



DETAILED MORPHOLOGICAL STUDY OF LEFT CORONARY ARTERY IN HUMAN CADAVERIC HEARTS

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Abstract:

Introduction: Recently coronary artery disease and anomalies have emerged as the most common cause of sudden cardiac death in fitness freak people and young athletes. In the management of congenital and acquired cardiac diseases, the morphological anatomy of coronary circulation and its variations is of paramount importance. Most common artery involved in ischemic heart disease is Anterior interventricular artery (Left anterior descending) which is branch of left coronary artery. So study of human cadaveric heart for morphological details of left coronary artery for origin, length, branching patterns and diameter and their variation in unrecognized population of Delhi NCR and Western U.P is a way to understand the variations and anomalies for better management.

Objective: To study the origin, length, diameter and patterns of branching and their variation of left coronary artery in hearts of human cadavers.

Method: 40 adult cadaveric heart specimens of unspecified age group and sex were dissected and the origin and variation of artery were observed.

Results: Out of 40 heart specimens, the origin of left coronary was from i posterior aortic sinus in all specimen. In 27 specimens bifurcation was found, in 12 specimens trifurcation was found and in 1 specimen quadrifurcation was found. and no cases of penta-furcation.

Conclusion: It is very significant to know the normal and variant branching pattern for early diagnosis and treatment of coronary arteries. There are magnitude of studies of left coronary artery and its variations but area specific study has importance for better management of ischemic heart diseases

Key words: left coronary artery, variations, cadaveric, branching pattern, coronary artery disease

Abbreviations: LCA- Left Coronary Artery, RCA- Right Coronary Artery, LDA- Left Anterior Descending
NCR- National Capital Territory

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INTRODUCTION:

The arterial supply of heart is from left and right coronary arteries which arise from the aortic sinus.^[1] The Right Coronary Artery (RCA) arises from the anterior aortic sinus and the Left Coronary Artery (LCA) arises from the left posterior aortic sinus. The branches of coronary arteries are located between the epicardium and myocardium.^[2] The LCA is generally wider than the RCA and perfuse more substance of the myocardium. The LCA shows a wide range of morphological variations than the RCA. The maximum part of left ventricle is supplied by left coronary artery. After origin from left posterior aortic sinus LCA passes between left atrial auricle and pulmonary trunk, emerging at left part of atrioventricular sulcus and gives two branches left anterior descending (anterior interventricular) and circumflex arteries.^[3] Sometimes LCA arises from the anterior aortic sinus and undergoes a longer course behind the pulmonary trunk before dividing.^[4] Rarely (in 2% case) the left anterior descending and circumflex arteries arise in separate manner from the left posterior aortic sinus. Further, the anterior interventricular artery branches into anterior ventricular rami (left diagonal, left conus) and septal rami. The circumflex artery gives rise to sinu-atrial nodal, atrial, ventricular, left marginal, posterior interventricular (19-20% individuals) arteries and Kugel's artery.^[5] During therapeutic procedures the severity of stenosis of coronary artery require understanding and diagnosis of coronary artery anomalies. Myocardial bridges (MB)^[6] have been reported in association with sudden death during exercise, but they are also an incidental finding at autopsy in up to 25% of the patient dying of other causes. The management of cardiovascular diseases has greatly evolved due to cardiac surgical and interventional advancement. These surgical and interventional procedure require details and precise morphological study of normal coronary arteries and their variations. For better outcomes for therapeutic interventions like angioplasty, coronary artery bypass grafting etc. the knowledge of detailed anatomy of coronary arteries, their variations and anomalies is necessary.^[7] This study intends to know the origin, branching pattern, terminations, dimensions, variation, and anomalies of LCA in heart of human cadavers of the population of West U.P and Delhi NCR.

AIM & OBJECTIVE

Aim: To observe the origin, branching pattern, termination, and variations in the left coronary artery (LCA) and its branches.

