



## ANATOMICAL STUDY OF TERMINATION AND COURSE OF LEFT ANTERIOR DESCENDING AND LEFT CIRCUMFLEX BRANCH OF LEFT CORONARY ARTERY IN HUMEN HEART.

### Anatomy

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### ABSTRACT

The left coronary (left main) artery arises from the left posterior sinus of Valsalva. As it passes to left and downward into atrioventricular groove it rather quickly divides into two or three major branches. Occasionally, the left coronary artery trifurcates into the LAD, left circumflex and the third (intermediate) artery. As major part of heart is supplied by these two branches of LCA that is LAD and Circumflex artery, hence present study is designed to see the course and termination pattern of these two arteries and review the available literature regarding these arteries, so that, the information regarding these arteries would be immensely useful to interventional radiologist and cardiologist to predefine the abnormalities and thus line of treatment. 50 cadaveric human heart specimens (25 male and 25 female) were used by under water dissection method and termination of LAD and CX Artery were noted. Observations regarding level of termination of Left Anterior Descending Artery (LAD) revealed that in 29 (58%), 15 (30%) male and 14 (28%) female, specimens it terminated at a point 2-5 cm up PIVS. In 15 (30%), 8 (16%) male and 7 (14%) female, specimens it terminated at posterior apex. In 6 (12%), 2 (4%) male and 4 (8%) female, specimens it terminated at anterior apex. In 1 (2%) specimen left circumflex artery terminate before obtuse margin. In 14 (28%), 6 (12%) male and 8 (16%) female, specimens it terminated at obtuse margin. It terminated between obtuse margin & crux in 26 (52%) specimens which includes 13 (26 %) male and 13 (26%) female specimens. In 6 (12%), 4 (8%) male and 2 (4%) female, specimens it terminated at crux and in 3 (6%) specimens it terminated beyond crux.

### KEYWORDS

Left anterior descending branch, left circumflex branch, Left coronary artery.

### INTRODUCTION

The left coronary (left main) artery arises from the left posterior sinus of Valsalva. The ostium lies below the margin of the cusps in 15%, and may be double, leading into major initial branches, usually the circumflex and anterior descending arteries. The left coronary artery is larger in calibre than the right and supplies a great volume of myocardium, including almost entire left ventricle and atrium except, in so called 'right dominance', in which the right coronary artery partly supplies a posterior region of the left ventricle<sup>1</sup>. The length of the trunk of the left main artery in general varies from 2 to 12 mm but may be up to 30 mm. Its diameter, ranging from 5 to 10 mm, is generally inversely related to its length<sup>2</sup>. Major branches of LCA are:

#### (I) Anterior interventricular (Left Anterior Descending or LDA) artery:

It is continuation of the left main coronary artery & travels into the upper portion of the interventricular sulcus and continues toward the apex of the heart and usually rounds the apex of the heart to supply a small portion of the diaphragmatic surface.<sup>3</sup> The Anterior interventricular artery gives many branches like left conus artery, Ventricular branches, Septal branches: Interventricular branches, or septal perforating branches, descend from the LAD and travel down through the interventricular septum. These anterior septal perforators and penetrate two thirds into the anterior septum.

(ii) **The circumflex artery:** The other major division of the left coronary artery, at its origin, the left circumflex artery has a diameter ranging between 1.5 and 5 mm. It arises at almost right angles to the main stem of the left coronary and the anterior descending branch, and encircles the heart to the left<sup>1</sup>. It continues round the left cardiac border into the posterior part of the groove and ends at left of the crux in most hearts, but sometimes continues as a posterior interventricular artery. The following branches arise from circumflex artery: Atrial branches, SA Nodal branch (In 40% of subjects). AV Nodal branch: It arises near the crux, in which case the circumflex usually supplies the posterior descending artery. Ventricular branches, Left marginal artery. In 90%, a large ventricular branch, the left marginal artery (also called obtuse marginal branch), arises perpendicularly from the circumflex artery and ramifies over the rounded 'obtuse' margin, supplying much of the adjacent left ventricle, usually to the apex. Kugel's artery described an early anterior atrial branch of the left circumflex artery.

Variations in the coronary arterial system mainly affect the diaphragmatic aspect of the ventricles and reflect the relative 'dominance' of supply by the left or the right coronary artery. The term is misleading, because the left artery almost always supplies a greater volume of tissue than the right. Hence, present study is designed to see the course and termination pattern of these LAD and Cx arteries and review the available literature on these arteries.

