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Original Research Article

Anatomical and Radiological Study of Coronary Dominance

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Abstract

Background: The coronary arteries are the first vessels that branch from the aorta In 90% of the individuals, the posterior descending interventricular artery arises from the terminal portion of the right coronary artery –right dominance. In almost 10%of the hearts, there is left dominance i.e., the left circumflex artery provides the posterior descending interventricular artery. The left dominance is associated with high mortality rate.

Aims & Objectives: To observe the dominance pattern of the coronary arteries.

Method: For the present study 40 embalmed cadaveric heart specimens were collected and studied for the coronary dominance pattern. The study was done on 102 angiograms and their reports at Cardiology Department Different views of angiograms were studied, Dominant pattern of Coronary Arteries were seen.

Conclusion: In this study, it was found that in most cases Males (85%) and Females (90%) were Right Dominant. Co-Dominance and Left Dominance are of small percentage in both the genders.

Keywords: Right Dominance; Left Dominance; Coronary Artery; Posterior interventricular artery (PIVA).

Introduction

The human heart is an important organ that pumps blood throughout the body through the circulatory system. The process of circulation is necessary for continued life of the cells, tissues, and ultimately the whole organism the cardiovascular system is the first major system to function in the embryo. The primordial heart and vascular system appear in the middle of the third week of embryonic life, but the heart actually starts functioning at the beginning of the fourth week. Since then it undergoes rhythmic and regular contractions and relaxations completing the 'cardiac cycle' which never stops until the cardiac death. The heart is supplied by right and left coronary arteries. Each coronary artery is a vasa vasorum of the

ascending aorta, because heart is developed from the fusion of two primitive endothelial tubes which represent the ventral aorta.

T.N. James [1] 1961, in his book, "Anatomy of the Coronary Arteries" describes that The coronary arteries are the first vessels that branch from the aorta, normally originating below the junction between the bulbus and the ascending aorta that is at the sinotubular junction. Coronary arteries, which are usually two in number, placed like a crown on the heart. The right coronary artery arises from the ostium of the anterior aortic sinus or the right coronary sinus and the left coronary artery arises from theostium of the left posterior aortic sinus or the left coronary sinus of the ascending aorta. Right conus artery, which is usually the first branch of right coronary artery, may arise from the anterior aortic sinus directly. Such an artery is called as third coronary artery. Most of the area of the heart is supplied by the LCA. The area irrigated by each of coronary arteries using angiography shows that the LCA irrigates 68.8% of the cardiac muscle mass (41.5% by LAD and 27.3% by the LCx). These values may vary depending upon the coronary arterial dominant pattern. Atherosclerosis is a pathological process when affecting coronary arteries, which is manifested as cardiovascular disease, has emerged as a leading cause of death globally. In coronary arteries, atherosclerotic disease can be present in any of the three epicardial vessels, the left anterior descending artery, left circumflex artery and right coronary artery as well as in the left main stem artery. The most common location for significant coronary artery disease in patients admitted for diagnostic coronary angiography is the left anterior descending artery.

In 90% of the instances, the posterior descending interventricular artery arises from the terminal portion of the right coronary artery –right dominance. The posterior interventricular branch descends in the posterior atrioventricular sulcus to meet the left anterior descending branch of left coronary artery and it determines the right dominance. In almost 10%of the hearts, there is left dominance i.e, the left circumflex artery provides the posterior descending interventricular artery.

Schlesinger, J.M. [2] (1940) in his study describes the relation of Anatomic Pattern to Pathologic Conditions of the Coronary Arteries. An obstructive coronary lesion will potentially cause ischemia in the myocardium distal to stenosis. A coronary angiogram will reveal, in addition to information of the culprit lesion location and severity, any presence of disseminated, diffuse atherosclerotic coronary disease. In addition to general treatment of atherosclerosis by risk factor intervention, preventive therapeutics, coronary ischemia is frequently treated by Coronary Bypass surgery and Percutaneous intervention like - Ballon dialatation, Stenting, Drug eluting stents, Thrombus aspiration. by the studies of Sim I, Gupta M, McDonald K [3], According to the WHO the leading cause of deaths in the world is due to ischemic heart disease, or generally known as coronary artery disease. This is responsible for nearly 9 million deaths every year in the world. The arteries, usually accredited to high blood pressure, diabetes, smoking, heavy drinking culture and sedentary lifestyle.

