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Anatomical variations of the Left Coronary Artery - A Cadaveric study

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Abstract:

Background- The heart is a hollow muscular organ situated in the mediastinum of the thoracic cavity. Coronary arteries are the first branch of aorta, most commonly originating below the junction between the bulbous and ascending part of aorta. The right and the left coronary arteries take origin from ascending aorta from its anterior and left posterior aortic sinus respectively. **Aim and Objectives-** To observe the anatomical variations in left coronary artery. **Material & Methods:**The study was carried out on 120 human cadaveric hearts from the Department of Anatomy, IMC&H Indore (M.P.), AFMS&RC Faridabad (Haryana), DYSPGMC Nahan (HP). **Result-** In the present study Left Coronary artery (LCA) originated from Left posterior aortic sinus in all the specimens. Bifurcation of LCA was observed in 88.33% of specimens, trifurcation of LCA in 10% of specimens, quadrifurcation and pentafurcation of LCA was also observed in 1% of specimens respectively.

Key words – Aorta, Bulboul, Cadaveric

Introduction-

The heart is a hollow muscular organ situated in the mediastinum of the thoracic cavity. Coronary arteries are the first branch of aorta, most commonly originating below the junction between the bulbous and ascending part of aorta. The right and the left coronary arteries take origin from ascending aorta from its anterior and left posterior aortic sinus respectively.

The right and the left coronary arteries take origin from ascending aorta from its anterior and left posterior aortic sinus respectively. Left coronary Artery (LCA) divides into left anterior descending artery (LAD) and left circumflex artery (LCX) (Bifurcation). LCA is larger than RCA and supplies greater part of myocardium[1,2].

Left anterior descending artery descends obliquely forward and to the left in the anterior interventricular groove. Its branches include the anterior ventricular rami for both right and left ventricles and the septal rami pass deeply and supply anterosuperior (two–thirds) of interventricular septum. Circumflex Artery passes to left in the left atrioventricular groove. It ends by anastomosing with the right coronary artery. Its branches are atrial and ventricular rami. The meeting point of interatrial groove, posterior interventricular groove and posterior part of atrioventricular groove is called the Crux of Heart. Right Coronary Artery takes origin from the anterior aortic sinus of ascending aorta. It Passes downwards into the right part of

atrioventricular groove, and reaches the crux of heart[1].The study of coronary arteries will be helpful for the interventional cardiologists and the radiologists to predefine the abnormalities before any invasive management is done. Considering the importance of knowledge of coronary arterial pattern in the cardiac surgeries and keeping in mind the ever evolving and yet unexplored facts, the present study has been undertaken to shed more light on this topic

Material & Methods:

The study was carried out on 120 human cadaveric hearts from the Department of Anatomy, IMC&H Indore (M.P.), AFMS&RC Faridabad (Haryana), DYSPGMC Nahan (HP).

The specimens were obtained from cadavers during the routine teaching sessions of dissections for undergraduate MBBS students. The thoracic cavity was opened after cutting the ribs and sternum. The great blood vessels were ligated by tying threads at two poles and then cutting them from between.

The anterior surface of heart was dissected to observe the origin of Left Coronary Artery (LCA) taking origin from the ascending aorta, between the left auricle and the left side of pulmonary trunk.

LCA was identified and any variation in the origin of LCA was noted down.

• LCA was traced to the level of its division on the superior end of anterior interventricular groove. It usually branches into Left Anterior Descending Artery (LAD) and Left Circumflex Artery (LCX).

The branching pattern of LCA and any variations in the division of the main trunk of LCA were noted

Results:

The present study was conducted in 120 specimens of cadaveric hearts and observed the coronary artery dominance.

Table 1: Origin of the Left coronary artery (LCA)

Origin	Number of Specimen (n)	Percentage
RPAS	**0**	**0%**
LPAS	**120**	**100%**
AAS	**0**	**0%**
Total	**120**	**100%**

In the present study, the Left coronary artery originated from the Left posterior aortic sinus (LPAS) in all the 100 specimens studied and none originated from the Right posterior aortic sinus (RPAS) or Anterior aortic sinus (AAS)

