



ANOMALOUS BRANCHING PATTERN OF RIGHT CORONARY ARTERY- A CADAVERIC STUDY

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ABSTRACT Because the coronary artery and the myocardium it supplies are nourished with pulmonary rather than systemic blood, malformations of the ostia and origin of coronary arteries have potentially deadly consequences unless they are identified and repaired surgically. The goal of the current study is to determine the right coronary artery's morphometry and pattern, with a focus on its branching pattern, anastomoses, and distribution region. **Material and Method-** The study's material consisted of the hearts of hundred adult human cadavers. The Right Coronary Artery's branching pattern and any variations were recorded. Every artery was drawn, and every specimen was captured on camera. The information was gathered, processed, examined, and contrasted with what was already known. **Result-** In 94% hearts RCA was originating from the Right anterior aortic sinus. Only in 3% specimens its origin was from left anterior aortic sinus. In most of the cases (80%), it terminates between the Right border and Crux. Rarely (2%), it reaches up to left border. We observed that when posterior interventricular artery arises from RCA, it reaches up to $\frac{3}{4}$ Way down PIVS in 15 hearts. In most of the hearts (45) it reaches upto $\frac{1}{2}$ Way down PIVS. In 98% hearts it arises from right coronary artery. Only in 2% hearts it originates directly from aorta. **Conclusion-** The coronary arteries exhibits a greater amount of deviation from their normal origin, course, branching pattern and termination points. So, it is therefore essential for medical professionals to understand such variations for better diagnosis and treatment of coronary artery diseases. These variations are different in different races.

KEYWORDS : Coronary Artery; Marginal Artery; Conus Artery; Variations; Branching Pattern.

INTRODUCTION

Coronary artery disease has become one of the major causes of death in developed as well as developing countries. In present times, a sound basic knowledge of the coronary artery pattern is essential because of the increasing use of diagnostic and therapeutic intercessions.

Much progress has been made in the last few years than in all foregoing medical history in the management of cardio-vascular diseases. Due to introduction of newer surgical and therapeutic techniques, in-correctable lesions have been controlled. Knowledge of the normal and variant anatomy and anomalies of coronary circulation is necessary in the treatment of congenital and acquired heart problems. For further improvement in heart related surgeries, a deep knowledge of cardiac anatomy is required.

The Right Coronary artery begins at the right aortic sinus and runs in the right anterior atrio-ventricular sulcus.

In various studies, it has been reported that the posterior interventricular artery arises from the Right Coronary Artery in 75% of cases (right dominance) and from the Left Coronary Artery in 10% of cases (left dominance), and in 15% of cases, posterior interventricular artery arises from both coronary arteries (Co-dominance). Hettler stated there are three types of coronary circulations viz. left coronary artery dominance, right coronary artery dominance and co-dominance. It has been proved in many studies that aberrant origin and distribution of the coronary arteries are one of the causes of sudden death in young and adult patients, along with physical exertion.

MATERIAL AND METHOD

The study was carried out on 100 formalin fixed adult cadaveric human hearts (Formalin = 40% solution of Formaldehyde in water .10% Formalin = 10 parts of formalin + 90 parts water). During study, these steps would be followed- Dissected human hearts were collected from the department of Anatomy. The hearts were thoroughly washed & preserved. Visceral pericardium and sub-epicardial fats were removed. The coronary arteries and their branches were carefully dissected out and followed till their termination. The arteries were painted with red fabric color to enhance contrast. Photographs were taken. Different parameters of right coronary artery were observed, recorded and statistically analysed.

RESULT

The observations are recorded in the following format-

➤ Following tables are showing different parameters of branching pattern of coronary arteries.

Table- 1- Origin of Right Coronary Artery

SITE	OBSERVATION (%)
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Right anterior aortic sinus	94
Left anterior aortic sinus	03
Posterior aortic sinus	01
Directly from aorta	02

Table 1 is showing the different sites of origin of RCA. In 94% hearts RCA was originating from the Right anterior aortic sinus. Only in 3% specimens its origin was from left anterior aortic sinus and directly from aorta in 2%. Similarly, it arises from posterior aortic sinus in 1 heart.

Table- 2-Termination of Right Coronary Artery

SITE	OBSERVATION (%)
Right Border	6
Right Border – Crux	80
Crux	9
Crux - Left Border	3
Left Border	2

Table -2 is showing the termination of Right Coronary Artery at different sites. In most of the cases (80%), it terminates between the Right border and Crux. Rarely (2%), it reaches up to left border and terminates there.

