



ANATOMICAL STUDY OF CORONARY OSTIA IN CADAVERIC HUMAN HEART

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ABSTRACT

The right and left coronary artery arises from the anterior and left posterior sinus of Valsalva respectively. Aortic root is an important area for various interventional diagnostic and surgical procedures for cardiologist and radiologist which comprises of the bulbar aortic sinus and the proximal ascending aorta. 50 cadaveric human heart specimens (25 male and 25 female) were used by dissection method. It has been observed that the mean diameter of left coronary ostium is more than that of right coronary ostium. The mean diameter of left coronary ostium in male is 4.37mm ± 0.84 and in female it is 4.16mm ± 0.67. On the contrary, in case of right coronary ostium the mean diameter were 3.04mm ± 0.76 and 3.14mm ± 0.70 in male and female respectively. In 18% specimens multiple openings were observed in anterior aortic sinus. However, in 4% specimen anterior aortic sinus with no openings were also observed. Multiple openings were also seen in left posterior aortic sinus in 4% specimen. No openings were observed in the pulmonary sinuses and the right posterior aortic sinus.

Knowledge of the level of ostia is very important to avoid difficulties during various diagnostic and surgical procedures, hence, to extract extra information regarding these issues, study was also extended to observe the level of ostia; and in this study right coronary ostium was found below Supravalvular Ridge (SVR) in 78% specimen, at SVR in 10% specimen and above SVR in 12% specimen. The left coronary ostium was found below SVR in 68% cases, at SVR in 16% cases and above SVR in 16% cases.

KEYWORDS : CORONARY OSTIA, HUMAN HEART

INTRODUCTION:

The Aortic root is an important area for various interventional diagnostic and surgical procedures for cardiologist and radiologist which comprises of the bulbar aortic sinus and the proximal ascending aorta. A slight circumferential thickening, known as the sinutubular ridge, marks the separation of these two structures. The bulbous sinus and the three aortic cusps merge to form the sinuses of Valsalva. The right sinus of Valsalva lies towards right and anterior in the aortic root and contains the right aortic semilunar cusp, whereas the left sinus of Valsalva lies towards left and posterior in the aortic root and contains the left aortic semilunar cusp. The posterior sinus of Valsalva lies posterior to the right sinus and contains the non-coronary aortic semilunar cusp. The coronary ostia are usually located below the sinutubular ridge. The ostium of each coronary artery tends to form a slight funnel, with the diameter of the left main coronary artery at its ostium slightly larger than that of the right coronary artery¹. The Right coronary artery arises nearly perpendicularly from the aorta, while the left coronary artery arises at an acute angle.² The location, level and size of ostium are very important in the successful performance of a coronary angiogram³.

MATERIAL AND METHOD:

Study was done in 50 cadaveric human heart specimens (25 male and 25 female). Hearts without any obvious macroscopic pathology within age group 20-60 years were included in this study. The visceral pericardium was removed and by micro dissection the RCA and LCA were exposed. The ascending aorta was cut longitudinally to see position, number and level of coronary ostium of left and right coronary artery. The diameter of ostium of coronary arteries was measured with the help of vernier caliper. The specimens were numbered from 1 to 50. Male and female specimens were preserved separately in 10% formaldehyde solution.

RESULTS:

Table – 1 Number and percentage of specimens of single/multiple ostia in aortic sinus

N=50 (25 Male & 25 Female)

No. of Op enin g	Anterior (Right) Aortic Sinus						Left Posterior Aortic Sinus						Right Posterior Aortic Sinus					
	Male		Fema le		Total		Male		Fema le		Total		Male		Fema le		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
0	1	2	1	2	2	4	0	0	0	0	0	0	25	50	25	50	50	100
1	17	34	22	44	39	78	24	48	24	48	48	96	0	0	0	0	0	0

2	6	12	2	4	8	16	1	2	1	2	2	4	0	0	0	0	0	0
3	1	2	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

In table No. 1, observation regarding number of openings in various aortic sinuses has been shown. In 39 specimens (78%) only one opening was found in anterior aortic sinus. Out of these 39 specimens, 17 were males (34%) and 22 were females (44%). Similarly, in 9 specimens (18%), multiple opening were noticed in anterior aortic sinus. Out of these nine specimens 8 specimens were found with two openings which includes six specimens of male and two female specimens and remaining one male specimen was found with three opening in anterior aortic sinus. These extra openings were minute and pinhead sized. However, anterior aortic sinus with no opening was also noticed during in 2 specimens (4%), one male and one female each.

In the left posterior aortic sinus, 48 (96%) of specimens were found with single opening out of which, male and female specimens were 24 (48%) each. Multiple opening was seen in 4% specimens. These 4% specimens were seen with 2 openings out of which one specimen (2%) was male and another was female

In right posterior aortic sinus, no opening was seen in all the 50 specimens.

