Study Of Coronary Artery Dominance Patterns In Western India – A Cadaveric Study

Dr.Vaibhav Bhatnagar[1], Dr. Seema Prakash[2], Dr. Parveen Ojha[3,] Dr. Ghanshyam Gupta[4], Dr. Manali Arora[5] (Corresponding Author)

[1](Anatomy, R.N.T Medical College/ Rajasthan University of Health Sciences, India)
[2](Anatomy, R.N.T Medical College/ Rajasthan University of Health Sciences, India)
[3](Anatomy, R.N.T Medical College/ Rajasthan University of Health Sciences, India)
[4](Anatomy, J.N.U Institute of Medical Sciences and Research Center/ Jaipur National University , India)
[5](Anatomy, Dr. S.N. Medical College/ Rajasthan University of Health Sciences, India)

Corresponding Author:

Dr Manali Arora

Assistant Professor

Anatomy, Dr. S.N. Medical College, Jodhpur

Abstract:

Background: *As cardiac dominance pattern varies in different populations. Dominance pattern of the heart has got important clinical significance. Since there are few studies available to determine coronary artery dominance in Western India so keeping this in view present study was done to determine coronary artery dominance in Western India.*

Material and methods: *Descriptive type of observational study was conducted in the Department of Anatomy R.N.T. Medical College, Udaipur (Rajasthan). 60 formalin fixed human cadaveric hearts following inclusion and exclusion criteria were dissected according to the protocol described in the Cunningham's manual and the variations in the dominance pattern on the basis of origin of posterior interventricular artery were noted and classified.*

Result: *It was found that out of total heart specimens 88.33%, 6.67% and 5% heart specimens showed right dominance, left dominance and co-dominance respectively.*

Conclusion: *Considering high risk of mortality in left cardiac/coronary dominance and co-dominance pattern, more prevalence of myocardial infarction in left coronary dominance and poor prognosis of left coronary dominance, the present study would be helpful to the cardiologists, radiologists and surgeons of western India.*

Keyword: *Coronary Artery, Cardiac Dominance, Cadavers.*

I. INTRODUCTION

The word 'dominant' is used for the coronary artery giving off the posterior interventricular artery. In the 'right dominance' pattern the right coronary artery gives the posterior interventricular artery (67%) and supplies left ventricle. In 15% of hearts, the circumflex artery which is a branch of left coronary artery gives the posterior interventricular artery (left dominance). In these cases the right coronary artery is small and does not supply the left ventricle[1]. In approximately 18% of people both Right coronary artery and Circumflex artery give rise to branches in or near the posterior inter ventricular groove. This pattern is called 'co-dominance' pattern or 'balanced type' pattern[1].As cardiac dominance pattern varies in different populations. Dominance pattern of the heart has got important clinical significance. As minority of population are having 'left coronary dominance' and people who are having left coronary dominance are likely to be affected by coronary artery diseases, because the entire left ventricle and ventricular septum are under control of left coronary artery, and obstruction of left coronary artery may produce output failure of systemic circulation[2].It plays an important role in coronary artery bypass grafting. Coronary dominance determination is through cardiac catheterization which

includes insertion of a catheter into the ostium of the right and left main coronary arteries and injection of radiocontrast dye to visualize coronary arteries. In coronary artery bypass grafting (CABG), detail knowledge of specific coronary artery anatomy is important; this is because the surgeon must identify which vessel is competent to receive venous graft. During occlusion of the right or left coronary artery in that case the posterior descending artery may be the choice.There have been a large number of studies conducted to determine the significance of cardiac dominance on patient outcome and pathology and according to them left coronary dominance is believed to be associated with worse prognosis for patients with acute coronary syndrome and stable coronary artery disease[3]. According to previous studies the increased risk seems to correlate with left heart dominant circulation, but more research has to be done to determine if different strategies need to be implemented to ensure better outcomes. Since there are few studies available to determine coronary artery dominance in Western India so considering high risk of mortality in left cardiac/coronary dominance and co-dominance pattern, more prevalence of myocardial infarction in left coronary dominance and poor prognosis of left coronary dominance so keeping this in view present study was done to determine coronary artery dominance in Western India. Thus Present study was conducted to study the coronary artery dominance patterns and its clinical significance.

II.   MATERIAL AND METHODS
Descriptive type of Observational study was conducted in the Department of Anatomy R.N.T. Medical College, Udaipur (Rajasthan). 60 adult cadaveric human hearts (convenient sampling method) were collected as study material from the cadavers in the dissection hall of Anatomy department.
Study type and design: Descriptive type of observational study

Study location: Department of Anatomy R.N.T. Medical College, Udaipur (Rajasthan).

