



## THE STUDY OF CORONARY ARTERY DOMINANCE AND ITS CLINICAL SIGNIFICANCE IN CENTRAL INDIA POPULATION

**Dr Surekha W. Meshram**

(M.B.B.S, M.D) Associate Professor, Dept. of Anatomy, GOVT. Medical College Gondia, Maharashtra, India

**ABSTRACT** **Introduction:** The anatomy of coronary arteries and their variations is significant for having knowledge of various heart diseases as well as proper interpretation of the coronary angiographies. In developed as well as developing countries heart diseases are one of the important cause of death. So this study is carried out to know the pattern of coronary artery dominance in Indian population and its relation to Heart Attack.

**Material and Methods:** This study is carried out in 50 embalmed human hearts by fine dissection method with the help of pointed forceps. The right and left coronary artery and their branches were dissected minutely and photographed.

**Results:** Right dominance was found in 34 hearts in 68%, left dominance was found 4 hearts in 8% and co-dominance was found in 6 hearts in 12%. The incidences of myocardial infarction and other heart diseases are more common with left dominance.

**Conclusions:** We found right coronary artery dominance more in this study. If the left dominance is present patient is more prone to Heart Attack. We can apply this knowledge in living subjects to overcome the morbidity and mortality in them and to help the cardiologist during routine diagnostic work up for cardiac diseases and management of these diseases

**KEYWORDS :** Artery, Coronary arteries, Dominance

### INTRODUCTION

The word coronary is derived from Latin word. It refers to crown like arrangement of all coronary arteries as they encircle the heart in atrio-ventricular sulcus. Today scientist are facing challenges because of worldwide prevalence of various heart diseases and morbidity and mortality due to heart attack. The original concept of coronary dominance was based on the sole criteria to the artery whether it is right or left coronary artery which particular cross the crux and thus supplied the chambers situated on the opposite side if none of the artery crossing the crux it is called as balance circulation.

Following are the different parameters used to determine dominance by various authors:

1. The coronary artery giving the posterior interventricular artery, Gray's Anatomy (1).
2. The coronary artery crossing crux, Venkateshu (2).
3. The coronary artery giving the AV nodal artery, Shirani (3).

In the present study the criterion as stated by Gray's Anatomy has been used to determine the dominance. According to text book of Gray's Anatomy the term dominance is used to refer the "posterior interventricular artery", whether it is a branch of right coronary artery or the left coronary artery or both.

In 'right dominance' posterior interventricular artery is a branch from the right coronary artery. In 'left dominance' the posterior interventricular artery is a branch from the left coronary artery. In case of 'co-dominance' the posterior interventricular artery is seen originating one is from right coronary artery as well as from the left coronary artery also.

### AIMS AND OBJECTIVE

The present study aimed at:

1. To know the detailed knowledge of coronary artery dominance by the dissection method.
2. To find out whether the left or right dominance is related to sudden death due to heart attack.

### MATERIAL & METHODS

The study is carried out in the Department of Anatomy, Jawaharlal Nehru Medical College, Sawangi (Meghe), Wardha. Total fifty hearts were obtained from cadavers of adult individual of both sexes, having age between 17-60 years. First the hearts were fixed in 10% formalin.

Dissections conducted on heart included the removal of epicardium and subepicardial adipose tissue and the tracing of each artery by fine dissection method. The course of right as well as left coronary artery is traced minutely and the branches of each artery are detected and labeled properly. The most representative preparations were photographed.

### Abbreviations:

AIVA- Anterior Interventricular Artery  
Crmx A- Circumflex Artery  
LCA- Left Coronary Artery  
PIVA- Posterior Interventricular Artery  
RCA- Right Coronary Artery

### OBSERVATIONS AND RESULTS

In the present study, as shown in the table, in 34 hearts (68%) of posterior interventricular artery was found to be a branch of right coronary artery (Fig no. 1). In 4 of these hearts, posterior interventricular artery was found to be a branch of left coronary artery (Fig no.2&3).