Though the above reasons are appropriate conditions for an ischemic heart disease [4], there were certain cases registered with a Ischemic heart disease in young individuals and sport persons, without involving any of the above said conditions. This weird situation gained importance in the exhaustive study of the incidence of the variations in Coronary arteries, which are potentially capable of inducing a Ischemic heart disease. The present studies have suggested that coronary artery disease is predominant in particular age group, sex and lifestyle factors. But the

following features like origin of arteries above or below sinotubular junction, branching pattern, level of block also play a significant role in causing coronary artery disease and also help in determining the treatment which has inspired me to take up the study.

Materials and Methods

The study was done on 40 embalmed cadaveric heart specimens preserved in the Department of Anatomy. These heart specimens were collected from cadavers allotted for dissection. The specimens thus collected were serially numbered from 1to 40. The specimens preserved in 10% formalin solution. Normal hearts with age group 20 to 80 years were included. Abnormal or putrefied hearts were excluded from study.

After opening the thorax, the pericardial cavity was opened, the great vessels were ligated and the specimen of heart along with great vessels was removed from thoracic cage. The visceral pericardium was removed to expose the coronary arteries. Further dissection is done on the hearts and coronary arteries were seen and the dominance pattern of the arteries was recorded

The study was done on 102 angiograms and their reports at Cardiology Department. Different views of angiograms were studied, Dominant pattern of Coronary Arteries were seen and lesions of coronaries were recorded. And the study was done above the age group of 20. Patients with coronary anomalies occurring as a result congenital heart disease, patients with previous history of coronary artery intervention (ballooning or stenting), patients with previous history of coronary artery bypass graft surgery were excluded from the study.

Observation & Results

Dominance of Coronary Arteries

Right Coronary Artery Predominance

In the present work, right coronary artery predominance was observed in 85% of specimens i.e. the PIVA was found to arise from the RCA at the crux in 34 specimens out of 40 specimens. Then the PIVA traversed the PIVS for a variable distance along thesulcus towards the apex. In some specimens PIVA anastomosed with the terminal partof AIVA.

Left Coronary Artery Predominance

Left coronary artery predominance was observed in 15% of specimens. In only two specimens out of 40 specimens the LCxA reached the crux and the PIVA was given at the crux which traversed the PIVS (Fig 2). Along with the PIVA two or three terminal branches were also given which run over the posterior surface of the left ventricle.

Table 1: Dominance of coronary arteries in the present study

Dominance Pattern	Specimen No.	Total %
Right Dominance	34	85
Left Dominance	6	15
Balanced	0	0

Table 2: Angiogram study in coronary arteries

Gender	No's	Percentage	Observation
Male	82	80%	Males (80%) are subjected to higher tendency of risk in getting CAD than in females (20%)
Females	20	20%	
Both in Male and Female	102	100%	

Table 3: Dominance in males and females

Dominance In Males and Females					
Gender	**No's**	**Right Dominant**	**Left Dominant**	**Co-Dominant**	**Observation**
Males	82	85%	12%	3%	Most of the cases in Males and Females were Right Dominant. Co-Dominance and Left Dominance are Small Percentage.
Females	20	90%	10%	0%	
Both in Male and Female	102	86%	12%	2%	