Sample size: 60 adult cadaveric human hearts

Study duration: November 2019 to October 2020

Inclusion and exclusion criteria: Adult human cadaveric hearts of both sexes deceased due to natural causes with no visible external pathology were included whereas cadavers with putrefied heart and heart with any history of bypass surgery were excluded.

Plan of action: After getting approval from institutional ethical committee (letter no. RNT/Stat./IEC/2019/125 dated 21.10.2019) all 60 heart specimens were dissected according to the protocol described in the Cunningham's manual and the variations in the dominance pattern on the basis of origin of posterior interventricular artery were noted and classified[4]. Accordingly, desired data of each and every heart specimen was taken and recorded on separate sheet of prescribed Proforma.

Statistical analysis: Data as such collected and thereafter consolidated in Microsoft Excel sheet to prepare master chart enabling to attain statistical analysis for achieving the purpose of the study. All nominal variables presented as counts and expressed as proportions (%) to facilitate comparisons. Comparison between two proportions was done by using 'Z test for difference of two proportions'. P-value less than 0.05 was taken as significant. Medcalc 16.4 version software was used for all statistical calculations.

Photograph-1: Human cadaveric hearts

III.   RESULTS
Table-1: Origin of posterior interventricular artery

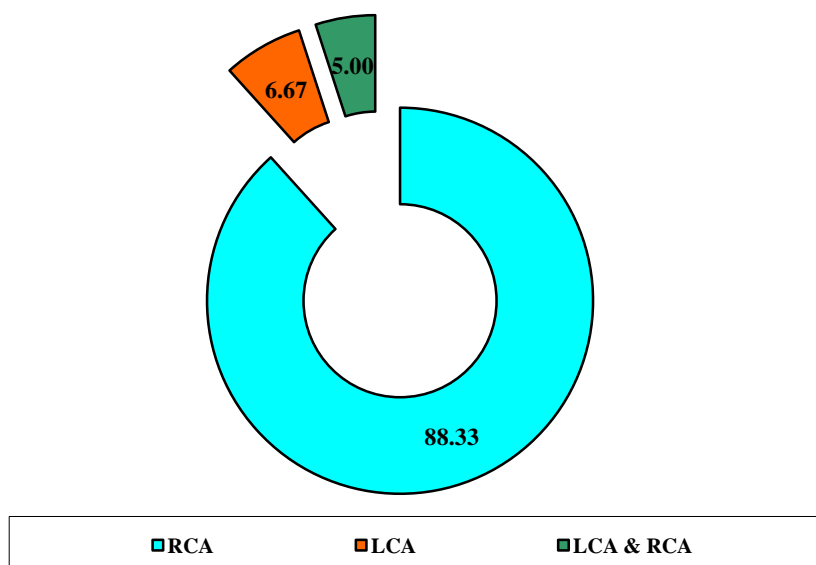| Post interventricular artery	No.	%
RCA	53	88.33
LCA	4	6.67
LCA & RCA	3	5.00
Total	60	100.00

Graph-1: Origin of posterior interventricular artery

Table-2: Distribution of heart specimens according to type of variations in Dominance

Type of variations in Dominance	No.	%
Right dominance	53	88.33
Left dominance	4	6.67
Co- dominance	3	5.00
Total	60	100.00

Table no. 1 shows that out of total studied heart specimens posterior interventricular artery arose from right coronary artery, left coronary artery and both right and left coronary artery in 88.33%, 6.67% and 5% hearts respectively.(graph:1)

Table no. 2 reveals that in the present study 88.33%, 6.67% and 5% heart specimens showed right dominance, left dominance and co-dominance respectively.(graph:2)
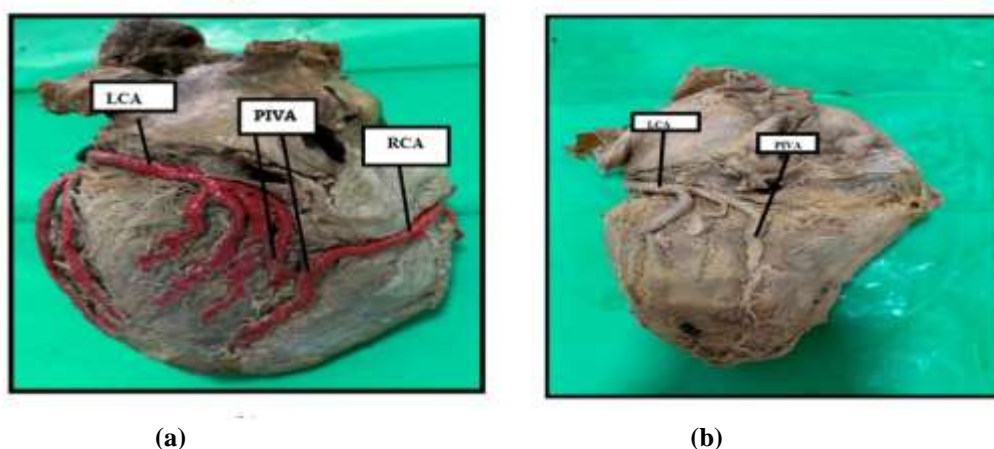
| (a) | (b) |