**Table 1: Showing origin of posterior interventricular artery (PIVA)**

	RIGHT DOMINANCE PIVA origin from right coronary artery	LEFT DOMINANCE PIVA origin from left coronary artery			CO-DOMINANCE PIVA origin from RCA & LCA
		Only Crmx	Only AIV	Both Crmx and AIVA	
	2	1	1		
No. of hearts	34	4			6
Percentage of hearts	68%	8%			12%

In 2 hearts, posterior interventricular artery was branch of circumflex artery (Fig no. 2). In 1 heart it was a continuation of anterior interventricular artery. In one case posterior interventricular artery was a branch of both circumflex artery and anterior interventricular artery (Fig. no3).

**Table 2: Showing dominance**

	No. of hearts	Percentage of hearts
Right Dominance	34	68%
Left dominance	4	8%
Codominance	6	12%

In "left dominance" incidence of myocardial infarction is more because arteriosclerosis and obstruction is usually seen in left coronary artery because it has more transverse diameter than the right. It is also observed that among the right and left coronary arteries, the left coronary artery supplies mainly more myocardium resulting in severe degree of myocardial infarction because of left dominance.

In 6 hearts (12%) posterior interventricular artery was found to be

branch of both right and the left coronary arteries. Therefore a codominance was seen in 12% of hearts. (Fig.No.4)

**DISCUSSION**

The earliest studies of coronary dominance in the heart were described by Branchi (4) 1904, Spalteholz (5) 1924 and Schlesinger (6) 1940. Their studies were based on the single criterion as to which coronary artery cross the crux. James (7) in 1961 considered majority of hearts to be left dominant on the basis of percentage of myocardium supplied by each coronary artery.

Findings in the present study are similar to those of DiDio 1975 (8), Kahn 1995 (9), Cavalcanti 1995 (10) and Venkateshu 2004. Venkateshu 2004 also used the dissection method but his findings were based on determining which particular artery crossed the crux and thus supplied the Chamber situated on the opposite side while in the present study the Criterion followed was **“which coronary artery give the PIVA artery”**.

The present study reports the incidence of right coronary dominance in 68% as compared to DiDio - 73.5% and Kahn -70% and Cavalcanti-69.09%

In the right dominance, the right coronary artery supplies the right ventricle (except a small region to right of anterior interventricular sulcus), a small part of left ventricular diaphragmatic surface, right Atrium and posterior inferior one third of interventricular septum thus obstruction of right coronary artery will affect these regions of heart but much of left ventricle left Atrium and interventricular septum supplied by left coronary artery will remain unaffected thus functioning of heart may not be as severely hampered. The observation of almost all the authors showed highest incidence of right coronary artery dominance as shown in table no. 3.

In individuals with left coronary dominance the entire left ventricle part of right ventricle and left Atrium and interventricular septum are under nutritional control of left coronary artery. Obstruction of this artery therefore may produce a massive infarct which may produce output failure of the heart.

So in case of left coronary artery block in left coronary dominant heart there will be massive injury to the heart which is only 8% in the present study.

Ahmed (11) 1972 shows 70% incidence of co-dominance studied by injection collagen method and Omar 1977 (12) By Radiographic method, he reported highest right coronary dominance 53.30%. Reig (13), Ortale (14) and Gray's Anatomy report a highly incidence of co-dominance ranging between 25 to 40% by the section method in the present study 12% incidence of Co-dominance has been reported.

The individuals with co-dominance have posted interventricular arteries from both right and left coronary arteries thus even in the case of obstruction of one coronary artery, the other artery is able to nourish the interventricular septum and region adjacent to it. These individuals may be least severely affected by coronary artery obstruction

The results of different authors are more or less comparable except right coronary artery dominance on the lower side reported by Reig and Ortale and Gray's Anatomy where no right coronary artery dominance was reported at all. Left coronary artery dominance of 70% was reported in Gray's Anatomy which is the highest reported by any author using dissection method