Objectives:

- To analyse the origin branching pattern, termination, and variations of coronary artery in the human cadaveric heart.
- To analyse the branching pattern of the main left coronary artery.
 - i) Bifurcation
 - ii) Trifurcation
 - iii) Quadrifurcation
 - iv) Pentafurcation
- To measure length and diameter of left coronary artery

MATERIAL & METHOD:**Source of data**

The proposed study was carried out in Department of anatomy, school of medical sciences and research, Sharda University, Greater Noida (UP), India and department of Anatomy, Noida International Institute of Medical sciences, Greater Noida (UP), India after the approval of ethical committee.

Sample size

This study includes total 40 cadaveric heart specimens. 30 specimens were taken from Department of Anatomy, School of medical Science & Research, Sharda University. 10 specimens were taken from Department of Anatomy, Noida international university, Noida.

Selection criteria

- **Inclusion criteria**

- i) Intact hearts were considered.
- ii) Adult heart specimens from cadavers of both sexes.

- **Exclusion criteria**

- i) Any damaged specimen.
- ii) Hearts undergone surgeries,
- iii) Hearts with lesions due to trauma.
- v) Hearts dissected to study the interior and blood vessel

Dissection Method:

A accurate dissection of left coronary artery in 40 cadaveric hearts fixed in 10% of formalin is carried out in the department of anatomy. The left coronary arteries and their branches were dissected on the sternocostal surface of heart. Origin, length, diameter, dominance and branching pattern was studied. The diameter and length of left coronary artery is measured with the help of thread and vernier caliper.

RESULT

The origin of the left coronary artery in all 40 specimens was found from the left posterior aortic sinus and no multiple origins were found.



The length of the main trunk of LCA was less than 6mm in 5 specimens, ranging between 7.1-8mm in 3 specimens, in between 8.1-9mm in 5 specimens, in between 9.1-10mm in 11 specimens, in between 10.1-11mm in 12 specimens, in between 11,1-12mm in 2 specimens

and in 2 specimens it was more than 13mm. The maximum length of the trunk of left coronary artery noted was 13.1mm and the minimum length noted was 3mm.

Table: Length of the main trunk of LCA in mm

Length of main trunk of LCA	Frequency	Percentage
<6mm	5	12.5%
7.1-8mm	3	7.5%
8.1-9mm	5	12.5%
9.1-10mm	11	27.5%
10.1-11mm	12	30%
11.1-12mm	2	5%
13-13.5mm	2	5%

BRANCHING PATTERN OF LCA

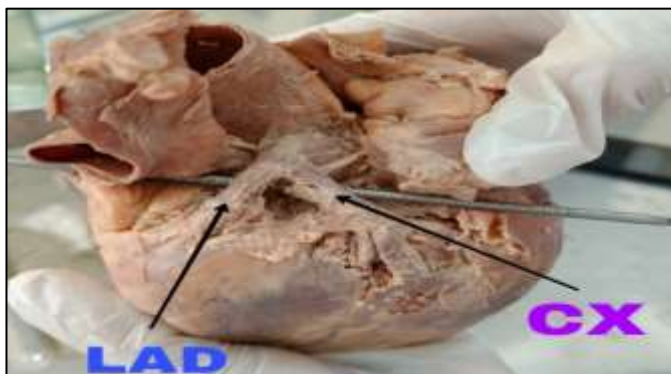
Regarding the branching patterns in our study the main trunk of LCA bifurcation in 27 specimens ,

trifurcation in 12 specimens and tetrafurcation in 12 specimens were found. In our study no case of pentafurcation of LCA was seen

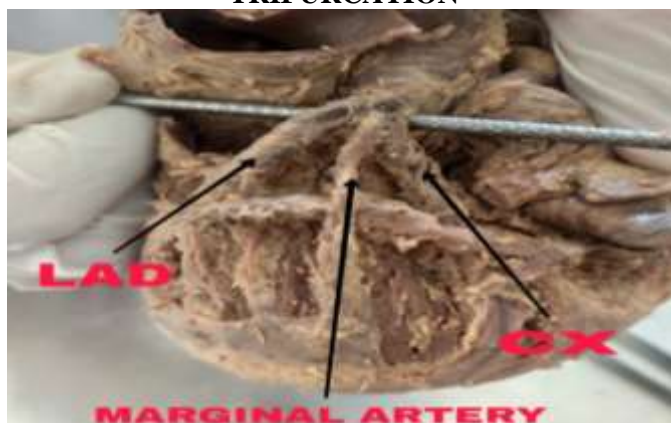
Table: Branching Pattern of main trunk of LCA