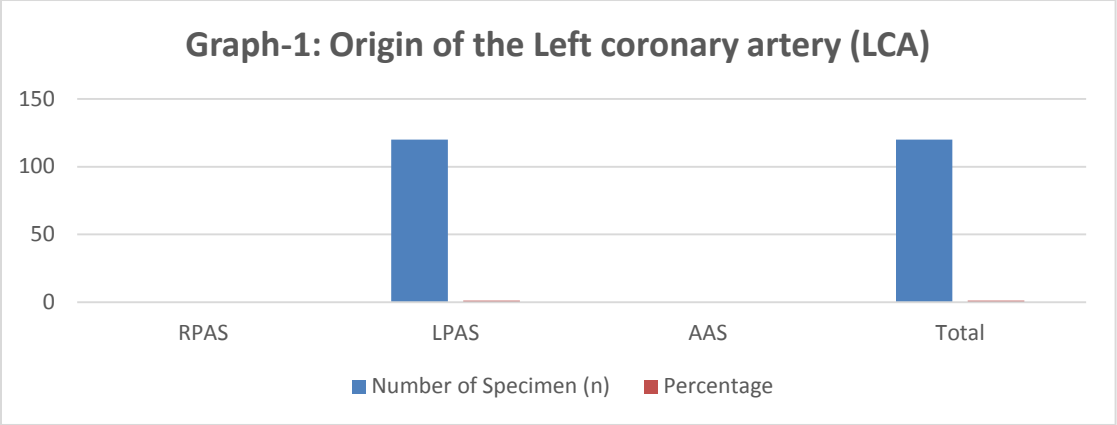

Figure-1 : Origin of LCA

Table 2: Division of main trunk of Left Coronary artery (LCA)

No of branches	Number of Specimen (N)	Percentage
Single	**0**	**0%**
Bifurcation	**106**	**88.33%**
Trifurcation	**12**	**10%**
Quadrifurcation	**1**	**0.83%**
Pentafurcation	**1**	**0.83%**
Total	**120**	**100%**

In the present study we observed that bifurcation of Left coronary artery (LCA) was found in 106 specimens (88.33%), trifurcation was in 12 specimens (10%), quadrifurcation in 1specimens (0.83%) and pentafurcation in 1 specimens (0.83%). Single Left coronary artery was not observed in any specimen.