**Table 3: Displaying results of dominance studied by various authors with their method of study**

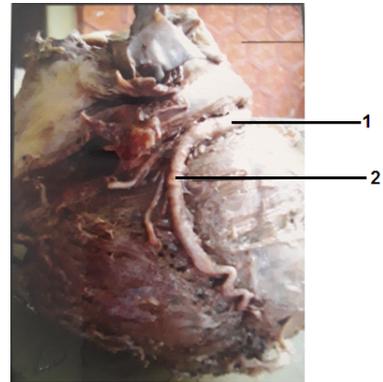
Researchers	Parameters used	RCAD	LCAD	Codominance
DiDio 1975	“	73.50%	19.40%	7.10%
Cavalcanti 1995	“	69.09%	11.82%	19.09%
Kahn 2003	“	70%	10%	20%
Kalpana R 2003	“	89%	11%	
Reig 2003	“	50-60%	10-15%	30-40%
Ortale 2004	“	62.50%	12.50%	25%
Gray's Anatomy (39 <sup>th</sup> Edn. Pg. 1014)	“	-	70%	30%

Venkateshu 2004	Artery crossing crux	68.75%	16.66%	14.58%
Shiran,2006	Artery giving AV nodal artery	90%	10%	-
Other Methods				
Ahmed 1972	Injection corrosion method	18.09%	11.70%	70.20%
Omar 1977	Radiographic	53.30%	16.70%	30%
Present study	Dissection	68%	8%	12%

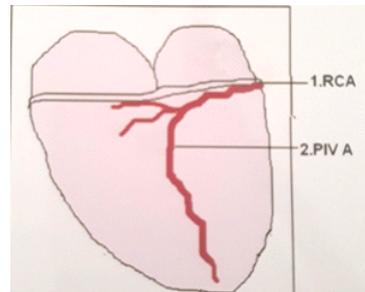
**CONCLUSION**

According to present study in most (68%) of Indian population Right dominance was found. In 12% of population Co-dominance was found. In 8% of population Left dominance was found. If there is an obstruction in left coronary artery dominant subjects, the degree of severity of myocardial infarction is more and may lead to death in single attack also. The incidence of severe degree of myocardial infarction is less in case of right coronary dominance. In the person who is having co-dominance not affected by coronary artery obstruction and thus he/she is prevented from myocardial infarction. The knowledge gained by this cadaveric study should be applied to live heart patients screened by angiography.

**Fig.1. Posterior Interventricular artery branch of Right coronary artery Right Dominance Fig. 1(A)**



**Fig.1(B)**



**Fig. 2 Posterior Interventricular artery branch of Left coronary artery-Left Dominance**

**Fig.2(A)**



Fig.2(B)

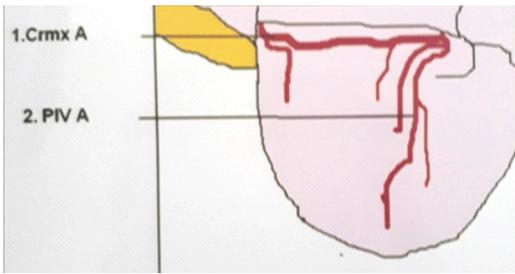


Fig. 3: Posterior interventricular artery branch of both circumflex and anterior interventricular artery- Left dominance

Fig.3(A)

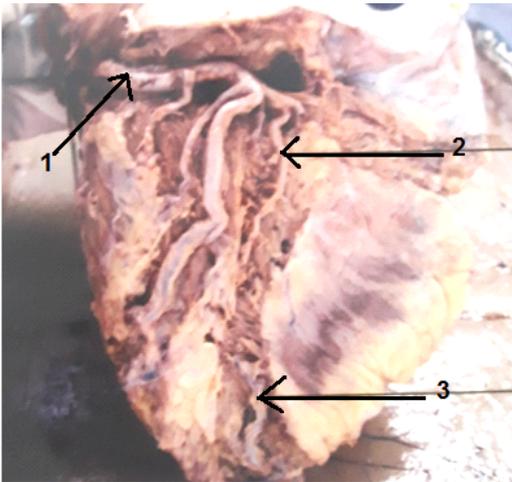


Fig.3(B)

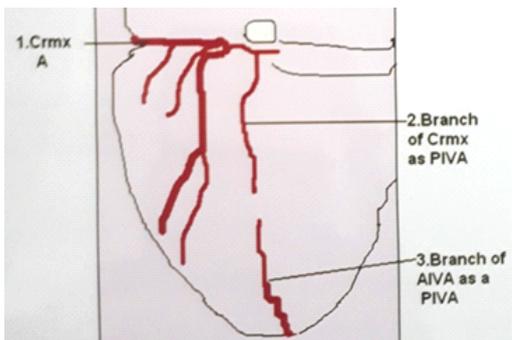


Fig. 4: Posterior interventricular artery arising from right coronary artery as well as left coronary artery

