

Pattern of CORONARY DOMINANCE in Humans

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Abstract

The heart starts functioning at the beginning of fourth week. It is normally supplied by two coronary arteries, Right coronary artery (RCA) and Left coronary artery (LCA). The term “coronary dominance” is used to refer to the coronary artery that gives origin to the posterior descending artery (PDA). Understanding of coronary artery dominance is required for cardiac surgeons and radiologists to improve operative outcome in coronary heart disease.

Keywords: Coronary Artery, Coronary Dominance, Posterior Descending Artery (PDA), Coronary Artery Disease (CAD)

Introduction

Heart is the first organ in the body to start functioning at the beginning of fourth week¹. The term 'Coronary' comes from the Latin term “Corona” meaning “Crown”. These arteries supplying the heart are present like a crown around the heart. The coronary circulation was first described by Banchi (1904)² as being supplied by two coronary arteries: Right coronary artery (RCA) and Left coronary artery (LCA). The right coronary artery after taking origin from the right aortic sinus, runs in the right atrioventricular groove and supplies the heart. Left coronary artery after taking origin from left posterior aortic sinus, runs in left atrioventricular groove and supplies the heart.

The term “coronary dominance” could be misunderstood as the dominant artery that irrigates the greater part of

myocardium, but in fact “CORONARY DOMINANCE” refers to the coronary artery that gives origin to the posterior descending artery (PDA) supplying the diaphragmatic surface of both ventricles and area of interventricular septum posteriorly.

The artery that gives rise to the posterior descending artery (PDA) determines the dominance. 3 types of coronary dominance have been documented; right dominance, left dominance and co-dominance². If the posterior descending artery is supplied by the right coronary artery (RCA), then the coronary circulation can be classified as “right-dominant”, if the posterior descending artery is supplied by the left circumflex artery (LCX), a branch of the left coronary artery, then the coronary circulation can be classified as “left-dominant” and if the posterior descending

artery is supplied by both the right coronary artery and the circumflex artery, then the coronary circulation can be classified as "co-dominant".

A US registry reported that left dominance and co-dominance were associated with development of coronary artery disease and increased in-hospital mortality³. Coronary artery disease is one of the major causes of death in developed countries. The incidence of coronary artery disease is increasing today in developing countries as well, because of changing life style, urbanization, sedentary nature of work, hyperlipidemia, diabetes mellitus, hypertension and obesity. Coronary dominance show variations among different populations. CAD is responsible for over 70% of sudden cardiac deaths in developing countries, therefore there is a need for the study of cardiac dominance in these populations. The knowledge of these variations are of paramount importance when considering various surgical interventions. Therefore knowledge of coronary artery dominance is important for cardiac surgeons to improve the operative outcome in coronary heart disease and for radiologists.

Materials and methods

A total of 36 cadaveric hearts and cardiac angiographies of 74 individuals were studied.

36 formalinized cadaveric hearts without any obvious pathology were obtained from the routine cadaveric dissections in the dissection hall of department of anatomy, GianSagar Medical College, Banur. These hearts were dissected to expose the coronary arteries and the arteries were traced carefully to see the origin of

posterior descending artery (PDA), as its origin would decide the coronary dominance for that heart. Each heart was numbered and the dominance for that heart noted down carefully.

The cardiac angiography reports of 74 individuals in Haldiram Moolchand Cardiovascular Centre of P.B.M Hospital, Bikaner were obtained for the study. Only the patients whose angiograms were commented to be without any severe cardiac disease or any gross anomaly of the heart by the cardiologist were included in the study. Angiographies for all the individuals were performed by routine methods. The informed consent by the patients to be included in the study were obtained. Angiograms of only the adult patients above 18 years of age were included and personal details of each patient was recorded. Angiograms were viewed to see the origin of posterior descending artery (PDA). Each angiograms was studied twice in separate setups to eliminate any error. Data thus collected was statistically analyzed.

Results

The results obtained from the cadaveric hearts and cardiac angiograms have been presented below table 1.

Among the cadaveric hearts, 72.2% had right dominance, 8.3% had left dominance and 19.5% had co-dominance. In the living population, right dominance was present in 74.3% individuals, left dominance was present in 5.5% population and hearts of 20.2% had co-dominance.

Out of the total right dominance was seen in 73.7%, left was seen in 6.3% of hearts and 20% hearts showed co-dominance.