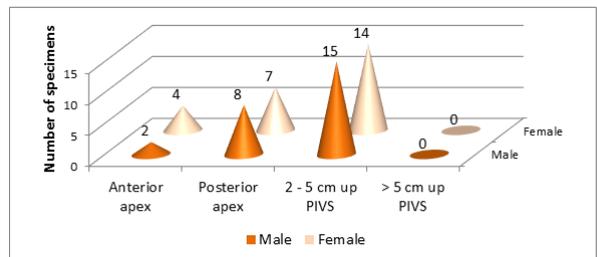
### MATERIAL & METHODS

Study was done in 50 human heart specimens (25 male and 25 female). Hearts without any obvious macroscopic pathology were included in this study. The visceral pericardium was removed and by micro dissection the Left Anterior descending and Cx branch of LCA were traced. The specimens were numbered from 1 to 50. Male and female specimens were preserved separately in 10% formaldehyde solution.

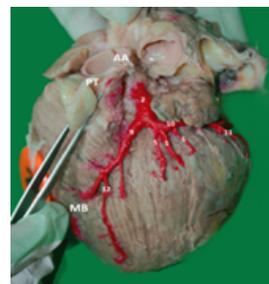
### RESULT

#### Graph-1

Level of termination of Left Anterior Descending Artery N=50 (25 Male & 25 Female)



As shown in Graph No. 1 observations regarding level of termination of Left Anterior Descending Artery (LAD) revealed that in 29 (58%), 15 (30%) male and 14 (28%) female, specimens it terminated at a point 2-5 cm up PIVS. In 15 (30%), 8 (16%) male and 7 (14%) female, specimens it terminated at posterior apex. In 6 (12%), 2 (4%) male and 4 (8%) female, specimens it terminated at anterior apex.



Photograph-1: Anterior view showing LAD & Cx branch

**Photographs showing different Level of termination of Left Anterior Descending Artery**



Photograph-2: Termination at anterior apex

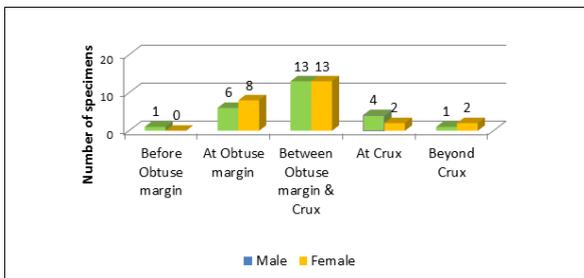


Photograph-3: Termination at posterior apex



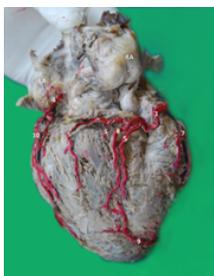
Photograph-4: Termination at 2-5 cms up PIVS

Graph – 2  
Level of termination of Left Circumflex Artery N=50 (25 Male & 25 Female)

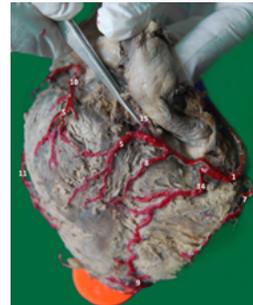


Graph No. 2 shows that, in 1 (2%) specimen left circumflex artery terminate before obtuse margin. In 14 (28%), 6 (12%) male and 8 (16%) female, specimens it terminated at obtuse margin. It terminated between obtuse margin & crux in 26 (52%) specimens which includes 13 (26 %) male and 13 (26%) female specimens. In 6 (12%), 4 (8%) male and 2 (4%) female, specimens it terminated at crux and in 3 (6%) specimens it terminated beyond crux.

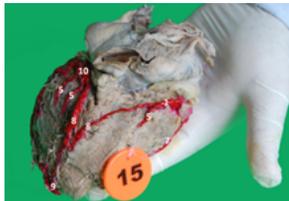
PHOTOGRAPHS SHOWING different Level of termination of Circumflex Artery