Photograph :2 (a) showing co-dominance pattern (b) showing left -dominance pattern

IV.   DISCUSSION
Table-3: Comparison of coronary dominance pattern with previous studies

Authors	N	Right dominance (in %)			Left dominance (in %)			Co-dominance (in %)		
		%	**Z**	**'p' value***	**%**	**Z**	**'p' value***	**%**	**Z**	**'p' value***
Nerantzis et al. (1980)[5]	300	88.00	0.146	0.884	12.00	0.974	0.330	-	-	-
Kalpana Ret al.(2003)[6]	100	89.00	0.129	0.898	11.00	0.630	0.529	-	-	-
Ortale JR et al. (2004)[7]	40	62.50	2.808	**0.005**	12.50	0.641	0.521	25.00	2.610	**0.009**
Abdellah et al. (2009)[8]	429	77.00	1.830	0.083	8.00	0.103	0.918	15.00	1.905	0.057
Kosar et al. (2009)[9]	700	76.00	2.017	**0.044**	9.10	0.398	0.391	14.80	1.904	0.057
Das H et al. (2010)[10]	70	70.00	2.320	**0.020**	18.57	1.745	0.081	11.43	0.997	0.319
Fazliogullari et al.(2010)[11]	50	42.00	4.952	**<0.001**	14.00	0.957	0.339	44.00	4.632	
Bhimali S et al. (2011)[12]	60	60.00	3.336	**<0.001**	23.33	2.300	**0.021**	16.66	1.761	0.078
Fazlul Aziz Main et al. (2011)[13]	200	60.50	3.862	**<0.001**	19.50	2.148	**0.032**	23.30	2.977	**0.003**
Reddy V et al. (2013)[14]	80	86.25	0.004	0.997	11.25	0.630	0.529	2.50	0.329	0.742
Vinitha G et al. (2015)[15]	50	62.00	3.011	**0.003**	22.00	2.054	**0.040**	16.00	1.596	0.111
Gohain Net al. (2015)[16]	90	64.44	3.078	**0.002**	24.45	2.598	**0.009**	11.11	1.007	0.314
Damor B et al. (2015)[17]	60	90.00	0.001	1.000	10.00	0.330	0.742	-	-	-
Pal M et al. (2016) [18]	70	70.00	2.320	**0.020**	22.00	2.198	**0.028**	8.00	0.332	0.740
Priyadharshini S et al. (2016)[19]	50	84.00	0.380	0.704	8.00	0.101	0.919	8.00	0.250	0.803
Ravi V et al. (2017)[20]	30	83.00	0.371	0.711	13.30	0.649	0.516	3.30	0.174	0.862
Singh V et al. (2019)[21]	100	83.00	0.629	0.530	14.00	1.091	0.275	3.00	0.153	0.879

| Present study (2020) | 60 | 88.33 | - | - | 6.67 | - | - | 5.00 | - | - |

*Z test for difference of two proportions

Table no. 4 reveals that when statistical analysis of pattern of coronary dominance was done in the form of Z test and p-value and compared with previous studies it was found that this finding of our study was commensurate with the findings of Nerantzis et al. (1980)[5], Kalpana R et al. (2003)[21], Abdellah et al. (2009)[8], Reddy V et al. (2013)[14], Damor B et al. (2015)[18], Priyadarshini S et al. (2016)[16], Ravi V et al. (2017)[14] and Singh V et al. (2019)[13]whereas in the studies of Ortale JR et al. (2004)[7], Kosar et al. (2009)[9], Das H et al. (2010)[10], Fazliogullari et al. (2010)[11], Bhimali S et al. (2011)[12], Fazlul Aziz Main et al. (2011)[13], Vinitha G et al. (2015)[15] Gohain Net al. (2015)[16] Pal M et al. (2016)[18]they found significantly different p-values when z test was applied.