Table – 2 Diameter the Right & Left Coronary Ostia (In mm)

N=50 (25 Male & 25 Female)

	RCA			LCA		
	Male	Female	Total	Male	Female	Total
Ostium Diameter (mean ± SD)	3.04 ± 0.76	3.14 ± 0.70	3.09 ± 0.72	4.37 ± 0.84	4.16 ± 0.67	4.26 ± 0.76

As shown in table No. 2 the mean diameter of ostium of RCA in male specimens was 3.04mm with standard deviation 0.76; while in female specimens mean diameter of ostium of RCA was 3.14mm with the standard deviation 0.70. It shows that mean of ostium of RCA in total specimens was 3.09mm with standard deviation 0.72.

On the other hand mean diameter of ostium of LCA was 4.37mm in male specimens, 4.16mm in female specimens and 4.26mm in total

specimens. Their standard deviations were 0.84, 0.67 and 0.76 respectively.

Table – 3 Level of Right Coronary Ostium

N=50 (25 Male & 25 Female)

Level of Right Coronary Ostium	Number and percentage of specimens					
	Male		Female		Total	
	No.	%	No.	%	No.	%
Below Supra-valvular Ridge	21	42	18	36	39	78
At Supra-valvular Ridge	3	6	2	4	5	10
Above Supra-valvular Ridge	1	2	5	10	6	12

As depicted in table No.3 the observation regarding level of right coronary ostium reveals that, in 39 (78%) specimens (42% male & 36% female) the right coronary ostium was below the Supra-valvular ridge. In five (10%) specimens, right coronary ostium was found at the supra-valvular ridge, three (6%) were male and two (4%) were female specimens. However in six (12%) specimens, right coronary ostium was found below the supra-valvular ridge. Out of these six specimens, one (2%) was male and remaining five (10%) were female specimens.

Table – 4 Level of Left Coronary Ostium

N=50 (25 Male & 25 Female)

Level of Left Coronary Ostium	Number and percentage of specimens					
	Male		Female		Total	
	No.	%	No.	%	No.	%
Below Supra-valvular Ridge	17	34	17	34	34	68
At Supra-valvular Ridge	3	6	5	10	8	16
Above Supra-valvular Ridge	5	10	3	6	8	16

While observing the level of left coronary ostium as shown in table No. 4 it was found that in total 34 (68%) specimens it was present below Supra-valvular ridge. Out of these 34 specimens, 17 (34%) specimens were male and 17 (34%) specimens were female. In Eight (16%) specimens it was present at supra valvular ridge and in eight (16%) specimens it was present above the Supra-valvular ridge. In the specimens in which it was present at the SVR, three (6%) were male and five (10%) were female specimens. In specimens where it was present above SVR the number of specimens was 5 (10%) and 3 (6%) for male and female respectively.

Discussion: Normally, an individual has two or, sometimes, three coronary ostia. Often, the conus branch of the RCA may arise separately from the right aortic sinus. The circumflex or LAD, on occasion, arises directly from the aortic root. The origin of the coronary arteries shows great variability. Garcia Gallego F et al (1992) noted about the independent origins of the Left anterior descending, circumflex and right coronary arteries from the right coronary sinus. ⁴Maresi E, Orlando E et al (1993) noted anomalous origin of the right coronary from the left sinus of Valsalva. ⁵

Table – 5 Percentage of specimens of single/ multiple ostia in aortic sinus

S. No.	Study done by	No. of opening	Anterior aortic sinus (%)	Left posterior aortic sinus (%)	Right posterior aortic sinus (%)
1.	Subhash D. Joshi, et al. (N=105)	0	0	0	100
		1	61.90	98.09	0
		2	29.52	1.90	0
		3	7.6	0	0
2.	Present study (N=50)	0	4	0	100
		1	78	96	0
		2	16	4	0

	3	2	0	0
	4	0	0	0

Subhash D Joshi, et al found 1 opening in 61.90% cases, 2 opening in 29.52%, 3 opening in 7.6% and 4 opening in 0.95% cases in Anterior Aortic sinus. They found 2 opening in 1.90% cases in Left posterior aortic sinus⁶. In their study, Gajbe U L, Gosavi S et al noted that two specimens showed two ostia in the anterior aortic sinus and three specimens showed three separate ostia in the anterior aortic sinus⁷. Standing et al (2005) have reported the incidence of extra openings in the right aortic sinus in 36% of cases.⁸