Photograph-5: Termination at obtuse margin



Photograph-6: Termination between obtuse margin & CruX



Photograph-7: Termination at crux



Photograph-8: Termination beyond crux

**DISCUSSION**

In 1977, Omar B. K. stated that, James considered majority of hearts as left coronary artery predominant since he argued that left coronary artery supplied more of myocardial tissue that the right one. Weight of heart piece supplied by right coronary artery varied from 45-160gms and left coronary artery varied from 75-175gms<sup>5</sup>. In 1978, Robert Walmsley, Hamish Watson and John Kirklin propounds that, regardless the variations in the territory supplied by the right coronary artery, the left coronary artery plays a dominant role in the blood supply to the myocardium.<sup>6</sup> The anterior interventricular and terminal branches of the left coronary artery, sometimes, arise separately from the aortic sinus.<sup>7</sup> Llia R, Rosenstein G et al (2001) found that the left anterior descending artery in left coronary dominance is usually long and wraps around the apex and angiographic interventions in such cases have important clinical significance.<sup>8</sup>

Table-1: Termination of left Anterior descending Branch (In %)

Termination	James (1961)	Kalpna R(2003)	Present study
Anterior apex	17	8	12
Posterior apex	23	12	30
2-5 cm up PIVS	42	80	58
>5 cm up PIVS	18	-	-

As shown in table No. 1, in the study carried out by James (1961)<sup>9</sup> LAD found to be terminated at anterior apex in 17%, at posterior apex 23%, 2-5 cm up the PIVS in 42% and more than 5 cm up the PIVS in 18% specimens. In the study done by Kalpna R<sup>10</sup> (2003) the LAD branch crossed over the apex to reach upto 2-5 cm up the posterior IV groove in 80%, up to the anterior apex in 8% and posterior apex in 12% of the specimens.

The abnormal origin of the circumflex branch of the left coronary artery is most common. This springs from the right coronary artery and usually crosses the posterior part of the aortic root and passes in the left atrioventricular sulcus<sup>11</sup> In 2006, Apsara M. P. mentioned that in one patient, origin of circumflex artery from right coronary artery was detected in the left anterior oblique (LAO) cranial view of right coronary artery and without providing circumflex branch, left coronary artery continued as left anterior descending<sup>12</sup>

**Table-2: Termination of Left circumflex artery (In%)**

Termination	James (1961)	Kalpana (2003)	Present study
Before obtuse margin	1	3	2
At obtuse margin	20	13	28
Between obtuse margin and crux	60	67	52
At crux	9	6	12
Beyond crux	9	11	6
Not present	1	--	--

As shown in the table No.2, the incidence of the termination of Left Circumflex artery, found in the studies carried out by James<sup>9</sup> and Kalpana<sup>10</sup> at various levels are: termination before obtuse margin ranged between 1-3%, at obtuse margin 13-20%, between obtuse margin and crux 60-67%, at crux 6-9% and beyond crux it ranged between 9-11%.

The present study showed that in 2% specimen the left circumflex artery terminated before obtuse margin. In 28% (12% male and 16% female) specimens it terminated at obtuse margin. It terminated between obtuse margin & crux in 52% specimens (26 % male and 26% female). In 12% (8% male and 4% female) specimens it terminated at crux and in 6% specimens it terminated beyond crux.

## CONCLUSION

Various scholars considered majority of hearts as left coronary artery predominant since LAD and Cx branches supply more of myocardial tissue as compare to right one. Over 45% of left coronary arteries have variant pattern of termination. Since the LAD artery is the most commonly occluded coronary arteries, blockage of this artery can lead to impairment of the conducting system. Its termination patterns are also very useful to interventional radiologists and surgeons. So, termination and course of LAD & Cx are to be studied more enthusiastically for a better understanding, evaluation and management of the disease.

## KEYS TO PHOTOGRAPHS

1-Right Coronary Artery	12-Left Diagonal Artery
2-Left Coronary Artery	13-Intermediate artery
3-Right Conus Artery	14-Posterior Right Diagonal Artery
4-Atrial branch	15-Atrioventricular Nodal Artery
5-Ventricular branch	16-Third Coronary Artery
6-Sinu-atrial Nodal Artery	17-Fourth Coronary Artery
7-Right Marginal Artery	RA-Right Atrium
8-Posterior Interventricular Artery	LA-Left Atrium
9-Left Anterior descending Artery	AA-Ascending Aorta
10-Left Circumflex Artery	PT-Pulmonary trunk
11-Left Marginal Artery	AAS-Anterior Aortic Sinus
	PAS-Posterior Aortic Sinus

## ABBREVIATIONS:

LAD- Left Anterior Descending Artery	Cx- Circumflex
LCA- Left Coronary Artery	RCA- Right Coronary Artery
SA- Sinuatrial	AV- Atrioventricular

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