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Anatomy

# ANATOMICAL STUDY OF MORPHOLOGY AND VARIATIONS OF RIGHT CORONARY ARTERY IN CADAVARIC HUMAN HEART.

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**ABSTRACT** The knowledge of normal and variant anatomy of coronary arteries is important in management of congenital and acquired heart diseases. Simple attention to potential variations in the origin and course of major coronary arteries can greatly enhance clinical outcome, hence, present study is designed to see the normal anatomical distribution and variation of the right coronary artery in the humanheart.50 cadaveric human heart specimens (25 male and 25 female) were used by dissection method. RCA arises from anterior (right) aortic sinus in 96% (48% male 48% female) specimens while in 4% (2% male & 2% female) it arose from left posterior aortic sinus along with LCA. In 52% specimen (28%male&24%female) RCA gave SA nodal branch, while in88% specimen (44%male & 44% female) it gave AV nodal branch. Right Conus Artery was traced in 82% specimen (36% male & 46% female). Posterior Interventricular Artery was branch of RCA in 86% specimen (42% male & 44% female). In the observation on the level of termination of RCA it was terminated at crux 34% and beyond the crux in 56%. It terminated at right boarder in 6% cases. In only one specimen (female) it was terminated between right boarder and crux. In another one specimen (female) it was terminated before right boarder. The course of RCA was found to be in all specimens except one in which it was found that immediately after its origin RCA was divided in to two arteries of same caliber.

**KEYWORDS :** : Right Coronary Artery, SA nodal branch, AV nodal branch

## INTRODUCTION

The increasing use of diagnostic and interventional procedures necessitates that a sound, basic knowledge of the coronary artery pattern is essential. The incidence of coronary artery disease is increasing today in developing countries as well, because of changing life style, urbanization, and increased exposure to pollution and toxic gases, smoking and a hectic and stressed life style, lipid disorders, hypertension, diabetes mellitus and other disorders which cause functional impairment and damage to vascular cells. The anatomical details and patho-physiological patterns of most coronary artery anomalies are presently well known1. Right coronary artery is embedded in adipose tissue throughout its course within the right atrioventricular groove. The right coronary artery arises from the anterior aortic sinus the ostium is below the margin of the cusps in 10%. The artery is usually single, but as many as four right coronary arteries have been observed.2 The Right coronary artery arises nearly perpendicularly from the aorta, while the left coronary artery arises at an acute angle.[3]

## MATERIAL & METHOD

Study was done on 50 human heart specimens (25 male and 25 female). Hearts without any obvious macroscopic pathology were included in this study. The visceral pericardium was removed and by micro dissection the RCA was exposed and its branches and course was traced. The specimens were numbered from 1 to 50. Male and female specimens were preserved separately in 10% farmaldehyde solution.

## RESULT

RCA arises from anterior (right) aortic sinus in 96% specimens (48% male 48% female). In 4% specimens (2% male & 2% female) it arose from left posterior aortic sinus along with LCA.

**Table-1 N=50 (25 Male & 25 Female)**

| Branches of RCA | Percentage of specimens | | |
|---|---|---|---|
| | Male | Female | Total |
| SA nodal branch | 28 | 24 | 52 |
| AV nodal branch | 44 | 44 | 88 |
| Right Conus branch | 36 | 46 | 82 |
| Posterior Desending branch | 42 | 44 | 86 |

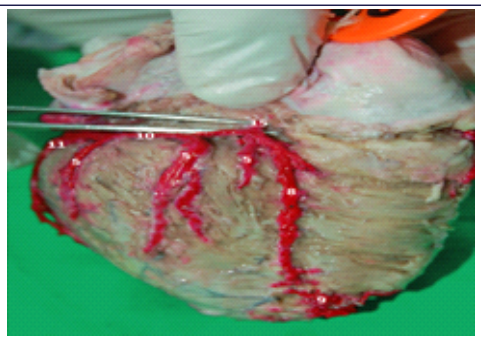
As per table 1, Right Coronary Artery gave SA nodal branch in 52% specimens out of which 28% were male and 24% were female specimens. In 88% specimens AV nodal artery was branch of Right coronary artery. Out of this 88% specimens (44% were male and 44%) were female specimens. In 86% specimens (42% male and 44% female), posterior descending artery was found to arise from Right coronary artery.

**Table – 2 Level of termination of Right Coronary Artery N=50 (25 Male & 25 Female)**

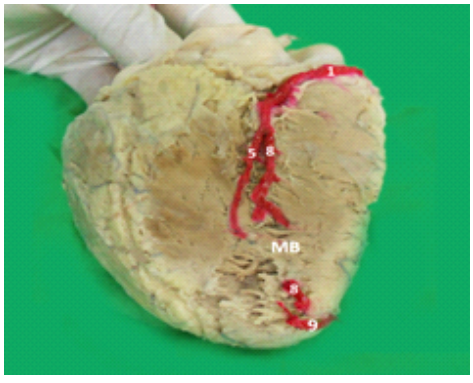
| Level of termination | Percentage of specimens | | |
|---|---|---|---|
| | Male | Female | Total |
| Before right border | 0 | 2 | 2 |
| At right border | 4 | 2 | 6 |
| Between right border & Crux | 0 | 2 | 2 |
| At Crux | 22 | 12 | 34 |
| Beyond Crux | 24 | 32 | 56 |

Table No. 2, below, depicts the observations on the level of termination of Right Coronary Artery, RCA terminated at Crux in 34% specimens, (22% male and 12% female). In 56% specimens it terminated beyond crux, (24% male and 32%female). In 6% specimens it terminated at Right border, (4% male and 2% female). In only 2%specimen it terminated between right border and crux. It terminated before right border in 2% specimens.


