

Anatomic Assessment of Coronary Ostia in Human Cadavers by Dissection Method: A Morphometric StudyNeelam Sinha¹, Sanjay Kumar Sharma², Rashmi Prasad³¹Associate Professor, Department of Anatomy, Nalanda Medical College, Patna, Bihar, India²Assistant Professor, Department of Anatomy, Nalanda Medical College, Patna, Bihar, India³Professor and HOD, Department of Anatomy, Nalanda Medical College, Patna, Bihar, India

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Corresponding author: Dr. Neelam Sinha

Conflict of interest: Nil

Abstract**Aim:** The aim of the present study was to assess the coronary ostia in human cadavers by dissection method.**Methods:** The present study was conducted on 60 hearts of human cadavers fixed with 10% formalin, collected from the Department of Anatomy, Nalanda Medical College, Patna, Bihar, India.**Results:** It was observed that the mean diameter of left coronary ostium was greater than right coronary ostium which was statistically significant (p -value <0.0001). There was decrease in diameter from coronary ostia to the roots of coronary arteries which was statistically significant (p -value=0.050). Decrease in diameter from left coronary ostium to root was 0.58 mm and right coronary ostium to root was 0.45 mm. Number of coronary ostia in anterior aortic sinus was single ostium in 50 (83.33%) specimens, double ostia in 6 (10%) specimens, triple ostia in two (3.33%) specimen and also absence of ostium in two specimens. Number of coronary ostia in left posterior aortic sinus was single ostium in 57 (95%) specimens and double ostia in 3 (5%) specimens.**Conclusion:** The advances made in coronary artery bypass surgeries and modern methods of myocardial revascularisation makes it necessary for thorough complete knowledge of coronary ostia. Understanding variations in morphology of coronary ostia should be sought before surgical interventions. The present anatomical data may help the cardiac surgeons to modify their surgical reconstruction of the aortic root in order to achieve satisfactory recovery.**Keywords:** Aortic sinus of Valsalva, Coronary arteries, Coronary ostia, Sinotubular junctionThis is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

In most mammals the heart is supplied with blood via the left and right coronary arteries. The coronary ostia are located in the coronary sinuses of the aortic root. According to the Nominal Anatomical Veterinaria [1], the left main coronary artery is divided into two vessels: the interventricular paraconal branch and the left circumflex branch. This is confirmed in the studies of Habermehl [2], Atalar et al [3], Smolaka et al [4], Yuan et al [5] and Kupczyńska et al [6] in selected species of mammals. However, some authors describe a tripartite branching of the left main coronary artery. The main distal branches are the interventricular paraconal branch, the left circumflex branch and the septal branch.[7-9] The right coronary artery is a less developed vessel, and its stem becomes the right circumflex branch.

The presence of a single coronary artery (SCA) has been described in humans. It is considered to be a rare congenital defect and often co-occurs with other congenital heart defects. 0.3–0.6% of humans are affected by abnormalities of one or both coronary

ostia. [10] The assessment of the morphology of the aorta and the coronary arteries is carried out in humans not only to diagnose certain diseases, but also prior to open and endovascular cardiovascular procedures. In veterinary medicine, anatomical studies of the aorta and the coronary arteries are carried out in animals which are used as experimental models before human clinical trials. [11-13] In particular, little attention has been paid to the domestic shorthair cat heart vascularity including the coronary ostia. There is morphological study that refer only to anatomical variations of location of the coronary ostia and presence of accessory ostia either for left, right or both coronary arteries. [14]

The aim of the present study was to assess the coronary ostia in human cadavers by dissection method.

Materials and Methods

The present study was conducted on 60 hearts of human cadavers fixed with 10% formalin, collected

from the Department of Anatomy, Nalanda Medical College, Patna, Bihar, India

The ascending aorta was sectioned transversely approximately 1 cm above the commissure of aortic leaflets. Next the aorta was longitudinally opened at the level of right posterior aortic sinus to enable the visualisation and analysis of coronary ostia. The

coronary arteries were sectioned at the level of their origin in the aortic wall. Measurements were studied with help of Vernier callipers and divider, and exact measurements were noted. Based on the data obtained, morphology of coronary ostia was analysed.

Results

Table 1: Diameters of coronary ostia

Coronary Ostia	No. of Specimens	Mean(mm)	SD	P- Value
Right	60	3.5	0.8	<0.0001
Left	60	4.5	0.6	

It was observed that the mean diameter of left coronary ostium was greater than right coronary ostium which was statistically significant (p-value<0.0001).

Table 2: Diameters of coronary ostia and roots of corresponding coronary arteries

Coronary Ostia	No. of Specimens	Diameter of coronary ostia		Diameter of roots of coronary arteries		Decrease in diameter		Average % of decrease		% OF Decrease	P-Value
		Mean (mm)	SD	Mean (mm)	SD	Mean (mm)	SD	Mean (mm)	SD		
Right	60	3.46	0.84	3.00	0.82	0.45	0.26	13.4	7.5	12.6	0.050
Left	60	4.32	0.76	3.70	0.64	0.58	0.30	12.6	5.7	12.8	

There was decrease in diameter from coronary ostia to the roots of coronary arteries which was statistically significant (p-value=0.050). Decrease in diameter from left coronary ostium to root was 0.58 mm and right coronary ostium to root was 0.45 mm.

Table 3: Number of coronary ostia in anterior aortic sinus

Number of coronary ostia in AAS	No. of specimens	Percentage(%)
0	2	3.33
1	50	83.33
2	6	10
3	2	3.33
Total	60	100.00

Number of coronary ostia in anterior aortic sinus was single ostium in 50 (83.33%) specimens, double ostia in 6 (10%) specimens, triple ostia in two (3.33%) specimen and also absence of ostium in two specimens.

