

## **A STUDY OF LOCATION AND MEASUREMENT OF CORONARY OSTIA IN ADULT HUMAN HEARTS**

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### **ABSTRACT**

Aim to know the variations in coronary ostia. The present study was undertaken on thirty eight adult human heart specimens. The specimens were obtained from the Department of Anatomy, Vijayanagar Institute of Medical Sciences, Ballari, Karnataka, India. In this study, many parameters were included like number of coronary ostia, position with respect to sinutubular ridge, whether centrally or peripherally located, the distance from sinutubular junction. In the present study, among 38 specimens, 2.63% of case showed two aortic sinuses, 5.26% of cases showed solitary coronary ostia, 5.26% of cases showed three coronary ostia. In 89.47% of cases, the coronary ostia were below the sinutubular ridge. In 23.68% of cases, right coronary ostial opening was centrally located and in 76.31% of cases, right coronary ostial opening was peripherally located. In 84.21% of cases, left coronary ostial opening was centrally located and in 21.05% of cases, left coronary ostial opening was peripherally located. Majority of the coronary ostia were at a distance of 2 to 6 mm from the midpoint of their respective sinutubular junction. Interpretation and conclusion: Accurate knowledge of coronary ostia in relation to the aortic root is important for a number of interventional and surgical cardiovascular procedures and radiologists.

**Keywords:** Aortic root, Aortic sinus, Coronary ostia, Left coronary ostia, Right coronary ostia, Sinutubular ridge.

### **INTRODUCTION**

The initial portion of the aortic root, which houses the leaflets of the aortic valve, is occupied by the aortic sinuses, also called the sinuses of Valsalva [1]. The aortic sinuses reach beyond the upper border of the cusp and form a well-defined, complete, and circumferential sinutubular ridge when viewed from the aortic aspect. These sinuses are named according to their position as the anterior, left posterior, and right posterior aortic sinuses [2]. Coronary ostia are the openings in these aortic sinuses that mark the origin of the coronary arteries. Normally, the right coronary ostium arises from anterior aortic sinus and left coronary ostium arises from left posterior aortic sinus [3]. The variations in the position of the coronary ostia in relation to the aortic leaflets and the diameter of the ostia are the factors involved in the possible reduction in coronary blood flow [4]. Accurate knowledge of the locations of the coronary ostia in relation to the aortic root is critical for a number of interventional and surgical cardiovascular procedures [5].

### **MATERIALS AND METHODS**

The study was done on 38 formalin fixed adult human heart specimens. The specimens were obtained during routine undergraduate dissection over a period of three years from the Department of Anatomy, Vijayanagar Institute of Medical Sciences, Ballari, Karnataka, India. The hearts were dissected, the pericardium involving the root of the aorta was removed, and the origin of right and left coronary arteries was traced. Then the ascending aorta was sectioned transversely approximately 1 cm above the commissures of the aortic leaflets. Next, the aorta was longitudinally opened at the level of right posterior aortic leaflets to enable the visualization and analysis of the aortic leaflets and their respective coronary ostia. The number of coronary ostia, their origin whether it is above or below the sinutubular ridge, location of coronary ostia whether location is in the centre of the aortic sinus or peripheral part of the aortic sinus.

The distance of these coronary ostia are measured in millimeters from the midpoint of their respective sinutubular junction.

**RESULTS**

In 37 of the 38 adult human heart specimens studied, three aortic sinuses were present. No opening is observed in the right posterior aortic sinus.

In 1 specimen (2.63% of case), two aortic sinuses were seen. In this case, both right and left coronary ostia opened in the anterior aortic sinus.

In 2 specimens (5.26% of cases), solitary coronary ostia opening in the left posterior aortic sinus was seen. In 2 specimens (5.26% of cases), three coronary ostia were seen. Out of three coronary ostia, two were opening in the anterior aortic sinus and one in the left posterior aortic sinus.

In 34 specimens (89.47% of cases), the coronary ostia were below the sinutubular ridge. In 4 specimens (10.52% of cases), coronary ostia were opening above the sinutubular ridge. In these four cases, two were right coronary ostia arising from anterior aortic sinus and two

were left coronary ostia arising from left posterior aortic sinus.

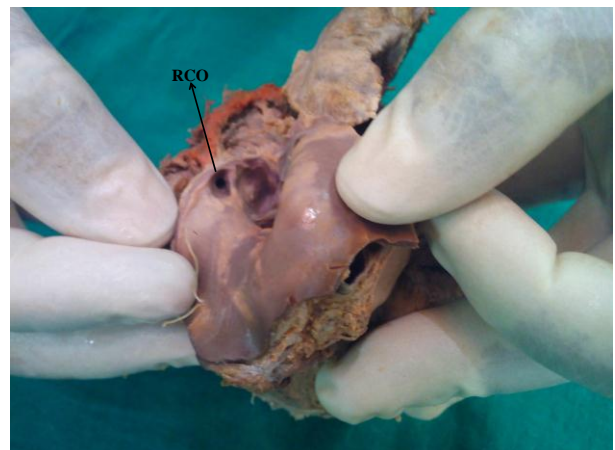
Out of 38 specimens, in 9 specimens (23.68% of cases), right coronary ostial opening was centrally located and in 29 specimens (76.31% of cases), right coronary ostial opening was peripherally located in their respective anterior aortic sinus. Out of 38 specimens, in 32 specimens (84.21% of cases), left coronary ostial opening was centrally located and in 7 specimens (18.42% of cases), left coronary ostial opening was peripherally located in their respective left posterior aortic sinus. In one heart specimen (2.63% of case), showing two aortic sinuses, left coronary ostial opening was peripherally located in the anterior aortic sinus.

