

## Variation In Number & Diameter of Coronary Artery Ostia: A Combined Gross Anatomical & Angiographic Study

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### Abstract:

**Introduction:** The right and left coronary arteries arise from the ascending aorta in its anterior and left posterior sinuses. The calibre of coronary arteries, both main stems and larger branches, based on measurements of arterial casts or angiograms, ranges between 1.5 and 5.5 mm for the coronary arteries at their origins. The left exceed the right in 60% of hearts, the right being larger in 17%, and both vessels being approximately equal in 23%.

**Material and Methods:** 55 heart specimens were dissected and 82 cases of angiography were studied. The aorta was cut opened transversely, approximately 0.5 cm above the openings of RCA & LMCA. Numbers of ostial openings were counted and Location of respective ostia in the aortic sinus was noted. After cutting coronary arteries just outside the wall of aorta inner diameter of each was taken with the help of Vernier caliper. In Angiography measurement of diameter of ostium was calibrated with the diameter of the catheter (2 mm) used.

**Result:** In 95.62% cases there were two ostia in aortic sinuses for RCA and LMCA each. In 3 cases the ostia of RCA were located in left posterior aortic sinus, In remaining 134 cases ostia of RCA were located in anterior aortic sinus. In all cases ostia of LMCA was located in left posterior aortic sinus. In 4.38% cases third ostium was present in anterior aortic sinus for 3<sup>rd</sup> coronary artery (right conus artery). Ostial diameter of RCA was  $3.55 \pm 0.92$  mm, LMCA was  $4.94 \pm 0.95$  mm and of 3<sup>rd</sup> coronary artery was  $1.2 \pm 0.4$  mm.

**Conclusions:** The origin of RCA & LMCA is in anterior aortic sinus & left posterior aortic sinus respectively with few exceptions in RCA. The diameter of LMCA was more than RCA.

The difference in ostial diameter in male and females is statistically not significant.

**Keywords:** Coronary Artery Ostia, Diameter, Left Coronary Artery, Right Coronary Artery

### I. Introduction

The right and left coronary arteries arise from the ascending aorta in its anterior and left posterior sinuses. The right coronary artery arises from the anterior (right coronary) aortic sinus. The artery is usually single, but as many as four right coronary arteries have been observed. The left coronary artery is larger in calibre than the right. It arises from the left posterior (left 'coronary') aortic sinus; the ostium may be double, leading into major initial branches, usually the circumflex and anterior interventricular (descending) arteries. The calibre of coronary arteries, both main stems and larger branches, based on measurements of arterial casts or angiograms, ranges between 1.5 and 5.5 mm for the coronary arteries at their origins. The left exceed the right in 60% of hearts, the right being larger in 17%, and both vessels being approximately equal in 23%. The diameters of the coronary arteries may increase up to the 30th year.<sup>[1]</sup>

During angiography the initial injection should be gentle because of the possibility that forceful injection through a catheter whose tip is immediately adjacent to the vessel wall may also lead to dissection.<sup>[2]</sup>

Coronary spasm of the Coronary ostium may also occur as a result of catheter intubation. When an ostial stenosis of the RCA is seen, intracoronary nitroglycerin or calcium channel antagonists may be useful in excluding catheter-induced spasm as a cause of the coronary artery narrowing.<sup>[2]</sup> With increase in coronary artery diseases, angiographic investigations are increasing day by day, our study targets variation in number & diameter of coronary artery ostia along with the sexual dimorphism.

### II. Material & Methods

The study was carried out with the permission of institutional ethics committee in the department of Anatomy, in collaboration with the Private cardiology institute in the city.

For gross study 55 heart specimens were dissected, For angiography study, angiographic data of 82 cases was studied which were already recorded with the help of CT Angiographic machine from the well equipped cardiology unit from a private institute in the city. In both type coronary arteries were traceable up to its termination.

By stripping the visceral pericardium from the anterior and posterior interventricular sulcus, as well as from right & left atrioventricular sulcus, the right coronary artery (RCA), left main coronary artery (LMCA), left circumflex artery (LCX) was identified. These arteries then traced up to the origin at aortic sinus. The aorta was cut opened transversely, approximately 0.5 cm above the openings of RCA & LMCA. Numbers of ostial openings were counted and Location of respective ostia in the aortic sinus was noted. The coronary arteries i.e. RCA and LMCA were cut just outside the wall of aorta. With the help of Vernier caliper the inner diameter of each was taken in two perpendicular axes and mean was calculated. Presence of an extra branch from the aortic sinus was seen and its observations were noted.