**Photograph-1: Termination of RCA before right border (Anterior view)**



**Photograph – 2: Termination of RCA at right Border (Posterior view)**




**Photograph – 3: Termination of RCA at Crux (Posterior view)**


**Photograph – 4: Termination of RCA beyond Crux (Posterior view)**

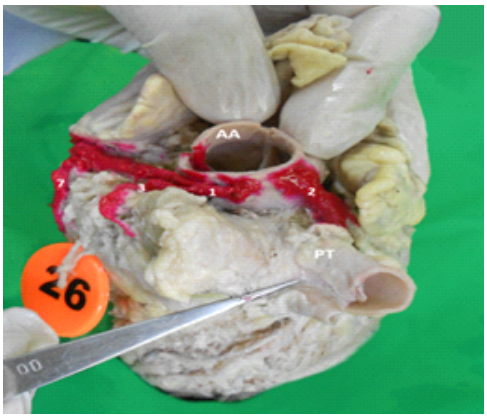
The course of Right coronary artery was found to be in all the specimens expect one specimen (specimen No. 18). During dissection of this specimen it was found that immediately after origin from anterior aortic sinus, RCA divided into two arteries of same caliber. One of these artery gave SA nodal artery, Atrial branches, Posterior descending branch, AV nodal branch while another artery gave ventricular branches and Right conus artery.


**Photograph - 5**

## DISCUSSION

Variation in the branching pattern of coronary artery is the peculiarity of coronary artery.As per Sim E. K. et al 1994,4 it is important to have knowledge of the variations in coronary artery system for the arterial switch operation and for complete transposition of the great artery. The usual pattern with the right coronary artery originating from the right sinus and left coronary artery from the left sinus (184 cases) and the circumflex coronary artery arising from the right artery (46 cases) accounted for 90% of the cases.

In his study, Moffat D. B. (1989) described that the anomalous origin of the coronary artery is rare but well noticed. Incidences of anomalous origin and incidences of origin of both coronary arteries from a single aortic sinus were 0.64% and 0.2% respectively5. In present study we have noted that in 4% (2% male & 2% female) RCA arose from left posterior aortic sinus along with LCA.




**Photograph – 6**

Richard S. Snell (2000) said that sinu-atrial node is usually supplied by right coronary artery but sometimes it is supplied by left coronary artery as well and the atrioventricular node and the atrioventricular bundle are supplied by the right coronary artery6According to the study done by Anjali S Sabnis7 (2012) SA node is supplied by RCA in 90% cases .similarly, AV node is supplied by RCA, 70%. Luis Ernesto Ballesteros et al8 noted that sinuatrial nodal artery originated from the right coronary in 60.6% cases. In present study we noted that that Right coronary artery gave SA nodal branch in 52% specimens (28% were male and 24% were female specimens). In 88% specimens (44%male 44%female) AV nodal artery was branch of Right coronary artery.

**Table – 3 Level of termination of Right Coronary Artery (In %) N=50**

| Level of termination | Kalpana R (2003) | Ballesteros LE et al(2011) | Present study |
|---|---|---|---|
| Before right border | - | - | 2 |
| At right border | 7 | - | 6 |
| Between right border & Crux | 3 | 8.6 | 2 |
| At Crux | 6 | 13.6 | 34 |
| Beyond Crux | 84 | 77.8 | 56 |

However, in studies carried out by Ballesteros LE (2011)8 and Kalpana R 9(2003): RCA very differently terminated at Crux in 13.6% and 6% cases, it ended beyond crux in 77.8% and 84% (out of these 84% cases 8% reached up to left border) cases respectively; and between right border and crux in 8.6% and 3% cases respectively. In the study carried out by Kalpana R (2003) it was found to end at right border of heart in 7% cases. Puttman C. E.10, who studied over coronary artery in 1988, says that, sometimes the posterior descending artery arises from right coronary artery or proximal to the acute margin of the heart and this is known as early origin of the posterior descending artery. At the crux, a characteristic inverted "U" shaped course of the right coronary artery seems as it passed over the coronary sinus and continues in the posterior atrioventricular groove to send branches to the posterior wall of the left ventricle. At this situation, the right coronary artery referred as the 'Dominant' artery.

## CONCLUSION

A comprehensive study of branching pattern and distribution of

coronary arteries in cadaveric human hearts carried out in the Department of anatomy. In comparison with the results of available literature the present study shows some differences.Various newer radiological techniques have been developed by Radiologist for the study of Coronary arteries and their branches. A lot of progress and advancement has been done in Coronary artery bypass surgery. The Radiologists and Cardiac Surgeons must have a very sound and thorough knowledge of branching pattern of Coronary arteries and their variations, so as to achieve best results during the management and treatment of individuals.

## KEYS TO PHOTOGRAPHS

| | |
|---|---|
| 1-Right Coronary Artery | 2-Left Coronary Artery |
| 3-Right Conus Artery | 4-Atrial branch |
| 5-Ventricular branch | 6-Sinu-atrial Nodal Artery |
| 7-Right Marginal Artery | 8-Posterior Interventricular Artery |
| 9-Left Anterior descending Artery | 10-Left Circumflex Artery |
| 11-Left Marginal Artery | 12-Left Diagonal Artery |
| 13-Intermediate artery | 14-Posterior Right Diagonal Artery |
| 15-Atrioventricular Nodal Artery | 16-Third Coronary Artery |
| 17-Fourth Coronary Artery | RA-Right Atrium |
| LA-Left Atrium | AA-Ascending Aorta |
| PT-Pulmonary trunk | AAS-Anterior Aortic Sinus |
| PAS-Posterior Aortic Sinus | |

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