

## A Study of Origin of Right and Left Coronary Arteries in Human Cadaveric Heart

Madhavi B. Ramteke\*, Charulata A. Satpute\*\*, Ashish V. Radke\*, Sonal A. Talokar\*, Yogesh S. Ganorkar\*

### Abstract

To know the variation in origin of right and left coronary artery. Location and position of each coronary ostium was noted with respect to aortic sinus and sinotubular junction. Number of ostia and diameter of ostium were noted. The present study was undertaken on 70 adult human hearts specimens from embalmed cadavers. Hearts were dissected and studied. Present study showed that in all 70 heart specimens three aortic sinuses i.e. anterior, left posterior, right posterior were present. The right coronary artery was found to be arising from anterior aortic sinus in 100% specimens and left coronary artery was arising from left posterior aortic sinus in 100% cases. In 90% (63) specimens right coronary artery arises below sinotubular junction, 10% (7) at sinotubular junction and no case above sinotubular junction was found. For left coronary artery 88.57% (62) cases, ostia were located below sinotubular junction, 11.43% (8) at the sinotubular junction and no case above sinotubular junction was noted. Single ostium was present in 80% (56) cases and two ostia were present in 20% (14) in anterior aortic sinus. In left posterior aortic sinus, single ostium was present in all 100% cases. No opening was seen in right posterior aortic sinus. The mean diameter of right coronary ostium was  $3.22 \pm 0.82$  mm while left coronary artery showed  $4.51 \pm 0.70$  mm.

**Keywords:** Aortic Sinus; Right Coronary Artery; Left Coronary Artery; Coronary Ostia; Ostium Diameter; Sinotubular Junction.

### Introduction

Beneficial therapeutic options are increasingly available for coronary arterial disease. A comprehensive appreciation of the architecture of coronary arterial system, therefore is crucial to optimal cardiac care [1]. The initial portion of the aortic root, which houses the leaflets of the aortic valve, is occupied by the aortic sinus, also called sinus of valsalva [2].

The aortic sinus reaches beyond the upper border of the cusps and forms a well defined, complete circumferential sinotubular ridge, when viewed from the aortic aspect. Sinuses are named according to their positions as the anterior, left posterior and right

posterior aortic sinuses. The right and left coronary arteries arise from the anterior and left posterior sinuses respectively [3]. In clinical terminology, the anterior, left posterior and right posterior sinuses are often called the right, left, and non-coronary sinuses, respectively. Recently, coronary artery anomalies as a cause of coronary heart disease are gaining consideration in the diagnostic workup. One of the subsets of coronary artery anomalies is the anomalous origin. This subgroup has important clinical manifestations, including sudden death, especially in young athletes [4].

### Material and Methods

The present study was carried out in the Department of Anatomy, Indira Gandhi Government Medical College, Nagpur. A total of 70 adult human hearts procured from dissection room cadavers of adult age groups from the Department of Anatomy, preserved in 10% formalin, were included in this study irrespective of sex. The heart was exposed and removed from the thoracic cavity by cutting through

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**Author's Affiliation:** \*Assistant Professor \*\*Associate Professor, Dept of Anatomy, Indira Gandhi Government Medical College, Nagpur, India.

**Corresponding Author:** Madhavi B. Ramteke, Assistant Professor, Department of Anatomy, Indira Gandhi Government Medical College, Nagpur-440018, Maharashtra, India.  
E-mail: madhavi.ramteke86@gmail.com

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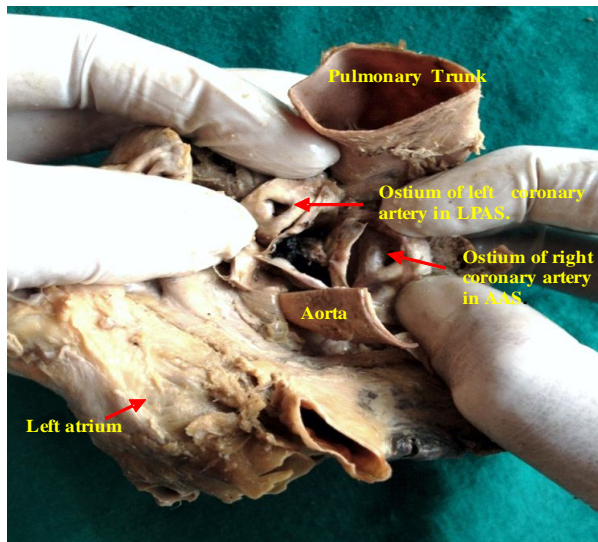
the ribs and sternum, cutting the great vessels and finally incising the pericardium. The heart was taken out of the pericardial cavity. The aorta was cut open longitudinally, just on the right side of the anterior aortic sinus reaching up to a level just distal to the aortic sinuses. The specimens thus collected are serially numbered from 1 to 70. Coronary arteries were dissected out and the presence and location of coronary ostia was noted. The number and positions of the ostia were noted with reference to the sinotubular rigde.