Branching Pattern of left coronary artery	Frequency	Percentage
Bifurcation	27	67.5%
Trifurcation	12	30%
Quadrifurcation	1	2.5%
Pentafurcation	0	0

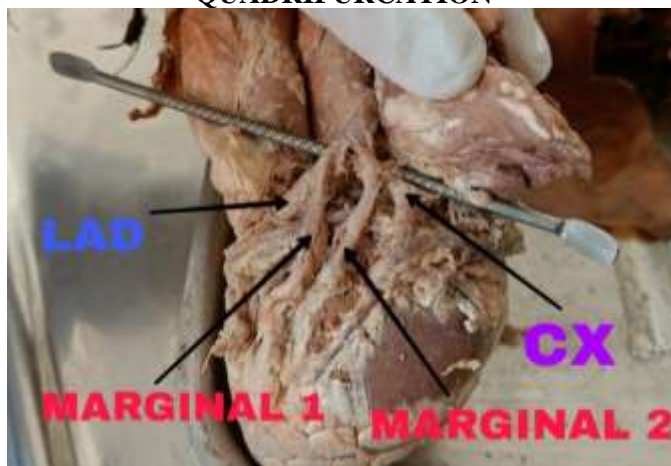
BIFURCATION



TRIFURCATION

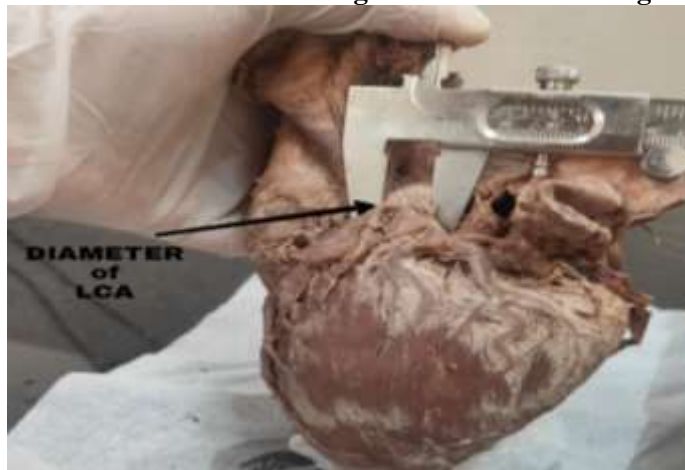


QUADRIFURCATION



In all 40 cases the right coronary artery had given the posterior interventricular artery indicating right cardiac dominance in 100% cases.

The external diameter of LCA at the origin was measured using vernier calliper



The external diameter of LCA measured in 40 specimens is given in the table below

Diameter of left coronary artery (in mm)	Frequency	Percentage
2.5- 3 mm	4	10%
3.1-4 mm	12	30%
4.1-5mm	15	37.5%
5.1-6 mm	8	20%
6.1 mm	1	2.5%