V.   CONCLUSION

In the present study 88.33%, 6.67% and 5% heart specimens showed right dominance, left dominance and co-dominance respectively.Considering high risk of mortality in left cardiac/coronary dominance and co-dominance pattern, more prevalence of myocardial infarction in left coronary dominance and poor prognosis of left coronary dominance, the present study would be helpful to the cardiologists, radiologists and surgeons of western India.

References:

[1]. Moore KL, Dalley AF, Agur AMR. Clinically Oriented Anatomy.6th ed. Baltimore: Lippincott Williams & Wilkins, Wolters Kluwer; 2010. p.144 – 47.
[2]. Datta AK. Essentials of human anatomy, Thorax and Abdomen. 8th ed. Calcutta: Current Books International; 2008. p.85.
[3]. Goldberg A, Southern DA, Galbraith PD, Traboulsi M, Knudtson ML. Coronary dominance and prognosis of patients with acute coronary syndrome. Am Heart J 2007;154: 1116–22.
[4]. Cunningham's textbook of Anatomy. 13thed. Oxford Medical Publications, Oxford University Press; 1981. p. 920 – 921.
[5]. Nerantzis CE, Lefkidis CA, Smiroff TB, Devaris PS. Variations in the origin of the posterior interventricular artery with respect to the crux cordis and the posterior interventricular groove- An anatomical study. Anat. Rec.1980; 252(3):413-17.
[6]. Kalpana R. A study on principal branches of coronary arteries in humans. J Anat. Soc. India. 2003; 52(2):137-40.
[7]. Ortale JR, Keiralla LC, Sacilotto L. The posterior ventricular branches of the coronary arteries in the human heart. Arq Bras Cardiol. 2004; 82(5):468-72.
[8]. Abdellah AAA, Elsayed ASA, Hassan MA. Angiographic coronary artery anatomy in the Sudan Heart Centre. Khartoum Medical Journal. 2009; 2(1):162-64.
[9]. Kosar. P., Ergun, E., Ozturk, C. and Kosar, U. Anatomic variations and anomalies of the coronary arteries: 64-slice CT angiographic appearance. Diagn Interv Radiol. 2009; 15(4):275-83.
[10]. Das H, Das G. A study of coronary dominance in population of Assam.J. Anat. Soc. India. 2010; 59 (2):187-191.
[11]. Fazliogullari Z, Karabulut AK, Unver Dogan N, Uysal II. Coronary artery variations and median artery in Turkish cadaver hearts. Singapore Med J. 2010; 51(10):775-80.
[12]. Bhimalli S, Dixit D, Siddibhavi M, Shirol V.S. A study of the variations in the coronary arterial system in a cadaveric human heart. World Journal of Science and Technology.2011; 1(5):30-35.
[13]. Fazlul Aziz Mian, Shahid N Malik, Muhammad Ismail, Iqbal Saiullah Khan, Mehboobur Rehman et al. Coronary artery dominance: What pattern exists in Pakistani population? Ann. Pak. Inst. Med. Sci. 2011; 7(1):3-5
[14]. Reddy V, Lokanadham S. Coronary dominance in south Indian population. Ijmrhs. Mar 2013; 2(1):78-82.
[15]. Vinitha G. Sarala H S. a cadaveric study on coronary preponderance. International Journal of Anatomy and Research, Int J Anat Res 2015; 3(3):1289-92.
[16]. Gohain N, Saikia R. An anatomical study of coronary artery dominance in human cadaveric hearts. J of Evolution of Med and Dent Sci July 2015; 4(57):9897-902.
[17]. Damor B, Tank K. A study on coronary dominance patterns in the human heart and its clinical significance. Journal of Research in Medical and Dental Science .2015; 3 (3):229-231.
[18]. Pal M, Saha D. A cadaveric study of coronary artery dominance on West Bengal   population. Indian Journal of Basic and Applied Medical Research.2016; 5 (3): 18 – 24.
[19]. Priyadharshini. S, Sivakumar. M. a study of coronary arterial dominance pattern. International Journal of Anatomy and Research. Int J Anat Res 2016; 4(3):2817-21.
[20]. Ravi V, Tejesh S. Anatomical variation in branching pattern and dominance in coronary arteries: A cadaveric study. Int J Anat Res. 2017; 5(1):3611-17.
[21]. Singh V, Kottapalli SB. Study of Coronary Domination in North Indian Population. IOSR Journal of Dental and Medical Sciences.2019; 18(04):50-52.