Group of 82 samples of angiography were selected randomly from the vast data which was already recorded in a private cardiology institute in the city, With the help of DICOM software on computer interface attached with the CT Machine under guidance of the senior interventional cardiologist. Each patient's data consist of more than 6 views, depending on the better visualization of coronary artery. Measurement of diameter of ostium was calibrated with the diameter of the catheter (2 mm) used for angiography. Collectively 137 cases observations were analyzed on SPSS V.13 software by Pearson Chi-square test.

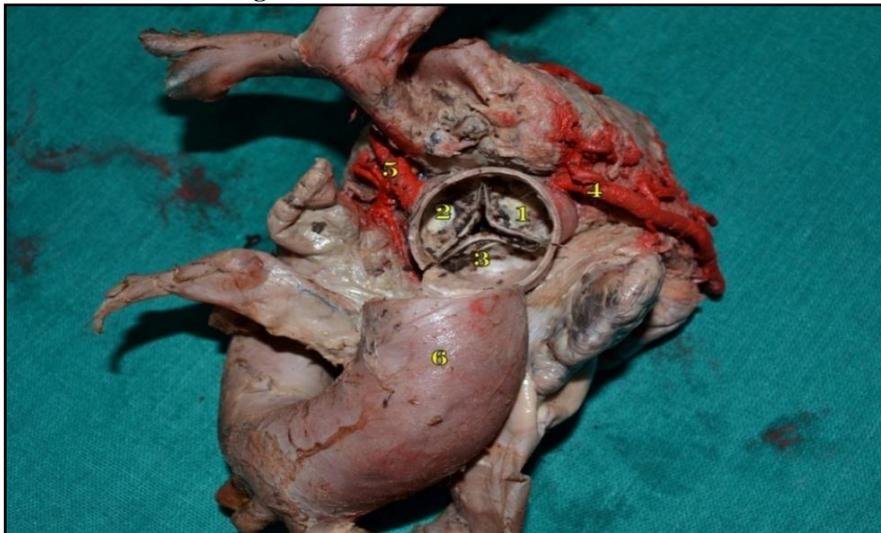
### III. Observations And Results

**Table 1:** No. of ostia in aortic sinus:

	Two	Three	p-Value & Significance
Male (n=102)	94.12% ( n = 96 )	5.88% ( n = 6 )	0.1428 Not Significant
Female (n=35)	100% ( n = 35 )	0.00% ( n = 0 )	
Total (n=137)	95.62% ( n = 131 )	4.38% ( n = 6 )	

Amongst total 137 cases the no. of ostia in the aortic sinus (Table-1) were two in 95.62% cases and three in 4.38%. Amongst 137 cases in all the left coronary artery ostia was present in the left posterior aortic sinus. The right coronary artery ostia was present in anterior aortic sinus in 134 cases (Figure-1), but in 3 male cases it was present in left posterior aortic sinus. The 3<sup>rd</sup> ostium in all 6 (4.38%) cases was for the third coronary artery, which was present in the anterior aortic sinus. The difference in males and females was statistically not significant ( $p > 0.05$ ).

**Figure 1:** Location of ostia in aortic sinus



(1. Anterior aortic sinus, 2. Left posterior aortic sinus, 3. Right posterior aortic sinus, 4. Right coronary artery, 5. Left main coronary artery, 6. Aorta)

**Table 2:** Diameter of ostia (mm)

	RCA M ± 1SD (mm)	LMCA M ± 1SD (mm)	Extra Coronary Artery M ± 1SD (mm)
Male (n=102)	3.55 ± 1.01	4.96 ± 0.94	1.20 ± 0.4
Female (n=35)	3.56 ± 0.6	4.88 ± 1	----
Total (n=137)	3.55 ± 0.92	4.94 ± 0.95	1.20 ± 0.4
p-Value & Significance	0.963 Not Significant	0.839 Not Significant	----

As shown in table-2, amongst males the diameter of ostia of RCA was 3.55 ± 1.01 mm, for LMCA it was 4.96 ± 0.94 mm and for 3<sup>rd</sup> coronary ostium it was 1.2 ± 0.4 mm. Amongst females the diameter of ostia of RCA was 3.56 ± 0.6 mm and for LMCA it was 4.88 ± 1 mm. Amongst total 137 cases mean diameter of ostia of RCA was 3.55 mm with standard deviation 0.92 mm, mean diameter of ostia of LMCA was 4.95 mm with standard deviation 0.95 mm. Mean diameter of ostia of 3<sup>rd</sup> coronary artery was 1.2 mm with standard deviation 0.4 mm.