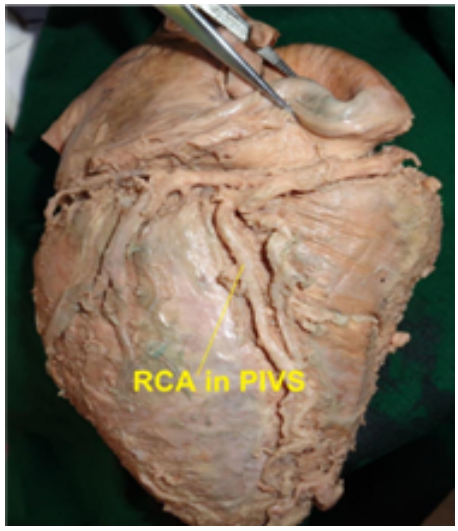

Figure 1: Right Dominance

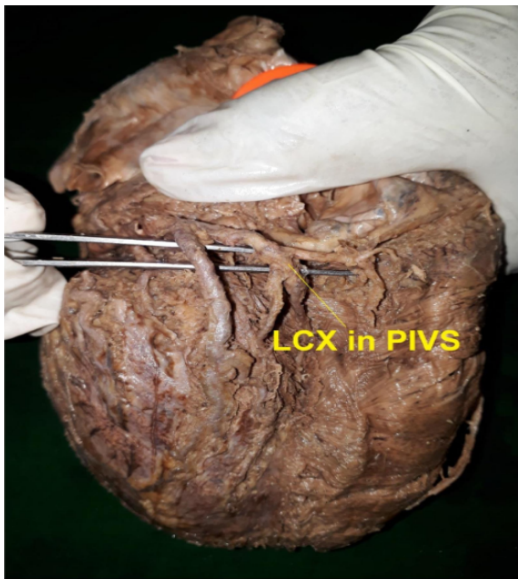

Figure 2: Left Dominance

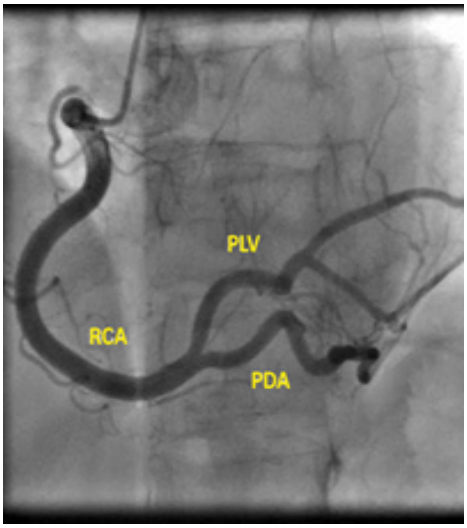

Figure 3: Coronary Angiography - Right Dominance

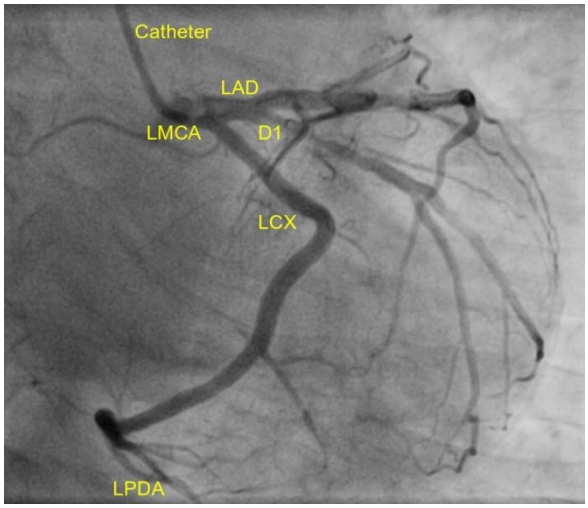

Figure 4: Coronary Angiography-Left Dominance

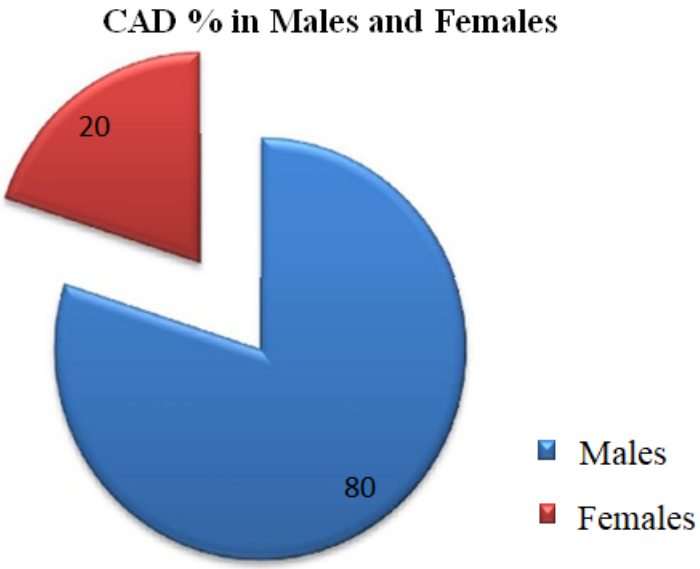

Figure 5: CAD tendency in Males and Females

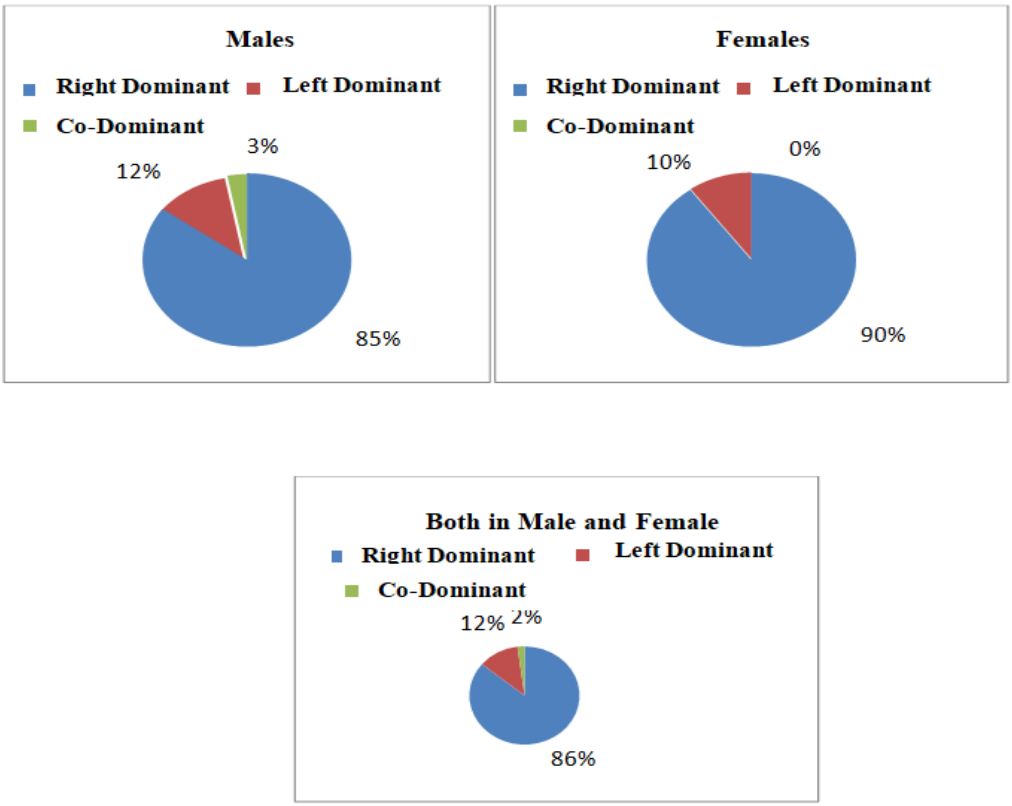

Figure 6: Dominance in males and females

Discussion

Coronary Dominance

Dominance pattern of heart has important clinical significance [5]. Left dominance was found to have significantly higher mortality than right coronary artery dominance and balanced (mixed) types. The present study shows 85% of right coronary artery predominance and 15% left dominance (Table.1). There was not even a single case of co-dominance (balanced type). In two cases where there is left dominance, the RCA was not traversing the coronary sulcus. It crossed the inferior border of the heart and entered the diaphragmatic surface of the heart. After crossing the diaphragmatic surface of the heart it entered the middle of the PIVS and disappeared deeply piercing the myocardium.

Most of the literatures showed the right dominance in more than 70% of hearts, left dominance in 20% of hearts and 10% of balanced type of coronary circulation. Balanced type of circulation is more common in females. According to James 1961, the left coronary artery predominance is seen in males. In the present study right dominance was seen in 85% of hearts and left dominance in 15% of hearts and there was no balanced type.

