcates as in our study it will give AIB, CxB & three diagonal branches. Bifurcated expression has been described as being the most common one.²

Diagonal branches have unusual anatomical features in humans. It does not travel along any cardiac groove but simply present over the surface of the ventricle. Although its distribution area is usually small, its existence may decrease the effects of occlusion of the AIB and the CxB. The third branch or diagonal branch of the LCA might be a source of arteries at the sternocostal surface of the left ventricle, such as the branches for the anterior papillary muscle of the left ventricle and anterior septal branches^{3&4}

MATERIAL & METHOD:

50 heart specimens were collected from the cadavers in Anatomy department of Netaji Subhash Chandra Bose Medical College, Jabalpur. The dissection was done under water. The visceral pericardium was removed and by micro dissection LCA was exposed. Than the branching pattern of main trunk of left coronary artery and its variation were noted. The specimens were numbered from 1 to 50. Specimens were preserved separately in 10% formaldehyde solution. To give contrast in photograph red acrylic paint was used to paint the main coronary artery and their branches. Photographs of specimen were taken by digital camera and labeled.

RESULTS:



Graph showing division of Main Trunk of LCA (N = 50)

The main trunk of LCA, after its origin from left coronary ostium, runs for some distance and bifurcate into Left Anterior Descending Artery (LAD) and Left circumflex artery. Types of division of LCA observed in present study as shown in graph were:

Bifurcation into LAD (Anterior interventricular artery or Ramus interventricularis artery) and Left circumflex artery (Ramus circumflexus) was found in 52% specimens,

Trifurcation into LAD, Left circumflex artery and Ramus diagonalis artery was seen in 38% of specimens, Quadrifurcation into LAD, Left circumflex artery, Ramus diagonalis I and Ramus diagonalis II was noticed in 8% specimens, (Specimen No. 21, 31 & 34).

Pentafurcation into LAD, Left circumflex artery, Ramus diagonalis I, Ramus diagonalis II and Ramus diagonalis III was observed 2% specimen (specimen No. 18).

DISCUSSION:

Author	Branches (%)				
	One branch	Bifurcation	Trifurcation	Quadrifurcation	Pentafurcation
Baptista (1991) ⁵	-	54.7	38.7	6.7	-
Cavalcanti (1995) ⁶	-	60	38.18	-	-

Author	Branches (%)				
	One branch	Bifurcation	Trifurcation	Quadrifurcation	Pentafurcation
Kalpana R (2003) ⁷	1	47	40	11	1
Surucu et al(2004) ⁸	-	47.5	47.5	2.5	-
Ortale et al., 2005 ⁹		50	46	4	
Ballesteros and ¹⁰		52	42.2	5.8	
Ramirez, 2008		46	44	10	
Fazliogullari et al., ² 2010		46	44	10	
Present Study	0	52	38	8	2

As shown in above table, Baptista CA noted bifurcation pattern in 54.7%, trifurcation pattern in 38.7% and quadrifurcation pattern in 6.7% of specimens⁵. Cavalcanti noticed in 60% of specimens that the left coronary artery showed bifurcation pattern and in 38.18% of specimens the left coronary artery showed trifurcation pattern⁶. Kalpana R noted bifurcation pattern in 47%, trifurcation pattern in 41%, quadrifurcation pattern in 11% and Pentafurcation pattern in 1% of specimens⁷. Ortale et al., 2005, Ballesteros and Ramirez 2008, Fazliogullari et al 2010 have noted bifurcation in 50, 52 & 46% cases respectively, trifurcation in 46, 42.2 & 44% cases respectively while they noted quadrifurcation in 4, 5.8 & 10% cases respectively but they all did not noticed any case of pentafurcation.

In the present study 52% specimens showed bifurcation pattern, 38% specimens showed trifurcation pattern, 8% specimens showed quadrifurcation pattern and 2% specimens showed Pentafurcation pattern.

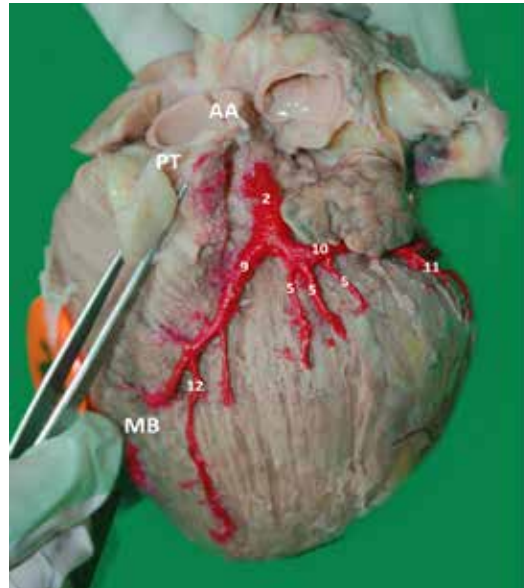
Such a wide range can be explained by the different approaches used for defining the diagonal branch. Some authors says, the diagonal branch is the artery located in the angle formed by the anterior interventricular branch and circumflex branch^{9&11}. Other authors used a broader approach and consider that the diagonal branch originates in the vertex of the angle formed by the terminal branches of the anterior interventricular branch and circumflex branch. In Bifurcation pattern the DB or ramus diagonalis present as a lateral branch of the AIB or as a marginal (obtuse) branch of the CxB Depending on whether it supplies the anterior or the lateral wall respectively with a greater prevalence of the first variety.^{10, 12, 13.}