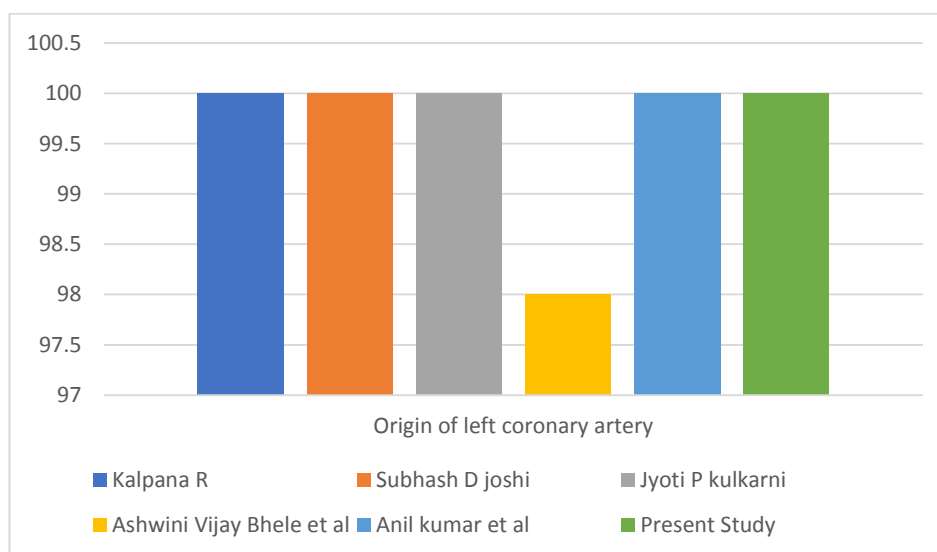
The average diameter of main trunk of LCA was found to be 4.34 mm

DISCUSSION:

Generally there is a wide variation in the blood vessels of human body. The coronary artery is one of them. It also shows wide variability among different population. Detailed knowledge of LCA has been highlighted due to need of interventional cardiac procedures for diagnosis and treatment in recent time..

In our observations LCA was arising from left posterior aortic sinus in 100% specimens , which was in accordance with the findings in study of

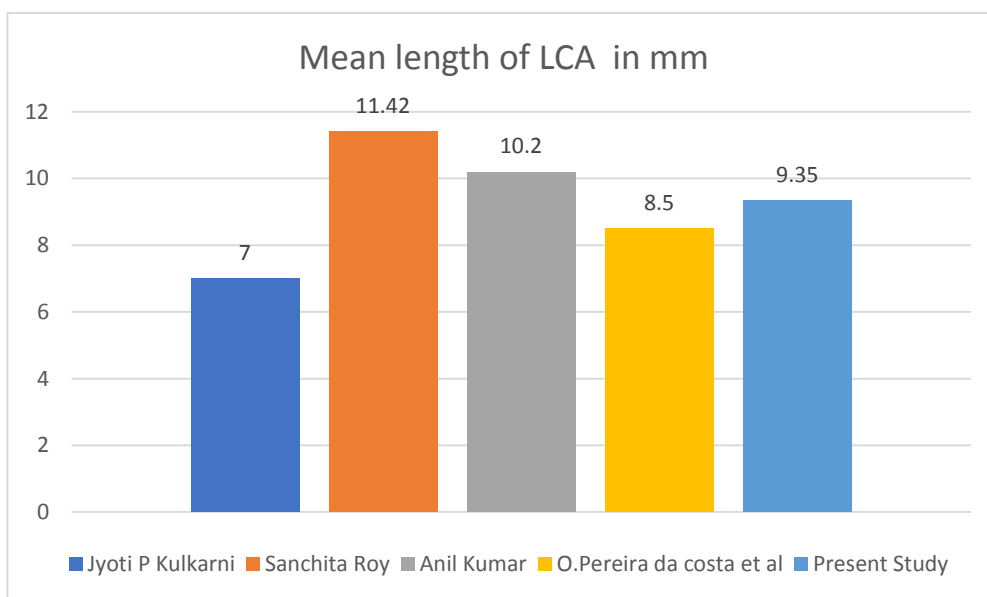
Kalpana R^[8] , Subhash D Joshi^[9], Kulkarni JP^[10] and kumar A et al^[11]. But some variations in origin of left coronary artery were noted by Ashwini Vijay Bhele^[13] who found the origin of LCA from left posterior aortic sinus in 98% specimens. Similarly Calvalcanti et al^[14] recorded the origin of LCA was from left posterior aortic sinus in 98.18 % specimens and he had observed in 1,8% specimens anterior interventricular artery and circumflex artery were arising from left posterior aortic sinus directly.