Table 4: Number of coronary ostia in left posterior aortic sinus

Number of coronary ostia in LPAS	No. of specimens	Percentage (%)
0	0	0
1	57	95
2	3	5
Total	60	100

Number of coronary ostia in left posterior aortic sinus was single ostium in 57 (95%) specimens and double ostia in 3 (5%) specimens.

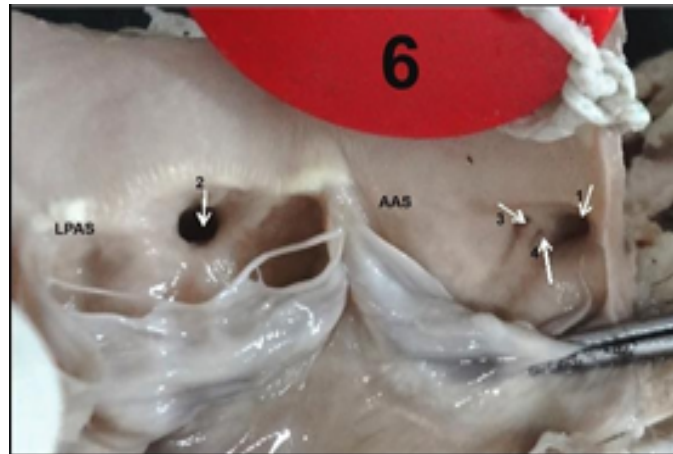


Figure 1: Diameter of left coronary ostium more than right coronary ostium

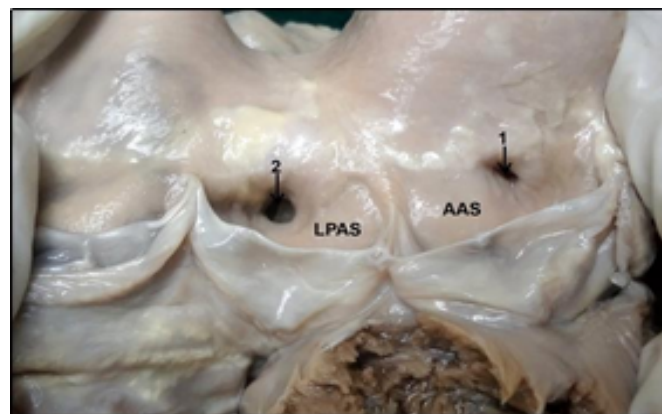


Figure 2: Multiple orifices in anterior aortic sinus 1. Right coronary ostium, 2. Left coronary ostium, 3. Ostium of third coronary artery, 4. Ostium of ventricular branch of Right coronary artery

Discussion

The Aortic sinus of Valsalva is dilatation of aortic root wall above the attached margin of each cusp. The upper margin of each sinus is limited by well-defined circumferential supra-ventricular ridge. The ostia of coronary arteries usually open near this ridge. The right coronary artery arises from anterior aortic sinus and left coronary artery arises from left posterior aortic sinus. [15]

Studies in humans present detailed morphometric analyses of individual leaflets of the aortic valve, the diameters of the coronary ostia, their distance from the aortic valve commissures, and the nadirs of the coronary sinuses. These data are used prior to open and endovascular procedures on the aortic valve and coronary arteries. [16-18] It was observed that the mean diameter of left coronary ostium was greater than right coronary ostium which was statistically significant (p -value <0.0001). This observation was in agreement with work done by Cavalcanti et al [19], Lopez-Minguez JR et al [20] found out of 16 post-mortem hearts the diameter of left coronary ostium was greater in 10 (71%) specimens than right coronary ostium. Kaur et al [21] reported that of the 77 studied hearts, the diameter of the coronary artery ostia was the same in seven cases, and that the

diameter of the right coronary artery ostium was greater than that of the left in 22 cases. Sirikonda and Sreelatha [22] emphasized that in the majority of the hearts they studied ($n = 100$), the left coronary ostium was larger (4.11 ± 0.88 mm) than the right coronary artery ostium (2.77 ± 0.905 mm).

There was decrease in diameter from coronary ostia to the roots of coronary arteries which was statistically significant (p -value=0.050). Decrease in diameter from left coronary ostium to root was 0.58 mm and right coronary ostium to root was 0.45 mm. Number of coronary ostia in anterior aortic sinus was single ostium in 50 (83.33%) specimens, double ostia in 6 (10%) specimens, triple ostia in two (3.33%) specimen and also absence of ostium in two specimens. Number of coronary ostia in left posterior aortic sinus was single ostium in 57 (95%) specimens and double ostia in 3 (5%) specimens. Mc Alpine WA²³ studied anomalous origin of different arteries from aortic sinuses besides third coronary artery and found that there were separate ostia for SA nodal artery and ventricular branch of right coronary artery. Joshi SD et al [24] described that multiple ostia, vertical shift and slit like ostia may confuse interpretation of images and pose difficulty during procedures such as angiography, angioplasty

and coronary artery bypass grafting. The unknown factors that interferes with wall tension of the aortic sinuses could promote development of anomalous coronary arteries' ostia. [25] Olabu BO et Al [26] have explained in their study that the separate orifices for third coronary artery and right coronary artery is due to insufficient unification of these two vessels during their ingrowth towards the ascending aorta.

Conclusion

The advances made in coronary artery bypass surgeries and modern methods of myocardial revascularisation makes it necessary for thorough complete knowledge of coronary ostia. Understanding variations in morphology of coronary ostia should be sought before surgical interventions. The present anatomical data may help the cardiac surgeons to modify their surgical reconstruction of the aortic root in order to achieve satisfactory recovery.

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