The difference in males and females was statistically not significant for RCA & LMCA (p>0.05).

#### IV. Discussion

**Table 3:** Comparison of No. of ostia in aorta in different studies

	Two	Three
Blake HU et al <sup>[3]</sup>	50-77%	23-50%
Gajbe UL et al <sup>[4]</sup>	83.33%	6.67%
Joshi SD <sup>[5]</sup>	61.91%	29.52%
Kalpana, R <sup>[6]</sup>	76%	24%
Saidi HS <sup>[7]</sup>	98%	2%
Present study	95.62%	4.38%

The right and left coronary arteries arise from the ascending aorta in its anterior and left posterior sinuses. The levels of the coronary ostia are variable <sup>[1]</sup>. The two ostia were for RCA & LMCA which were present in anterior aortic sinus and left posterior aortic sinus respectively. Sometimes more than two ostia may be present, the extra ostia for the extra coronary artery. In present study two ostia were present in 95.62% cases. This result correlates with the result of Saidi HS <sup>[7]</sup>. The third ostia for third coronary artery was present in 4.38% cases. This result correlates with the result of Gajbe UL et al <sup>[4]</sup>. In present study ostia of RCA in 3 cases was present in left posterior aortic sinus, such presentation was found by Koşar P. et al <sup>[8]</sup> in 4 cases (0.5%) and Saidi HS <sup>[7]</sup> in 1 case.

**Table 4:** Comparison of Diameter of ostia (mm) in different studies

		RCA M ± 1SD (mm)	LMCA M ± 1SD (mm)	Extra Coronary Artery M±1SD (mm)
Ballesteros LE et al <sup>[9]</sup>	Total (n=500)	3.42 ± 0.66	3.77 ± 0.61	----
Cavalcanti JS et al <sup>[10]</sup>	Total (n=51)	3.46 ± 0.93	4.25 ± 0.94	----
Cheemalapati S et al <sup>[11]</sup>	Male(n=61)	2.75 ± 0.6	3.72 ± 0.65	----
	Female(n=33)	2.55 ± 0.57	3.40 ± 0.58	----
	Total(n=94)	1.89 ± 0.39	2.16 ± 0.42	----
Sahani D <sup>[12]</sup>	Male(n=385)	3.2 ± 0.5	3.7 ± 0.7	----
	Female(n=115)	2.8 ± 0.44	3.2 ± 0.6	----
Present study	Male(n=102)	3.55 ± 1.01	4.96 ± 0.94	1.20 ± 0.4
	Female(n=35)	3.56 ± 0.6	4.88 ± 1	----
	Total(n=102)	3.55 ± 0.92	4.94 ± 0.95	1.20 ± 0.4

The diameter of ostia of RCA in present study was 3.55 ± 0.92 mm, which correlates with the results of Ballesteros LE et al <sup>[9]</sup> & Cavalcanti JS et al <sup>[10]</sup>.

The diameter of ostia of RCA amongst males in present study was 3.55 ± 1.01 mm, which correlates with the results of Sahani D <sup>[12]</sup>. The diameter of ostia of LMCA in present study was 4.94 ± 0.95 mm, which correlates with the results of Cavalcanti JS et al <sup>[10]</sup>.

#### V. Conclusion

- 1) In 95.62% (n = 131) cases there were two ostia in aortic sinuses for RCA and LMCA each.
- 2) In 3 cases the ostia of RCA were located in left posterior aortic sinus, In remaining 134 cases ostia of RCA were located in anterior aortic sinus.
- 3) In all cases ostia of LMCA was located in left posterior aortic sinus.

- 4) In 4.38% (n = 6) cases third ostium was present in anterior aortic sinus for 3<sup>rd</sup> coronary artery (right conus artery).
- 5) Diameter of RCA ostia was  $3.55 \pm 0.92$  mm.
- 6) Diameter of LMCA ostia was  $4.94 \pm 0.95$  mm.
- 7) Diameter of ostia of 3<sup>rd</sup> coronary artery (i.e. right conus artery) in all 6 cases was  $1.2 \pm 0.4$  mm.
- 8) The diameter of LMCA was more than RCA.

❖ **List Of Abbreviations:**

- RCA – Right Coronary Artery.
- LMCA – Left Main Coronary Artery.
- LCX – Left Circumflex Artery.
- n – Sample size
- M – Mean
- SD – Standard Deviation

❖ **Conflict Of Interests:** None

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