In our study the mean length of main trunk of left coronary artery was 9.35mm, which was greater than the findings in studies of Pereira et al

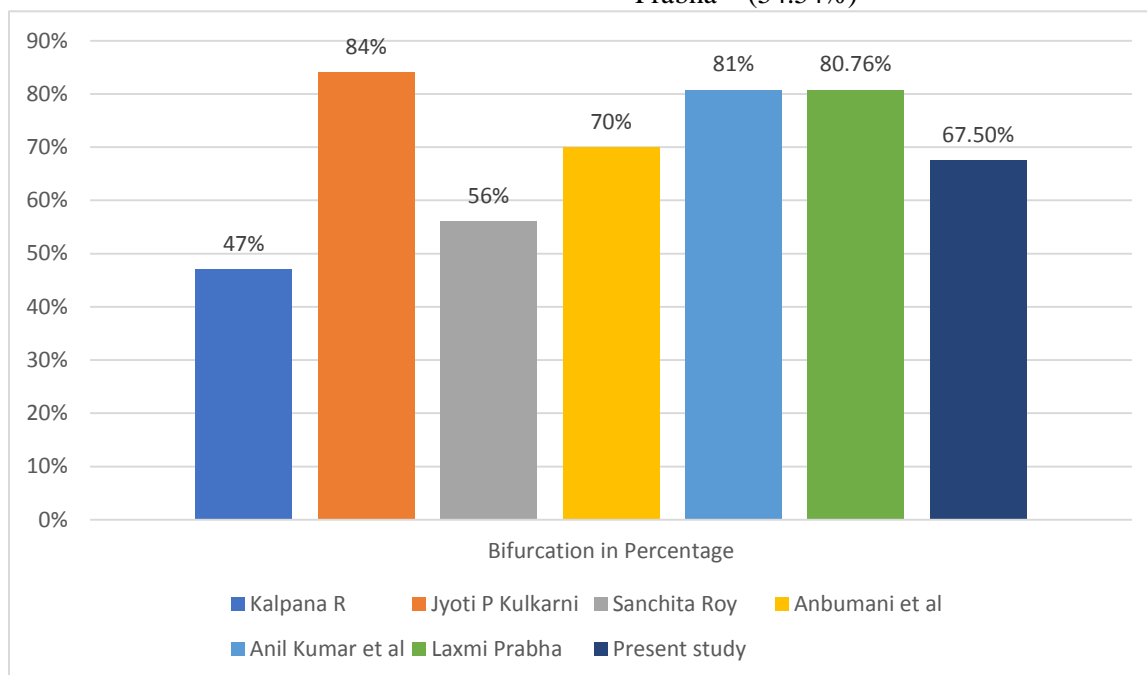
(8.53mm), Kulkarni JP (7mm), L.E. Ballesteros^[15](6.53mm) . In contrast the mean length of LCA

was smaller than the value observed by Kumar A et al(10.2mm) and Sanchita Roy^[16] (11.42mm).



The division of LCA into anterior interventricular, circumflex and diagonal arteries is very variable and commonest pattern of branching is bifurcation followed by trifurcation . In the present study the branching patterns of main trunk of LCA were as bifurcation) in 27 specimens (67.5%), trifurcation in 12 specimens (30%), quadrification in 1 specimen (2.5%) and no case of pentafurcation was found. These findings