## Result

In present study, 70 heart specimens showed three aortic sinuses i.e. anterior, left posterior and right posterior and all the ostia were related to the aortic sinuses. The right coronary artery was found to be arising from anterior aortic sinus in 100% of heart specimen. The left coronary artery was arising from left posterior aortic sinus in all 100 hearts studied. No ostium was found in right posterior aortic sinus.

**Table 1:** Position of coronary ostia in aortic sinuses

Name of Sinus	Right Coronary Artery N (%)	Left Coronary Artery N (%)
Anterior Aortic Sinus (AAS)	70 (100%)	0
Left Posterior Aortic Sinus (LPAS)	0	70 (100%)
Right Posterior Aortic Sinus (RPAS)	0	0



**Photograph 1:** Ostium of right coronary artery in Anterior Aortic Sinus (AAS) and ostium of left coronary artery in Left Posterior Aortic Sinus (LPAS)

Table 2 shows that out of 70 specimens, right coronary artery ostium were located below sinotubular junction in 90%, 7 cases (10%) at the sinotubular junction and no case above sinotubular junction. For the left coronary artery: 62 cases (88.57%) ostia were located below sinotubular junction, 8 cases (11.43%) at the sinotubular junction and no case above sinotubular junction. Thus it is observed that maximum number of cases (90% and 88.57%) was distributed below sinotubular junction for both right and left coronary artery while no case for right and left coronary artery found above sinotubular junction.

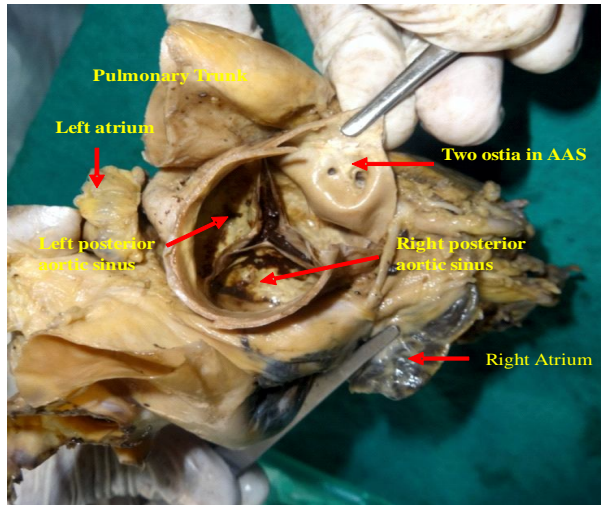
Table 3 shows that in anterior aortic sinus, single ostium was present in 80% and two ostia were present in 20% cases. In left posterior aortic sinus, single ostium was present in all 100% cases for left coronary artery. No opening was seen in right posterior aortic sinus.

**Table 2:** Level of coronary ostium with respect to sinotubular junction

Level of coronary Ostium	Right Coronary Artery N (%)	Left Coronary Artery N (%)
Below STJ	63 (90%)	62(88.57%)
At STJ	7 (10%)	8(11.43%)
Above STJ	0	0
Total	70(100%)	70(100%)

**Table 3:** Number of coronary ostia in the aortic sinuses

No. of coronary ostia	Anterior aortic sinus (%)	Left Posterior aortic sinus (%)	Right Posterior aortic sinus (%)
1	56 (80%)	70 (100%)	0
2	14 (20%)	0	0
3	0	0	0



**Photograph 2:** Two ostial openings in Anterior Aortic Sinus (AAS)

The range of diameter of right coronary ostium is from 1.57-5.02 mm. with mean of  $3.22 \pm 0.82$  mm. The diameter of left coronary ostium ranges from 2.82-5.8 mm. The mean diameter of ostium for left coronary artery is  $4.51 \pm 0.70$  mm. P-value is 0.000 which is highly significant. Thus it is observed that diameter of ostium for left coronary is larger than right coronary artery.

### Discussion

The findings of present study correlated with findings of the other studies mentioned in Table 5 with no opening seen in right posterior aortic sinus.