Variations in the length diagonal branches have special importance in heart surgery because their external portion is frequently used for an autogenous bypass implant.⁵

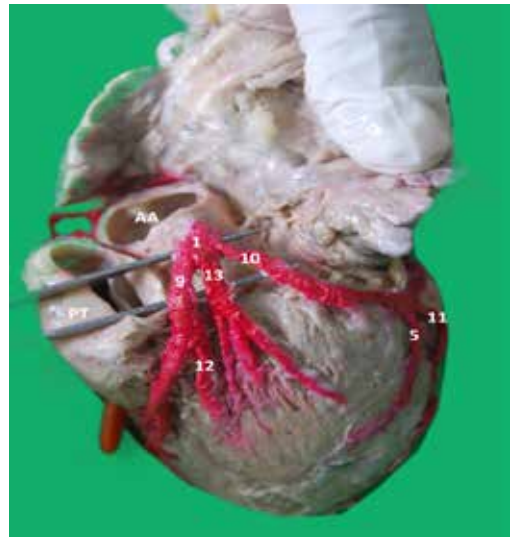
CONCLUSION:

If there is obstruction in the left coronary artery, the degree of severity of myocardial infarction is more and may cause death in single attack. Identification of the median artery (intermediate artery, ramus diagonalis, diagonal branch) is clinically very important. In humans, the DB or ramus diagonalis is described as a source of arteries supplying either the anterior wall of the left ventricle, the anterior portion of the septum, or the anterior papillary muscle of the left ventricle. Though its area of distribution to the heart is small, in its absence the area is irrigated by branches of LAD and LCx, hence in the occlusion of LAD & LCx more area is affected. Therefore this study may be useful in clinical and theoretical implication regarding left coronary artery.

PHOTOS:



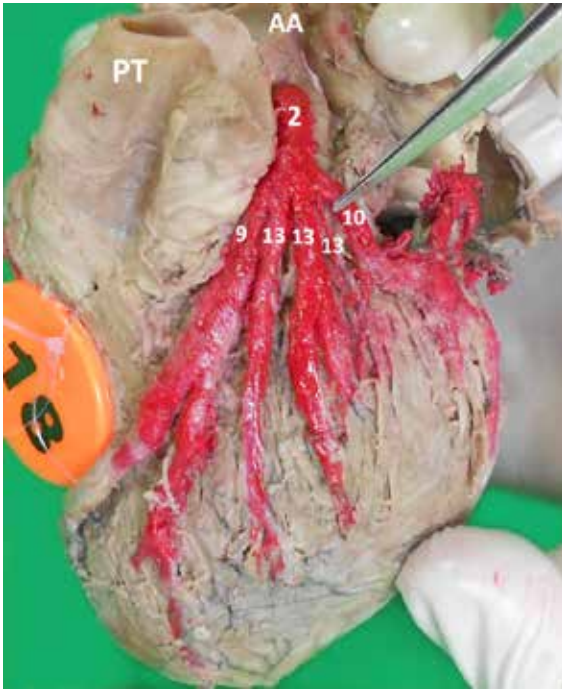
Photograph No. 1 – Bifurcation of LCA. (Anterior view)



Photograph No. 2 – Trifurcation of LCA. (Anterior view)



Photograph No. 3 Quadrifurcation of LCA. (Anterolateral view)



Photograph No. 4 – Pentafurcation of LCA. (Anterolateral view)

Key to Photographs

- 1 - Right Coronary Artery
- 2 - Left Coronary Artery
- 3 - Right Conus Artery
- 4 - Atrial branch
- 5 - Ventricular branch
- 6 - Sinu-atrial Nodal Artery
- 7 - Right Marginal Artery
- 8 - Posterior Interventricular Artery
- 9 - Left Anterior descending Artery (Anterior Interventricular Artery)
- 10 - Left Circumflex Artery
- 11 - Left Marginal Artery
- 12 - Left Diagonal Artery
- 13 - Intermediate artery/ Ramus diagonalis/ Median artery
- 14 - Posterior Right Diagonal Artery
- 15 - Atrioventricular Nodal Artery
- 16 - Third Coronary Artery
- 17 - Fourth Coronary Artery
- RA - Right Atrium

- LA - Left Atrium
- AA- Ascending Aorta
- PT - Pulmonary trunk
- AAS- Anterior Aortic Sinus
- PAS- Posterior Aortic Sinus

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