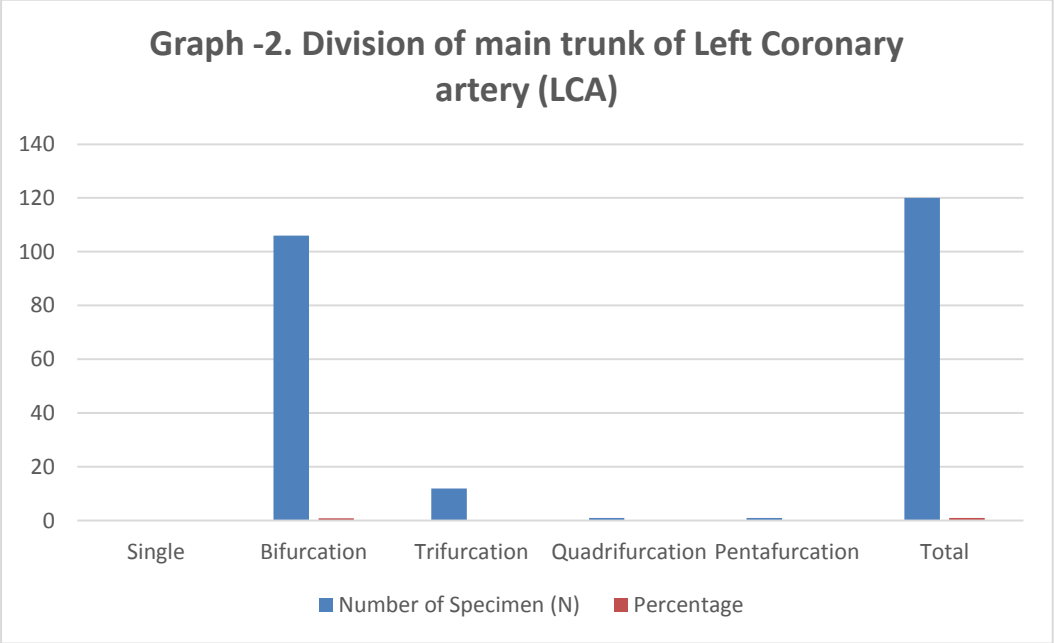

Figure-2 : Bifurcation of LCA

Figure-3 : Trifurcation of LCA

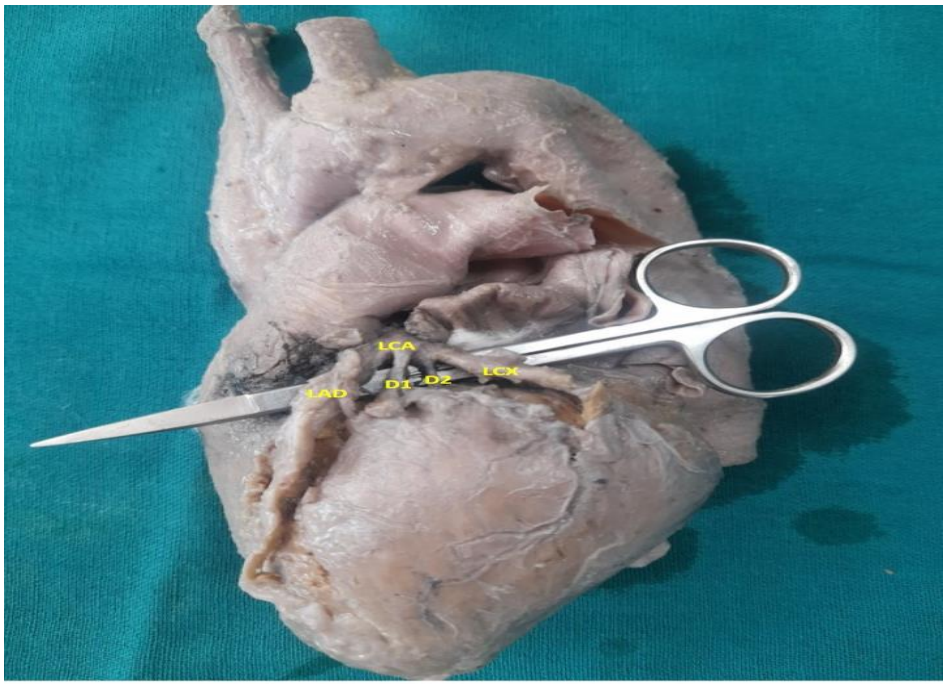

Figure-4 : Quadrifurcation of LCA

Figure-5: Pentafurcation of LCA

Table -3 : Showing origin of Left coronary artery

Authors	**RPAS**	**LPAS**	**AAS**
Bharambe VK		100%	
Gajbe UL		100%	
Mutyal SR		100%	
Kulkarni JP		100%	
Kalpana R		100%	
Bhimalli S		100%	

Dharmendra P			1.07%
Fazliogullari et al.		100%	
Dattatray et al.		100%	
Chougule et al.		100%	
Roy et al.		100%	
Jaishree et al.		100%	
Mirza et al.		100%	
Gathe and Pandit		100%	
Agarwal et al.		100%	
Meshram et al.		100%	
Ravi and Tejesh		100%	
Present Study		**100%**	

In the present study the left coronary artery originated from left posterior aortic sinus in all the specimens (100%) which is similar to study done by various researcher such as Bharambe VK et al, Gajbe UL, Kulkarni JP ,Mutyal SR, Kalpana R, Bhimalli S, Dattatray et al. , Fazliogullari et al, Chougule et al., Roy et al., Jaishree et al., Mirza et al. , Gathe and Pandit , Agarwal et al. , Meshram et al. , Ravi and Tejesh .

• Dharmendra et al observed the variations in 1.07% of cases where LCA originated from Anterior Aortis Sinus (AAS). No such observation was found in present study.

Table – 4: Showing comparison of branching pattern of main trunk of LCA:

Author	**Single**	**Bifurcation**	**Trifurcation**	**Quadrifurcation**	**Pentafurcation**
Dombe D	0%	54.70%	35.90%	7.80%	0%
Ballesteros LE	0%	52%	42.20%	5.8%	0%
Dharmendra P	0%	58.06%	35.48%	6.45%	0%
Bharambe VK	0%	64%	36%	0%	0%
Kulkarni JP	0%	83.3%	16.6%	0%	0%
Kilic C	0%	86%	14%	0%	0%
Kalpana R	1%	47%	40%	11%	1%
Grande N	0%	10.5%	89.5%	0%	0%
Chougle P	0%	35%	15%	0%	0%
Baptista CAC	0%	54.7%	38.7%	6.7%	0%
Cavalcanti et al.		60%	38.18%	-	-
Surucu et al.		47.5	47.5	2.5%	2.5%
Ortale et al.		50	46	4	-
Fazliogullari et al.		46	44	10	-
Agnihotri et al.		66	30	4	-
Santoshkumar and		70	26	4	-