Table- 3-Termination of Posterior Interventricular Artery

TERMINATION OF POSTERIOR INTERVENTRICULAR ARTERY	OBSERVATION
Provided By	
I - Right coronary Artery :	
$\frac{1}{4}$ Way down PIVS *	17
$\frac{1}{2}$ Way down PIVS	45
$\frac{3}{4}$ Way down PIVS	15
At Apex	01
Total	78
II- Left coronary Artery:	
$\frac{1}{4}$ Way down PIVS	03
$\frac{1}{2}$ Way down PIVS	07
$\frac{3}{4}$ Way down PIVS	07
At Apex	00
Total	17
III- Both:	
$\frac{1}{4}$ Way down PIVS	01
$\frac{1}{2}$ Way down PIVS	03
$\frac{3}{4}$ Way down PIVS	01
At Apex	00
Total	05

*PIVS= Posterior interventricular sulcus

In table 3 we observed that when posterior interventricular artery arises

from RCA, it reaches up to $\frac{3}{4}$ Way down PIVS in 15 hearts. In most of the hearts (45) it reaches upto $\frac{1}{2}$ Way down PIVS i.e. the common termination of PIVA is $\frac{1}{2}$ Way down PIVS. When PIVA arises from LCA, it reaches up to and terminates at $\frac{3}{4}$ and $\frac{1}{2}$ Way down PIVS in 7 hearts. In case of co-dominance the common termination of PIVA is $\frac{1}{2}$ Way down PIVS in 3 hearts. Thus, we can conclude that the common termination of PIVA is $\frac{1}{2}$ Way down PIVS.

DISCUSSION

The clinical importance of new patterns of coronary arteries with new variety of myocardial bridges makes this examination of first noteworthiness in the management of heart ailments for cardiovascular experts and variety in its anatomical features for anatomists. As we all know, in present time new imaging technologies have developed and used on a large scale. These can be used for non-invasive methods of treatment, which require a thorough knowledge of normal and variants found in coronary anatomy. If normal and aberrant structures are not clearly understood, they may lead to misinterpretations and huge complications during heart surgeries.

The observations are categorized under following headings-

- Anomalies of Ostia,
- Anomalies of Origin of Coronary arteries
- Branching pattern and Termination of Coronary arteries

Anomalies of Ostia

Normally, we have 3 ostia for the origin of coronary arteries. They location may fluctuate in relation to the sino-tubular junction. In some cases, they have a "Low" origin i.e. from the lowest part of sinus of Valsalva. In others, they may take a "High" origin from ST-Junction-as observed by Vlodaver et.al. in 1975. The common location of coronary ostia is at the level of ST-junction.

2.) Anomalies of Origin- In a case reported by Santucci PA et.al. in 2001 reveals abnormal origin of coronary arteries from Innominate artery. They assessed that this abnormal origin could be a cause of syncope in adults. In a number of studies it has been made cleared that anomalous origin of coronary arteries is associated with CAD. Cheathan JP (1987) found that the RCA was originating from Descending thoracic aorta.

Table 4- Comparison of Origin of RCA in Different Studies-

Name Of Coronary Artery	STUDY	Location of Ostia		
		Below ST-Junction	At the level of ST-Junction	Above the ST-Junction
RCA	Joshi SD et.al. (2010) (By Dissection)	94%	7%	4%
	Mallashetty N. et.al. (2012) By Dissection	100%	-	-
	Prajapati B et.al. (2013) (By Dissection)	91%	0%	9%
	Bhele et.al. (2017) (By Dissection)	90%	6%	4%
	Present study (By Dissection)	95%	5%	-

Table 5- Comparison of Termination of RCA in Different Studies-

STUDY	ORIGIN POINTS OF RIGHT CORONARY ARTERY					
	Right aortic sinus	Left aortic sinus	Non-coronary sinus	Directly from aorta	Directly from Pulmonary Trunk	From LAD
N. Garg et.al. (2000) (Coronary arteriography)	2.52%	48.74%	48.74%	-	-	-
Fazliogullari Z. 2010 (By Dissection)	100%	-	-	-	-	-
Bhele et.al. (2017) (By Dissection)	100%	-	-	-	-	-
Turkoglu S. (2018) By Angiography	-	0.31%	-	-	-	0.02%

Present study	94%	3%	1%	2%	-	-
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CONCLUSION

In today's time, with the advancement of new imaging technologies for diagnosis of various diseases, it is necessary to have a detailed knowledge of normal and aberrant anatomical structures of human body. In reference to the present context, surgeons, anatomists, medical practitioners and students must be aware of the normal and diverging features of Coronary arteries and Myocardial bridges. Most of the variations are benign, but these are important from clinical and surgical point of view. The observations of the present study on cadaveric human hearts of Rajasthan suggests that-

- 1) The Ostia for RCA are mainly located below the Sino-tubular junction.
- 2) Most common termination point of RCA is between Right border and crux of heart.
- 3) In 78% specimen Right dominance was observed.

From the above mentioned observations, it is concluded that the coronary arteries exhibits a greater amount of deviation from their normal origin, course, branching pattern and termination points. So, it is therefore essential for medical professionals to understand such variations for better diagnosis and treatment of coronary artery diseases. These variations are different in different races.

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