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Original Research Article

A STUDY OF CORONARY ARTERY PREDOMINANCE AND ITS CLINICAL IMPORTANCE

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Abstract

Introduction: Origin of the posterior interventricular artery was taken as the basis of dominance. The knowledge of the coronary predominance is necessary for the evaluation of problems like myocardial infarction, angina pectoris, and other heart diseases and it is also important for the management of these cardiac problems. Many earlier studies have shown that coronary heart disease (CHD) is not only confined to urban population but even increasing in rural population as well because of changing life style, urbanization, sedentary life style, etc.
Aim: To study coronary artery predominance.
Materials and Methods: 60 hearts preserved in 10% formalin were collected. Human hearts irrespective of age and sex without having any obvious pathology were included in the study. Hearts were dissected meticulously to see the coronary arteries and its branch in the posterior inter-ventricular sulcus.
Results: Right dominance was found in 52 hearts i.e., 86.67%, left dominance was found in 8 hearts i.e., 13.33%.
Conclusion: Right coronary artery (RCA) supplies to major area of diaphragmatic surface of the heart through posterior interventricular artery. Dominance pattern of heart has important clinical significance. The dominant RCA usually supplies the atrioventricular (AV) node. Therefore an inferior wall infarct caused by occlusion of the RCA will have higher risk of AV block.
Keywords: Coronary Artery, Predominance, Atrioventricular block, Infarct.

Introduction

Coronary heart disease (CHD) is a leading cause of mortality and morbidity worldwide, particularly in developed countries. The prevalence in India had increased rapidly from 1% in 1960 to 9.7% in 1995 in urban population [1].

The knowledge of the coronary predominance is necessary for the evaluation of problems like myocardial infarction, angina pectoris, and other heart diseases and it is also important for the management of these cardiac problems. Many earlier studies have shown that CHD is not only confined to urban population but even increasing in rural population as well because of

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changing life style, urbanization, sedentary life style, etc. [2,3]. This study was conducted to help the physicians and surgeons to understand the pattern of coronary artery dominance while performing therapeutic and surgical procedures.

The term 'Coronary' comes from the Latin term "Corona" meaning "Crown". The heart is normally supplied by two coronary arteries: Right coronary artery (RCA) and left coronary artery (LCA). Coronary arteries are known for their wide variations with regard to origin, course, termination and branching pattern [4].

Determination of dominance pattern: In the right coronary dominance, the posterior interventricular artery (PIVA) arises from the RCA and RCA extends past the PIVA in the atrioventricular groove, giving off one or more posterolateral branches to the inferior surface of the left ventricle. In this case, the distal part of circumflex artery (CX) is very small or absent. In the left coronary dominance, the PIVA and all the posterolateral branches arise from the circumflex artery; the RCA is small and terminates before reaching the crux; it does not supply any blood to the left ventricular myocardium. In the co dominance, the PIVA arises from both RCA and CX artery [5,6].

Materials and Methods

This is a cross-sectional study done in Department of Anatomy, Government Medical College, Nagpur, Maharashtra, India. 60 hearts preserved in 10% formalin were collected. Human hearts irrespective of age and sex without having any obvious pathology were included in the study. The thoracic cavity was opened and the pericardium was reflected. The great vessels were cut and the heart was removed out from the thoracic cavity. Visceral pericardium was removed. The sub-pericardial fat on the hearts were dissected meticulously to see the coronary arteries and its branch in the posterior inter-ventricular sulcus. Photographs were taken. Relevant data were recorded and analyzed statistically

Results

Table 1:

Dominance Pattern	Number of hearts	Percentage
Right Dominance	52	86.67%
Left Dominance	8	13.33%
Total	60	100%