Balaji					
Ogengo et al.		54.8	32.2	9.6	3.4
Roy et al.		60	38	2	-
Jaishree et al.		81.5	14.5	4	-
Mirza et al.		45	42.5	4	-
Patel et al		74	18	6	2
Reddy and Pusala		86	14	-	-
Vidya Lakshmi et al		60	14	10	2
Singh et al		50	34	14	2
Mallashetty and Itagi		66.67	23.33	10	-
Ravi and Tejesh		80	13.3	3.3	3.3
Present Study	**-**	**88.33%**	**10%**	**0.83%**	**0.83%**

Kalpana R reported single branch of LCA in 1% specimens. No other researcher has observed such a branch of LCA. No such branch was observed in present study.
Bifurcation of LCA was reported in 80-90% of specimens by Kilic C , Kulkarni JP, Ravi and Tejesh, Reddy and Pusala, Jaishree et al. Which is comparable to the present study 88.33% of specimens. Bifurcation of LCA was reported in 60-80% of specimens by Bharambe VK, Cavalcanti et al. , Agnihotri et al. , Santoshkumar and Balaji , Roy et al., Patel et al, Vidya Lakshmi et al, Mallashetty and Itagi. Bifurcation of LCA was reported in 40-60% of specimens by Dombe D, Ballesteros LE, Dharmendra P, Kalpana R, Baptista CAC, Surucu et al. , Ortale et al. , Fazliogullari et al. , Ogengo et al., Mirza et al., Singh et al, Bifurcation of LCA observed by Chougle P and Grande N in 35% and 10% of specimens respectively . Grande N reported trifurcation of LCA in 89.5% specimens which is highest finding of all the studies done by various researchers. Trifurcation of LCA was observed to be in range of 30-50% by Dombe D, Ballesteros LE, Dharmendra P, Bharambe VK, Kalpana R, Baptista CAC, Cavalcanti et al., Surucu et al. , Ortale et al. , Fazliogullari et al. , Agnihotri et al., Roy et al. , Patel et al,), Ogengo et al., Mirza et al., Singh et al.

Researchers found Less than 30% of trifurcation is Kulkarni JP, Kilic, Chougle P, Santosh kumar and Balaji , Jaishree et al. , Patel et al Reddy and Pusala , Vidya Lakshmi et al, Ravi and Tejesh and Mallashetty and Itagi. In comparison the present study reports least number of hearts (10%) showing trifurcation. Quadrifurcation of LCA was observed to be in range of 2-10% by Dombe D, Ballesteros LE, Dharmendra P, Kalpana R, Baptista CAC, Surucu et al. , Ortale et al. , Fazliogullari et al. , Agnihotri et al. , Santoshkumar and Balaji , Jaishree et al. , Vidya Lakshmi et al, Ravi and Tejesh and Mallashetty and Itagi. Roy et al., Patel et al, Ogengo et al. , Mirza et al., Singh et al. In comparison the present study reports least number of hearts (10%) showing trifurcation. Surucu et al. , Ogengo et al., Patel et al, Vidya Lakshmi et al, Singh et al , Ravi and Tejesh observed pentafurcation in 2.5%, 3.5%, 2% ,2%, 2% and3.3% respectively. Kalpana R observed pentafurcation in 1% of specimens which is comparable to the present study (0.83%).

Conclusion

In the present study Left Coronary artery (LCA) originated from Left posterior aortic sinus in all the specimens. Bifurcation of LCA was observed in 88.33% of specimens, trifurcation of LCA in 10% of specimens, quadrifurcation and pentafurcation of LCA was also observed in 1% of specimens respectively.

The data of the present study will be helpful for interpretation of coronary angiography and surgical myocardial revascularisation. The advances made in coronary arterial bypass surgeries and modern methods of coronary artery disease treatment makes it imperative that a thorough, sound and complete knowledge of normal and variant anatomy of coronary arteries and circulation is required, which led to this study.

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