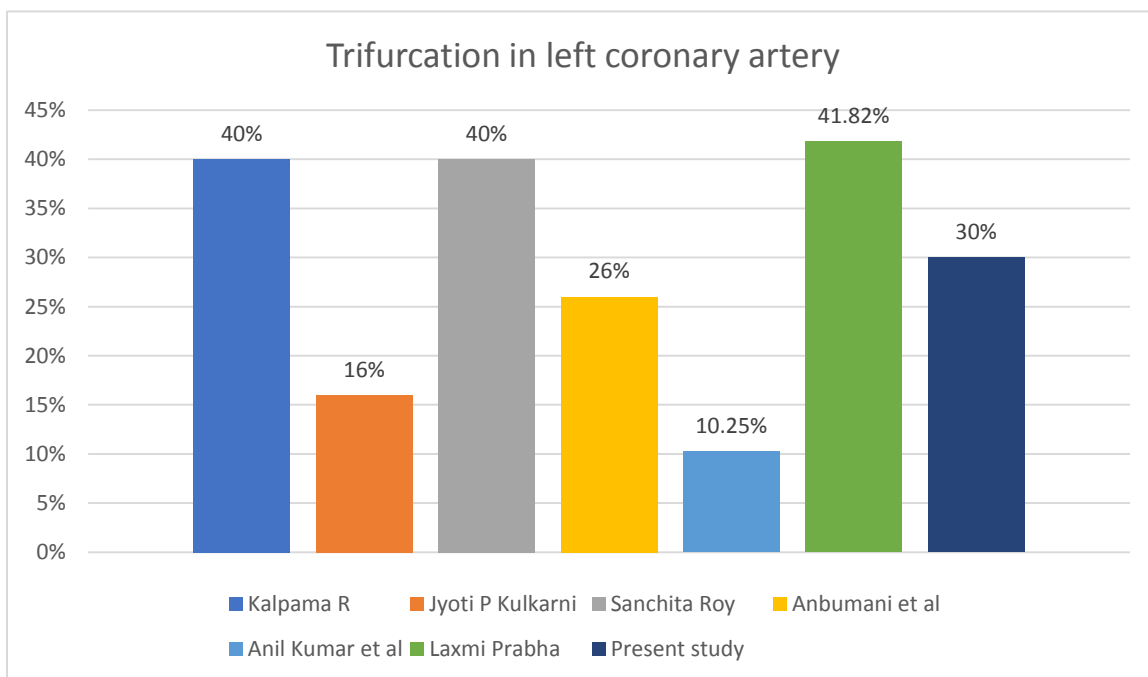
correlate with the studies of Ashwini Vijay Bhele et al and Najma Mobin, H. Basavanagowdappa.^[17] In our study the maximum number of specimen , branching pattern of LCA was bifurcation(in 67.5%) , which was lesser than the findings in studies of Jyoti P Kulkarni (84%) and Anil Kumar et al(80%) .But bifurcation of LCA in our study was more than the findings Kalpana R(47%), Sanchita Roy(56%) and Laxmi Prabha^[18](54.54%)



In our study, trifurcation (30%) of LCA was lesser than the observations of Kalpana R 40%),

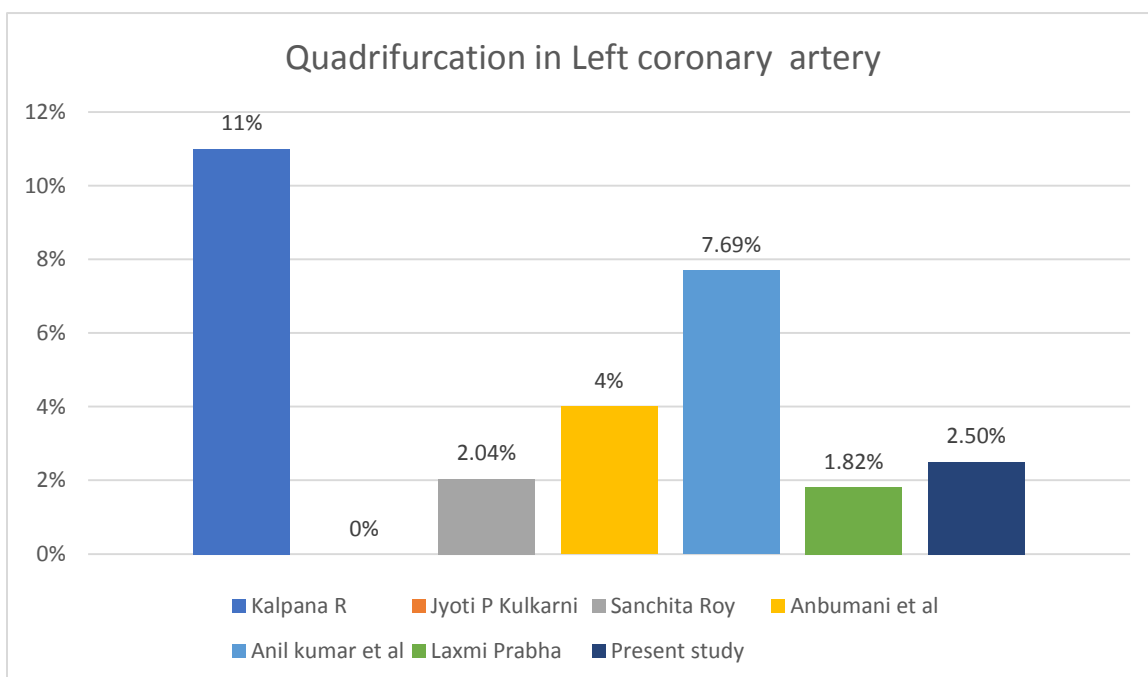
Kulkarni (16%), Ashwini Vijay Bhele et al (24%) and Anil Kumar et al (10.25%).