The comparison of our values with the previous authors reveals a higher percentage of right dominance and there is a steep fall in the percentage of left dominance. 85% right dominance in the present study tallied with the 90% right dominance values of James (1961) and 89% of right dominance stated by Kalpana R[6]. The 15% left dominance in the present study tallied with the results 10%, 11.82% and 11% left dominance stated by James (1961), Cavalcanti [7] (1995) and Kalpana R [6] (2003) (Table 4).

Results obtained in present study resemble with the results obtained by James [1] (1961), Kalpana R [6] (2003) and Kumar Keshaw (2008, 1990) who did not find the

balanced or co dominance type of coronary arterial pattern in any human heart.

Some important facts revealed by Fazlul aziz Mian et al [8] during coronary angiography investigations such as the origin of SA nodal artery is not related to coronary arterial dominance. [9] The presence of myocardial bridging is more related to coronary dominance especially in the leftcoronary circulation. [10-11]

Conclusion

In the present work, right coronary artery predominance was found in 85% of the cases in which the PIVA was given by RCA at the crux which was passing in the PIVS. The leftcoronary predominance was found in 15% of cases in which the PIVA was given by LCX.No balanced type / Co-dominance was observed in a single case. It was well known that CAD was observed more in LCA predominance than in RCA / Co-dominant types of dominance. Angiogram readings in the present study out of the cases studied, Males (80%) are subjected to higher tendency of risk in getting coronary artery disease (CAD) than in Females who are 20% of the total cases. In the present work Right, Left and Co-Dominance of Males and Females were studied separately. In this study, it was found that in most cases Males (85%) and Females (90%) were Right Dominant (Table.3). Co-Dominance and Left Dominance are of small percentage in both the genders.

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