

Study of Origin, Course and Branching Pattern of Left Coronary Artery in Hyderabad Karnataka Region

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Abstracts: Background: Sound knowledge of left coronary artery (LCA) is necessary for performing coronary angiographies and shunt surgeries. Study of origin, course of left coronary artery and its branches helps in judging the area of myocardium supplied by them which in turn helps in judging the size of infarct. Methodology: The present study is done on 76 adult heart specimens obtained from routine dissection conducted for undergraduate students in the Department of Anatomy at Bidar Institute of Medical Sciences, Bidar and also at other nearby medical colleges of Karnataka and Maharashtra. The data obtained is tabulated and analyzed statistically. Results: In our study, in all the cases the Left coronary artery originates from left posterior aortic sinus. Bifurcation of left coronary artery is seen in 81.5%, trifurcation in 14.5% and quadrifurcation in 4% cases. The left anterior descending artery (LAD) terminates by wrapping around apex in 70% cases and the left circumflex artery (LCX) terminates between obtuse border and crux of heart in 52.5% of cases. Conclusion: The present study is done to know origin, distribution, branching and level of termination of left coronary artery in adult human hearts of Hyderabad Karnataka region to provide vital inputs for making a correct diagnosis and planning treatment for procedures like coronary angiography, stenting procedures and surgical myocardial revascularization in extensive myocardial ischemia. [Jaishree H. NJIRM 2015; 6(2):1-5]

Key Words: Left coronary artery, Left anterior descending artery, Left circumflex artery.

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Introduction: The left coronary artery which is usually larger than the right coronary artery arises from left posterior aortic sinus of ascending aorta and supplies the major part of heart including the greater part of left atrium, left ventricle and interventricular septum.¹

The advances made in coronary arterial bypass surgeries and modern methods of myocardial revascularization make it imperative that a thorough, sound and complete knowledge of the normal and variant anatomy of coronary artery and circulation is required.²

Study of distribution of left coronary artery and its branches helps to know the area of myocardium irrigated by them which in turn helps in judging the size of infarct occurring following occlusive arterial disease.³

Knowledge of Left coronary artery is useful in diagnostic imaging necessary in surgery for adult congenital heart disease and also provides additional information with regard to the spatial relation between the relevant cardiac structure and the coronary arterial system required for

planning the operation and providing a good outcome.⁴

Considering these factor, knowledge of left coronary artery and variations is essential. The knowledge of coronary circulation is not only important for anatomists but also for radiologists and cardiologists performing angiographies and shunt surgeries, in diagnosis and treatment of diseases involving the coronary arteries in population of Hyderabad Karnataka region.

Material and Methods: The sample size used for this study is 76 heart specimens. The specimen of adult human hearts used for this study were obtained from routine dissection conducted for undergraduate students in the Department of Anatomy at Bidar Institute of Medical Sciences, Bidar and also at other nearby medical colleges of Karnataka and Maharashtra. The origin, course, branching and distribution of left coronary artery are studied by dissection method.

The specimens were collected from the cadavers during routine dissection for undergraduate medical students. By cutting the ribs and sternum the thoracic cavity is opened. The great vessels

were ligated by tying thread at two places and then cut in between. The parietal pericardium is incised and heart along with great vessels is taken out of the pericardial cavity. Each specimen is thoroughly washed to free it from the blood clots. All specimens were preserved in 10% formalin solution. The specimens were labelled numerically. First the anterior surface of the heart was dissected.

On the anterior surface of the heart, origin of the left coronary artery arising from the ascending aorta between the left auricle and the left side of the pulmonary trunk is identified. The LCA is usually larger in calibre. Any variation in the origin of LCA is noted and then the LCA was traced until its division on the superior end of anterior interventricular groove. It usually branched into LAD and LCX artery. Any variation in the division of main trunk is noted. The variant artery is dissected along its course from origin to termination. Origin and termination of variant artery is noted.

The LAD running in the anterior interventricular groove was dissected along its course as far as toward the apex of the heart and followed it until its termination. The number of branches from LAD is noted and dissected up to the termination.

The LAD was dissected and the level of termination was noted.

The circumflex artery is identified and dissected along its course curving to the left around the heart running within the coronary sulcus towards the crux of the heart. The posterior surface of heart is dissected to identify the branches of circumflex artery and the level of termination of LCX is noted. Any variation in branching pattern of LCX is noted and the variant artery is dissected up to the level of termination.

Results: Out of 76 specimens studied, the LAD reaches the apex but does not supply inferoapical segment in 22 (30%) specimens, LAD wrapped around apex and supplied the inferoapical segment in 54 (70%) specimens and in none of the specimens LAD terminated before cardiac apex.

In our present study, the left coronary artery originates from left posterior aortic sinus in all the specimens.

Table1: Level of Termination of LAD.

	Termination of LAD	Specimen	Percentage
A	Before cardiac apex	0	0
B	Reaching apex but not supplying inferoapical segment	22	30%
C	LAD wrapping around apex and supplying inferoapical segment	54	70%
	Total	76	100%

Table2: Level of Termination of LCA.