Sanchita Roy (40%), and Laxmi Prabha (41.82%) and but it was greater than findings of Jyoti P
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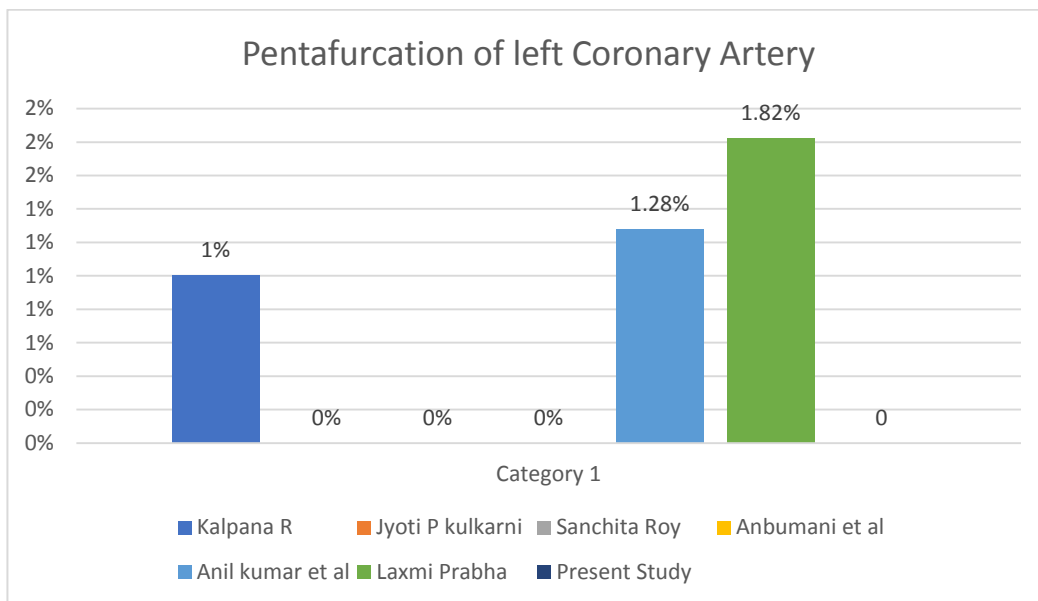
In this study, Quadrifurcation of LCA was found in 2.5% specimens which was lesser than the findings in studies of Anbumani et al^[19] (4%),

Kalpana R (11%), Anil Kumar et al(7.69%), but it was greater than findings of J P Kulkarni 0% & Laxmi Prabha (1.82%) in their studies.