**Table 4:** Size of right and left coronary ostia

Diameter of coronary ostia	Range(mm.)	Mean(mm.)	t-value	p-value
Right coronary ostia	1.57-5.02	$3.22 \pm 0.82$	10.01	0.00, HS
Left coronary ostia	2.82-5.8	$4.51 \pm 0.70$		

**Table 5:** Comparison of position of coronary ostia of right and left coronary arteries of present study with other studies

Authors	Right Coronary Ostium	Left Coronary Ostium
Kalpana R. (2003) <sup>5</sup>	Ant. Aortic Sinus	Lt. Post. Aortic Sinus
Joshi S et al (2010) <sup>4</sup>	Ant. Aortic Sinus	Lt. Post. Aortic Sinus
Bhimalli S et al (2011) <sup>6</sup>	Ant. Aortic Sinus	Lt. Post. Aortic Sinus
Kaur D et al (2012) <sup>3</sup>	Ant. Aortic Sinus	Lt. Post. Aortic Sinus
Bharambe V et al (2013) <sup>7</sup>	-	Lt. Post. Aortic Sinus
Mutyal S et al (2014) <sup>1</sup>	Ant. Aortic Sinus	Lt. Post. Aortic Sinus
<b>Present Study</b>	<b>Ant. Aortic Sinus</b>	<b>Lt. Post. Aortic Sinus</b>

**Table 6:** Comparison of level of coronary ostia with respect to sinotubular junction of present study with other studies

Study	Level of right coronary ostia with respect to sinotubular junction (%)			Level of left coronary ostia with respect to sinotubular junction (%)		
	Below	At	Above	Below	At	Above
Kalpana R. (2003) <sup>5</sup>	90	9	1	80	20	0
Bhimalli S. et al (2011) <sup>6</sup>	84	16	0	93	6.66	3.3
Kaur D. et al (2012) <sup>3</sup>	83	14	3	78	15	7
Prajapati B. et al (2013) <sup>8</sup>	91	0	9	94	0	6
Mutyal S. et al (2014) <sup>1</sup>	76.67	15	8.33	68.33	18.33	13.33
<b>Present Study</b>	<b>90</b>	<b>10</b>	<b>0</b>	<b>88.57</b>	<b>11.43</b>	<b>0</b>

**Table 7:** Comparison of number of ostial openings in aortic sinuses

Authors	Number of openings in aortic sinuses							
	Ant. Aortic sinus (AAS) (%)				LPAS (%)			RPAS (%)
	1	2	3	4	1	2		
Joshi S.D. et al (2010) <sup>4</sup>	61.9	29.52	7.61	0.95	98.09	1.9	0	
Mutyal S.R. et al (2014) <sup>1</sup>	88.33	10	1.67	0	98.33	1.67	0	
Present Study	80	20	0	0	100	0	0	

Coronary ostia can be located below, at, or above the sinotubular junction. Ostia located just above the aortic sinus were considered variants of the normal origin. A coronary ostium was considered vertically

ectopic if it arose more than 0.5 cm above the sinotubular junction of the aorta. It is difficult to insert the catheter tips in patients with the ostium above the level of sinotubular junction and during open aortic

surgeries it is very difficult to cannulate the vessels which arise from the anomalous ostia [3].

The studies of Kalpana R. (2003) [5] and Bhimalli Set al (2011) [6] showed the findings similar to present study, with maximum cases of ostium below sinotubular junction both for right and left coronary arteries.

The present study showed findings similar to the Mutyal S.R. et al (2014) [1] with maximum cases of one opening in anterior aortic sinus for right coronary

artery and for left coronary artery in left posterior aortic sinus with one ostium.

Knowledge of coronary ostia diameter and its variation is also helpful in designing the coronary perfusion cannula which is used to administer cardioplegic solution directly into the left and right coronary arteries in the aortic insufficiency [3].

The findings of present study correlated with the study of Kaur D. et al (2012) [3].

**Table 8:** Comparison of mean diameter of right and left coronary ostia of present study with other studies

Studies	Ostia diameter(mm.)	
	Right Coronary Artery	Left Coronary Artery
Bhimalli S. et al (2009) <sup>6</sup>	2.38±1.33	3.17 ±0.34
Kaur D. et al (2012) <sup>3</sup>	3.9± 1.0	4.6 ±1.0
<b>Present Study</b>	<b>3.22±0.82</b>	<b>4.51±0.70</b>

## Conclusion

The present study describes normal and variant anatomy of the ostia of coronary arteries in unsuspected population. It is helpful in determining the incidence of anomalies. Knowledge of location, position with respect to aortic sinus and sinotubular junction; and number of the coronary ostia is mandatory factor while catheterization of coronary arteries for various diagnostics and therapeutic purpose for cardiothoracic surgeons and radiologist.

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