	Termination of left circumflex artery	Specimen	Percentage
A	At obtuse border	16	21%
B	Between obtuse border and crux	40	52.5%
C	At the crux	8	10.5%
D	Turn at right angle to continue in PIVS	12	16%
E	Between crux and acute border	0	0%
	Total	76	100%

The LCX terminates at obtuse border in 16 (21%) out of 76 specimens, between obtuse border and crux of heart in 40 (52.5%) specimens, terminates at the crux in 8 (10.5%) specimens, terminates by turning at right angle to continue in posterior interventricular sulcus (PIVS) in 12 (16%) specimens and in none of the specimens LCA terminates between crux and acute border.

Table3: Division of Main Trunk of LCA

	No of branches	Specimen	Percentage
a	Bifurcation	62	81.5%
b	Trifurcation	11	14.5%
c	Quadrifurcation	3	4%
d	Pentafurcation	0	0%
	TOTAL	76	100%

In relation to the branching pattern of left coronary artery, out of 76 specimens bifurcation is seen in 62 (81.5%) cases followed by trifurcation in 11 (14.5%) cases and quadrifurcation in 3 (4%) cases and in none of cases pentafurcation is seen.

Discussion: In the present study the LAD reaches the apex in one third of specimens (30%), which was higher when compared to the studies done by Kalpana R⁵ (12%) and Siri A M⁷(13%). In 70% cases the LAD wrapped around apex and supplied the inferoapical segment. Similar observations were seen in studies done by Kalpana R⁵(80%) and Siri A M⁷ (87%). In none of specimens LAD terminated before cardiac apex and the findings were similar to study done by Siri A M⁷(0%).

Table: 4 Comparison of level of termination of LAD artery.

Termination of LAD	Kalpana R ⁵	Siri A M ⁷	Present study
Before cardiac apex (%)	8%	0%	0%
Reaching apex but not supplying inferoapical segment (%)	12%	13%	30%
LAD wrapping around apex and supplying inferoapical segment (%)	80%	87%	70%

Table: 5 Comparison of level of termination of LCX artery

Termination of left circumflex artery	Hirak Das et al ⁶	Kalpana R ⁵	Present study
At obtuse border (%)	17.14%	13%	21%
Between obtuse border and crux (%)	52.86%	67%	52.5%
At the crux (%)	18.57%	6%	10.5%
Between crux and acute border (%)	11.4%	11%	16%
Acute border (%)	0%	0%	0%

The studies tabulated above showed similar observations in the termination of LCX artery. In majority of cases it terminated between obtuse border and crux. The incidence of termination of LCX artery between obtuse border and crux in our study (52.5%) is similar when compared with the study done by Hirak Das et al⁶(52.86%). In none of the studies the LCX artery terminated at the acute border.

In our study higher incidence of termination of LCX artery at obtuse border (21%) and between the crux and the acute border (16%) was seen when compared with other studies

Figure 1: Photograph showing trifurcation of left coronary artery



Table 6: Comparison of the branching pattern of LCA

Authors and No of specimens	1 branch	Bifurcation %	Trifurcation %	Quadrifurcation %	Pentafurcation %
Baptista C A et al, ⁸ n=100	1.8%	60%	38.1 %	-	-
Surucu H S ⁹ n=40	-	47.5 %	47.5%	2.5%	2.5%
Kalpana R ⁵ n=100	1%	47%	40%	11%	1%

Reig J et al, ¹⁰ n=100	–	62%	38%	–	–
Ballesteros L.E et al, ¹¹ n=154	–	52%	42.2%;	5.8%	–
Das Hirak, ⁶ n=100	–	60%	35%;	5%	–
Dattatray D. Dombe et al, ¹² n=64	1.6%	54%	35.9%	7.8%	–
Present study n=76	–	81.5 %	14.5%	4%	–

In majority of cases the common pattern of branching of LCA is bifurcation. The results of bifurcation of our study are consistent with earlier reports. The frequency of quadrifurcation of LCA in present study is 4%, which is similar with findings reported by Das Hirak et al⁶ as 5% and by Ballesteros L.E et al¹¹ as 5.8%.

Trifurcation of the LCA is less common and lowest reported in our study (14.5%) when compared with Surucu et al⁹ (47.5%), Ballesteros L.E et al¹¹ (42.2%), Das Hirak et al⁶(35%). Surucu et al⁹ (47.5%) and Kalpana R⁵ (47%) reported lower incidence of bifurcation of LCA as compared to other studies. The incidence of penta-furcation was only reported by Surucu et al⁹ as 2.5% and by Kalpana R⁵ as 1%.

Conclusion: In all cases the Left coronary artery takes origin from left posterior aortic sinus.

In majority of cases, the Left anterior descending artery terminates by wrapping around apex and supplies inferoapical segment. The Left circumflex artery terminates between obtuse border and crux. These findings explain why in some lesions of coronary arteries there is extensive myocardial ischemia. Hence knowledge of such variation is important for cardiologists.

Bifurcation is found in 81.5%, trifurcation in 14.5% and quadrifurcation in 4% cases. Left main trifurcation coronary artery disease stenting is a

challenging and complex percutaneous procedure. Hence adequate understanding and knowledge of the trifurcation pattern is vital for success of the procedure.

Hence the study of origin, course and branching pattern of the left coronary artery in Hyderabad Karnataka region is helpful in performing cardiac operations such as heart pacemaker implantation, angioplasty and stent placement in the population of this region.

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