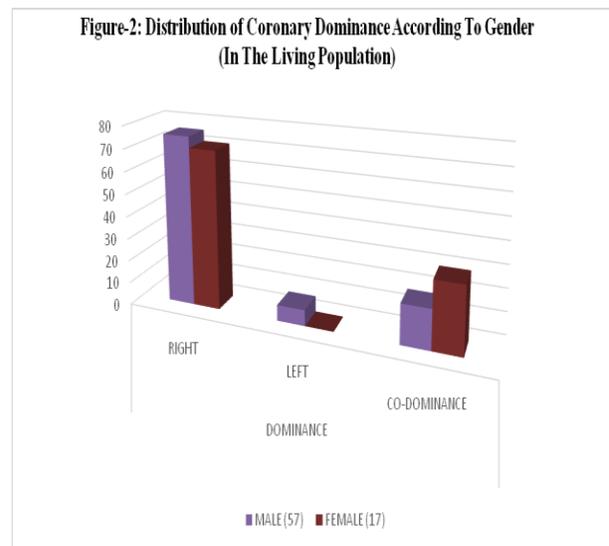
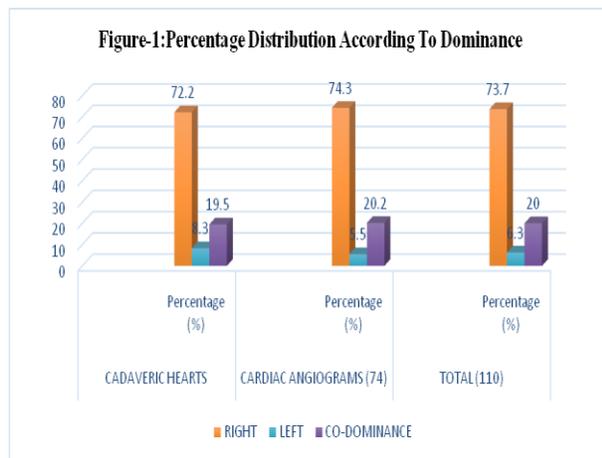
Table 1: Distribution According To Dominance.

SUBJECTS	DISTRIBUTION	DOMINANCE		
		RIGHT	LEFT	CO-DOMINANCE
CADAVERIC HEARTS (36)	Frequency	26	3	7
	Percentage (%)	72.2	8.3	19.5
CARDIAC ANGIOGRAMS (74)	Frequency	55	4	15
	Percentage (%)	74.3	5.5	20.2
TOTAL (110)	Frequency	81	7	22
	Percentage (%)	73.7	6.3	20

Table 2: Distribution of Coronary Dominance According To Gender (In The Living Population).

GENDER	DISTRIBUTION	DOMINANCE		
		RIGHT	LEFT	CO-DOMINANCE
MALE (57)	Frequency	43	4	10
	Percentage (%)	75.5	7	17.5
FEMALE (17)	Frequency	12	0	5
	Percentage (%)	70.5	0	29.5

The table 2 shows 75.5% of right dominance in males and 70.5% in females, 7% and 0% left dominance and 17.5% and 29.5% co-dominance in males and females respectively.



Discussion

Out of total 110 hearts studied for coronary dominance, right dominance was found in 73.7% cases, left was present in 6.3% cases and 20% cases were of co-dominance.

This pattern is showing the higher prevalence of right dominance in general population. The similar trend of right coronary dominance was also seen when the population was studied according to gender.

As seen from above table the percentage of right dominance in various populations studied on angiograms range from 60.4% to 82.4%. The results from the present study show 74.3% of right dominance, which is almost in the middle of the range of the previous studies and therefore is in

comparison to studies done by other authors.

The percentage of left dominance range from 8% to 13.3% whereas present study shows 5.5% of left dominance, which is far less than that commented by various other authors.

Percentages of co-dominance are also quite variable in different populations, 20.2% in present study is towards the higher range of other studies.

Percentage of right dominance among the studies shown in the table are almost comparable although it is slightly higher in a study by Kalpana et al. Also the percentage of left and co-dominance in cadaveric study are almost similar to that of other cadaveric studies.

Table 3: Comparison of Coronary Dominance pattern of various studies (in living subjects).

S.No.	Author	Year of study	Right dominance (%)	Left dominance (%)	Co-dominance (%)
1.	Murphy et al ⁴	1977	81.2	9.1	9.7
2.	Jose et al ⁵	2003	62.5	12	-
3.	Zamir et al ⁶	1988	81	12	-
4.	Kaimkhani et al ⁷	2004	60.4	15	24.5
5.	Vasheghani et al ⁸	2008	84	10	-
6.	DakhanePrafulle S et al ⁹	2015	82.4	13.3	4.3
7.	Priyadarshini S et al ¹⁰	2016	84	8	8
10.	Present study	2016	74.3	5.5	20.2

Table 4: Coronary Dominance pattern in comparison to other authors (in cadaveric hearts).

S.No.	Author	Year of study	Right dominance (%)	Left dominance (%)	Co-dominance (%)
1.	Kalpana et al ¹¹	2003	89	11	-
2.	Hutchins et al ¹²	1978	70	10	20
3.	Hirak das ¹³	2010	70	18.57	11.43
4.	Present study	2016	72.2	8.3	19.5

Also the present study shows the pattern of right coronary dominance that is the Posterior descending artery in 73.7% cases arising from right coronary artery. This result of right coronary dominance in our study is similar to all the above authors, ImadGhanemShukri et al, (2009)²⁵ and Mandal S, Saha JB et al (2009)²⁶.

Conclusion

The results of present study when compared to previous studies are almost similar in terms of right dominance and co-dominance and slightly variable in terms of left dominance. This may be because of lesser number of cases in the present study, so a study on larger number of subjects may be able to give us the exact frequency of coronary dominance in our population.

Knowledge of frequency of coronary dominance in the population is also important because it may be of help to the cardiac surgeons in predicting the outcome of patients with atherosclerosis as left dominance of the heart has been associated with greater mortality.

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