Fig.4(A)

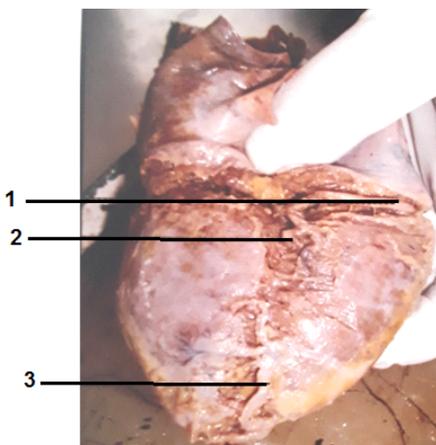
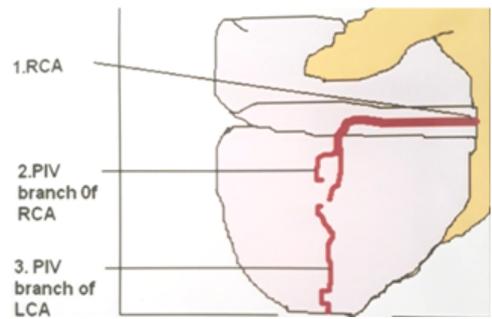


Fig.4(B)



REFERENCES

1. Gray's Anatomy 39th edition, page no. 1014.
2. 9. Venkateshu K.V. Coronary Artery Dominance. Anatomica Karnataka 2004; 18-21
3. Shirani j., Brofferio A. isolated coronary artery anomalies online 2003 cited 2006 June 20, 11 screen.
4. Branchi A. Morfologia delle arterie coronariae cordis. Arch et al Anat Embriol 1904;87-64.(Quoted by Reig Villalonga in 2003)
5. Spalteholz Z. Die Arterian der Herzwand, Leipzig, Hirzel 1924;p15. (quoted by Bergman et al in 2004)
6. Schlesinger M T. Relation of the anatomical pattern o the pathological condition of the coronary arteries. American Medical Association Archives of pathology 1940;30:403-415. (quoted by B. K. Omer in 1977)
7. James T.N. Anatomy of coronary arteries, New York : Harper & Row: 1961:1-50. (Quoted by B.F. Waller in Hurt's "The heart" 1995)
8. DiDio, L. J. A. & WAKEFIELD, T.W. (1972). Origin, classification, nomenclature and incidence of the arterial arteries in normal human hearts, with special reference to their clinical importance. Acta Cardiologica 27, 565
9. Kahn C E. Coronary artery dominance. (Online). 1995 (cited 2004 MAY 26); Available form : URL: <http://www.mcw.edu/chirus/doc/00460.html>
10. Cavalcanti JS, de Lucena, Oliveira M, Pais e Melo AV Jr, Balaban G, DE Andrede Oliveia CL, de Lucena Olivaria E. Anatomic variation of coronary arteries. Arq Bras Cardiol 1995 Dec; 65(6):489-9212
11. Ahmed SH El-Rakhawy M.T, Abdulla A., Harrison R.G.A. new conception of coronary artery preponderance Acta anat 1972;83:87-94
12. Omar B.K. Coronary artery predominance a new parameter for its study. Journal of Anatomical society, India 1977;26(2):85-90.
13. J. Reig Villalonga European Journal of Anatomy, ISSN 1136-4890 Volume 8, 1,2004, pages 39-53
14. Ortale JR Keiralla LC, Sacilotto L.
15. Coronary artery dominance.(Home)(disclaimer) ©2002, C.e. kahn, JF.2002-04-18.
16. Coronary artery Dominance. Charles E, Kahn, jr. MD-2february 1995 last updated 26 may 2004
17. Coronary artery diseases. Left anterior artery length and right coronary artery dominance. Coronary artery diseases 12(1):77-78, February 2001d.IIia, Reuben Rosenshtein, GABRIEL; Marc Weinstein, jean Cafri , Carlos Abuful, Akram Gueron, Mosche.