In our study, Pentafurcation of LCA was not seen, which was matching with the studies of Jyoti P K, Sanchita Roy, Anbumani et al and Najma Mobin . But pentafurcation of LCA was observed in studies of Kalpana R (1%), Ashwini

Vijay Bhe(6%) Anil K et al (1.28%) and Laxmi Prabha (1.82%)



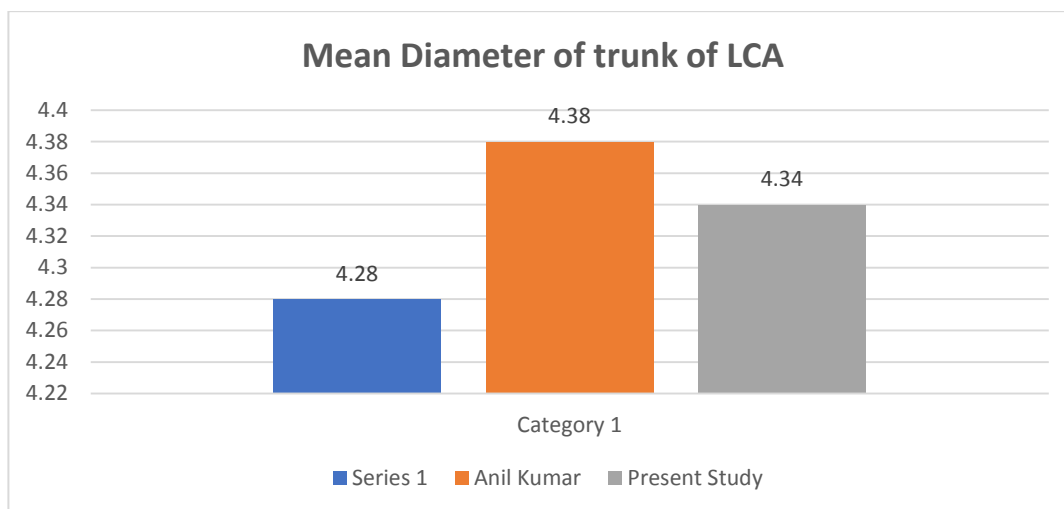
Details of Branching Pattern of LCA

Study	Bifurcation	Trifurcation	Quadrifurcation	Pentafurcation
Kalpana R	47%	40%	11%	1%
Jyoti P Kulkarni	50%	10%	nil	Nil
Sanchita Roy	56%	40%	2.04%	Nil
Anbumani et al	70%	26%	4%	Nil
Anil Kumar et al	80.76%	10.25%	7.69%	1.28%
Laxmi Prabha	54.54%	41.82%	1.82%	1.82%
Present study	67.5%	30%	2.5%	Nil

In our study, the mean diameter of LCA at beginning was 4.34 mm, which was more than value measured by Anil Kunar et al (4.38 ± 2.01mm) but less than value calculated by Nagraj

Mallashetty et al^[20] (4.28 ± 0.90mm) . Venkateshwer Reddy M^[21] found that the LCA diameter ranges between 2 mm to 6 mm.

Name of study	Mean value of left coronary artery diameter
Nagaraj Mallashetty et al	4.28 ± 0.90mm
Anil Kumar et al	4.38 ± 2.01mm
Present study	4.34mm



So on basis of aforesaid discussion it can be inferred tha the results of our study are almost similar to the findings of various studies

CONCLUSION:

A precise anatomical knowledge of coronary arteries and their variations is of paramount importance for successful and satisfactory result for treatment of ischemic heart diseases. The interventional cardiological procedures like cardiac angiography and angioplasty and cardiac surgery CABG (Coronary Artery Bypass Grafting) require detailed of branching patterns of coronary arteries with variations. In this regard present study will provide additional information pertaining to origin, length, diameter, and branching patterns with variations of left coronary artery for cardiac catheterization during interventional cardiac procedure.

Although many studies have conducted on branching patterns of left coronary artery but our study represent the detailed anatomical aspect of left coronary artery with variations in region of Delhi NCR & Western UP. Further studies of coronary arteries by cadaveric dissection and CT Cardiac angiography are required for validation of present study

CONFLICT OF INTEREST: NIL

SOURCE OF FUNDING: Self

ETHICAL CLEARANCE: Obtained

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