Table – 6 Mean diameter of Right and Left coronary ostia

Study done by	Diameter of Coronary ostia (Mean ± SD) (in mm)	
	Right Coronary Ostium	Left coronary Ostium
Parimala Sirikonda, Sreelatha S	2.77 ± 0.905	4.11 ± 0.88
Dalbir Kaur et al	3.9 ± 1.0	4.6 ± 1.0
Dattatray D. Dombé et al	-	3.3 ± 0.57
Bellestero et al	-	3.58 ± 0.59
Present study	3.09 ± 0.72	4.26 ± 0.76

Parimala Sirikonda, Sreelatha S noted the mean diameter of RCO was 2.77mm and that of LCO was 4.11mm⁹. As per Dattatray D. Dombé et al, the mean ostium diameter of the LCA was 3.3 mm ± 0.57 (range 2 to 5 mm).¹⁰ The mean diameter of Right Coronary ostia in the present study is found to be more in comparison with that found by Parimala Sirikonda, Sreelatha S². On the contrary it is found to be less in comparison with that found by Dalbir Kaur et al¹¹. The mean diameter of LCO in the present study was more in comparison with that found by Parimala Sirikonda et al⁹, Dattatray D. Dombé et al¹⁰ and Bellestero et al¹². However, it is found to be less in comparison with that found by Dalbir kaur et al.¹¹

Table – 7 Levels of Right and Left coronary ostia (In %)

Study done by	Right Coronary Ostium			Left Coronary Ostium		
	Below SVR	At SVR	Above SVR	Below SVR	At SVR	Above SVR
Dattatray D. Dombé et al	-	-	-	79.7	17.2	3.1
Subhash D. Joshi et al	89.52	6.66	3.80	80	15.23	4.76
Present Study	78	10	12	68	16	16

In a majority of the cases, the positions of the ostia were below the sinutubular ridge. As per study carried out by Dattatray D Dombé et al¹⁰, Left coronary ostia was found below SVR in 79.7%, at SVR in 17.2% and above SVR in 3.1% cases. As per Subhash D Joshi et al right coronary ostium was found below sinutubular ridge in 89.52% cases, at sinutubular ridge in 6.66% cases and above sinutubular ridge in 3.80% cases. Similarly, left coronary ostium was found below sinutubular ridge in 80% cases, at sinutubular ridge in 15.23% cases and above sinutubular ridge in 4.76% cases⁹.

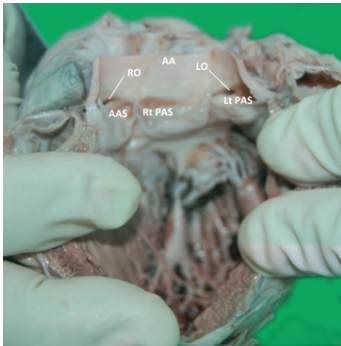
In the present study, right coronary ostium was found below SVR in 78% specimens, at SVR in 10% specimens and above SVR in 12% specimens. While, left coronary ostium was found below SVR in 68% cases, at SVR in 16% cases and above SVR in 16% cases.

CONCLUSION:

The problems during procedures like angiography, angioplasty and coronary artery bypass grafting may occur due to presence of multiple ostia, vertical and slit-like ostia as one may get confused in interpretation of the images. To avoid these difficulties and problems, knowledge of the level of ostia is very important. To gain some extra information regarding this, study on the level of ostia was also done. In some cases, even when the ostia were present

above the level of commissures, the sinutubular ridge arched over the ostial opening rather than being straight. The sinutubular ridge is arched to accommodate the ostium within the sinus. Difficulty in manipulating the catheter tips will be considerably higher in patients with the ostium above the level of STJ. Hence, it can be concluded that knowledge of this study may help cardiologist in their clinical practice and may serve as a base of better procedures.

2	-	Left Coronary Artery
AA	-	Ascending Aorta
PT	-	Pulmonary trunk
AAS	-	Anterior Aortic Sinus
PAS	-	Posterior Aortic Sinus



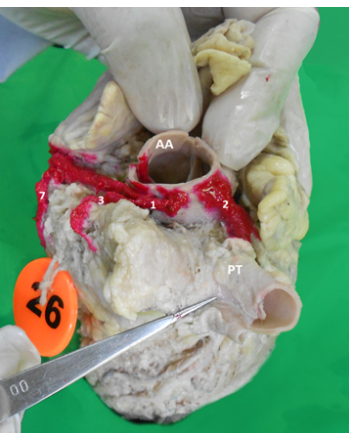
Photograph:1– Various aortic sinuses and right & left ostium. (Anterior view)



Photograph No. 2– Multiple openings in Anterior Aortic Sinus. (Superior view).



Photograph No. 3 Two openings in Posterior Aortic Sinus. (Superior view)



Photograph No. 4– RCA & LCA both arising from left Posterior Aortic Sinus

Keyto Photographs

1	-	Right Coronary Artery
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