The distance in millimeters of right coronary ostia from midpoint of its sinutubular junction was in the range of 1 to 2 mm in 7 specimens (18.42% of cases), and 2 to 6 mm in 31 specimens (81.57% of cases). The distance in millimeters of left coronary ostia from midpoint of its sinutubular junction was in the range of 1 to 2 mm in 11 specimens (28.95% of cases) and 2 to 6 mm in 27 specimens (71.05% of cases).

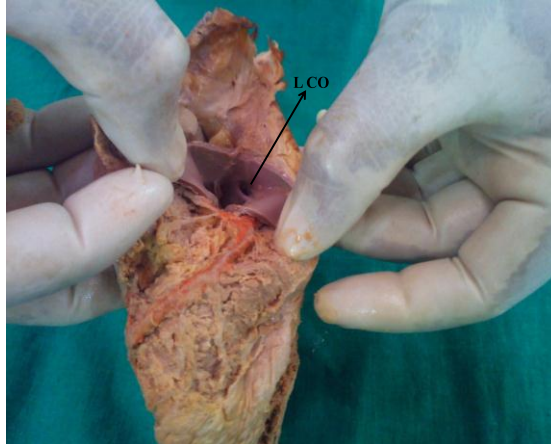
**Figure 1. Showing 38 adult human heart specimens**



**Figure 2. Showing right coronary ostia [RCO] in the anterior aortic sinus.**



**Figure 3. Showing left coronary ostia [LCO] in the left posterior aortic sinus.**



## DISCUSSION

The great importance of coronary catheterization for diagnostic and therapeutic purposes has currently motivated several studies on the anatomic position of coronary ostia [4]. Coronary blood flow may be affected by changes in morphological and topographical features of the coronary ostia [6]. The present study is a humble effort to highlight the same. Solitary coronary arteries can be a substrate for sudden cardiac death, and carries the potential to precipitate severe ischemic heart disease, including myocardial infarction in younger patients. Antonellis J et al and Fiorilli R et al reported cases of single coronary artery arising from either of the aortic sinuses [12,13].

An abnormal location or an accessory origin of the coronary orifices may disturb performing an aortotomy incision for aortic exposure, preparing a coronary button, in root replacement, direct delivery of cardioplegia through the coronary orifices and approaches for aortic root enlargement [6].

Stranding et al have reported the incidence of extra openings in the right aortic sinus in 36% of individuals [7]. Sahni and Jit reported extra openings in 34.8% of male hearts and 27.8% of female hearts [8]. Wolloscheck et al reported extra ostia in 65% of cases in an anatomic and transthoracic echocardiographic study [9]. Schlesinger et al and James have described the origin of the SA nodal artery directly from the aortic sinuses in some instances [10,11].

A study conducted by Shinde VS, Mallikarjun M, Raveendra GT reported that the majority of the coronary ostia were present below the sinutubular ridge this may be functionally more efficient than the ostia above the sinutubular ridge [3]. Valodaver et al reported a 44% incidence of ostia being present above the sinutubular ridge [1], while Pejkovic et al reported a very high incidence of ostia at or above the level of the sinutubular junction (82% left and 90% right) [14]. Turner and Navratnam found that 62 of the 74 main coronary ostia lay either at or immediately below the sinutubular ridge [15]. Joshi SD et al reported that majority of ostia lay below the sinutubular ridge [2].

Shinde VS, Mallikarjun M, Raveendra GT documented that 75% of the left coronary ostia and 60% of the right coronary ostia were centrally located<sup>3</sup>. Subhash D Joshi et al reported centrally located left coronary ostia in 80% and right coronary ostia shifted towards the right posterior sinus in 59% [2]. McAlpine WA proposed that the location of the right coronary ostium in the right half of the corresponding

aortic sinus is appropriate, because the right coronary artery is destined to pass around the tricuspid valve, therefore having a more direct course than if it originated in the left or medial portion of the sinus. According to that author, displacement of the left coronary ostium to the right would be more appropriate because the anterior and left parts of the heart are supplied by the left coronary artery [16]. Still regarding this same point, Muriago et al added that the more central location of the left coronary ostium is justified, because, after its origin, the left coronary artery heads to the space between the pulmonary trunk and the left auricle, branching right after that [17].

Sudden death in young individuals has been reported in cases where the coronary ostia were found to be slit-like at autopsy [18]. Slit-like ostia are often associated with acute angulations of the initial part of the coronary artery and predispose individuals to ischemia of the myocardium [19].

In the present study, among 38 specimens, 2.63% of case showed two aortic sinuses, 5.26% of cases showed solitary coronary ostia, 5.26% of cases showed three coronary ostia. In 89.47% of cases, the coronary ostia were below the sinutubular ridge. In 23.68% of cases, right coronary ostial opening was centrally located and in 76.31% of cases, right coronary ostial opening was peripherally located. In 84.21% of cases, left coronary ostial opening was centrally located and in 21.05% of cases, left coronary ostial opening was peripherally located. Majority of the coronary ostia were at a distance of 2 to 6 mm from the midpoint of their respective sinutubular junction.

## CONCLUSION

The study of coronary ostia and its variations provide a basis for understanding anatomical details of coronary ostia with respect to their position, number, location, deviations from normal origins. On occasion, normal variants, such as multiple ostia, vertical or circumferential shift in position, and slit-like ostia, may confuse interpretation of the images and may pose a difficulty during procedures, such as angiography, angioplasty, and coronary artery bypass grafting.

Accurate knowledge of coronary ostia in relation to the aortic root is important for a number of interventional and surgical cardiovascular procedures, including cannulation or catheterization of the coronary arteries, aortic graft repair or root replacement, and implantation of percutaneous aortic valves (PAV) or transapical valve replacement.

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