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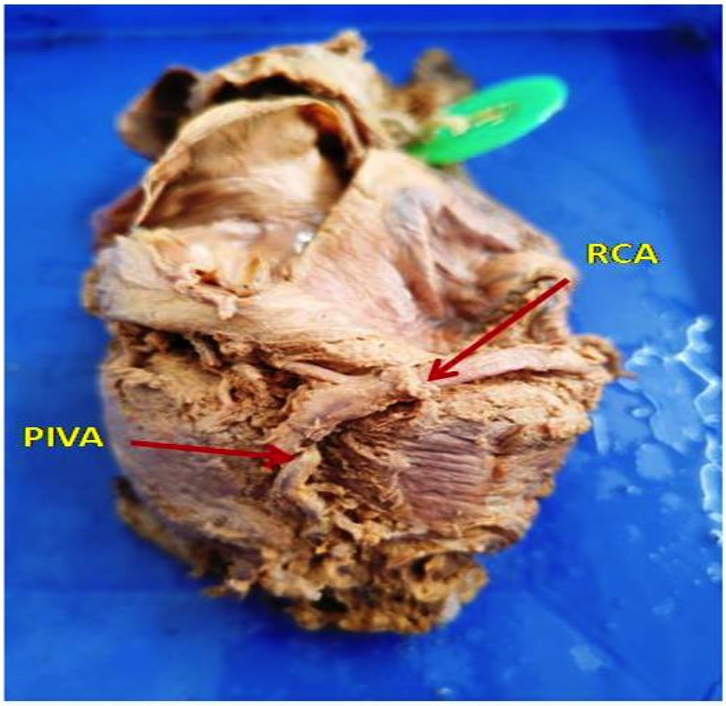
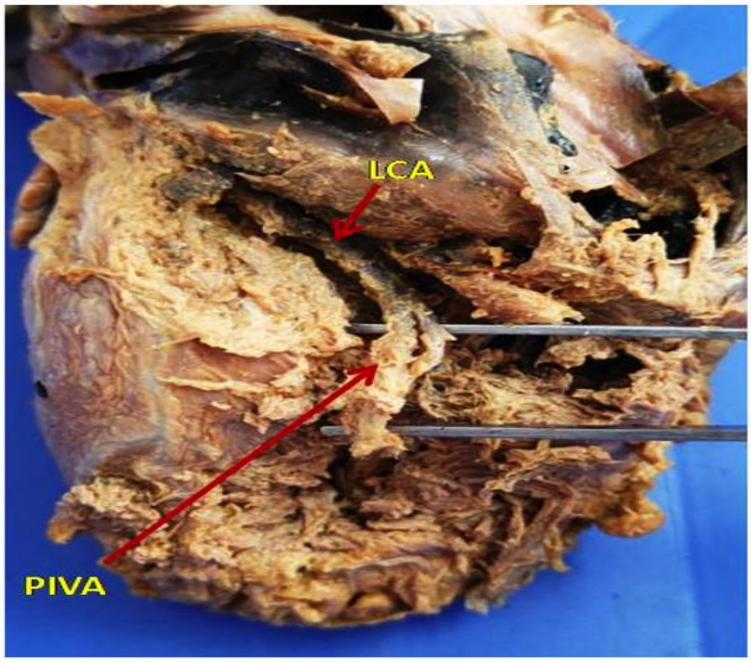
Fig. 1: Specimen of heart showing right coronary artery predominance



RCA – Right Coronary Artery
PIVA – Posterior Interventricular Artery

Fig. 2: Specimen of heart showing left coronary artery predominance



LCA – Left Coronary Artery
PIVA – Posterior Interventricular Artery

Discussion

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Developmentally there is a dual origin of coronary arteries, proximal and distal. The distal portion develops first. It is comprised of a retiform vascular network, similar to the capillary network that forms in the other parts of body. This network develops in the interventricular and atrioventricular grooves and forms a complete ring around the developing vessels (peritruncal ring) and communicates with the heart chamber and extra cardiac great vessels. Further development of some vessels and regression of others, the final coronary pattern develops. This theory adequately explains the variations of coronary vasculature [7,8] .

Normally in human heart, if the PIVA is a branch of RCA, it is termed as right predominance which occurred in 86.67 % of hearts in the present study while left predominance was seen in 13.33% of the total hearts. This result is compared with studies of various workers which have been shown in Table 2.

Table 2: Comparison of the present study with a previous similar study

Name of the Author and Year of Study	No. of the Heart Studied	Right Predominance (%)	Left Predominance (%)	Balanced (%)
Blumgart HL, Schlesinger MJ, Davis D (1940) [3]	225	108 (48)	41 (18)	76 (34)
Jain SP, Hazary H (1958) [13]	30	17 (56.6)	3 (10)	10 (33.4)
Paulsen S, Vetner M (1973) [18]	400	283 (70.8)	38 (9.5)	79 (19.7)
Hadzisclimovic H (1978) [19]	60	42 (70)	6 (10)	12 (20)
DiDio LJ, Wakefield TW (1975) [14]	55	73.5%	19.4%	7.1%
Cavalcanti JS, et al. (1995) [10]	110	88.18%	11.82%	_____
Kalpana R. (2003) [11]	100	89 (89)	11 (11)	_____
Das H et al. (2010) [1]	70	49 (70%)	13(18.57%)	8(11.43%)
Amgain K et al. (2013) [9]	75	46 (61.34)	18 (24)	11(14.67)
Darmender P et al. (2014) [7]	77	83.11%	16.88%	_____
Present study	60	52 (86.67)	8(13.33)	_____

Almost all authors have reported higher percentages of right dominance [Table 2]. Even in the present study, right dominance was more common (86.67%). However Blumgart HL et al. [3] found a lower percentage for right dominance (48%). Likewise, left dominance in this study (13.33%) were similar to those found by some authors [10,11]. In many of the other studies, authors have observed balanced type of circulation [1,3,9,12-14,18,19]. Some of the studies including present study have observed only right and left dominance but not observed the balanced type [7,10,11]. Some of the studies observed less percentage of left predominance than the balanced type [3,13,18,19].

Blumgart et al. correlated between the CHD and the predominance of the heart. According to them, the incidence of coronary thrombosis and angina pectoris is predominant in the hearts with left coronary predominance [3].

Dominance pattern of heart has important clinical significance. Left dominance was found to have significantly higher mortality than right dominance and mixed types [15]. Dominance also showed a role in left anterior descending (LAD) artery stenosis. It was observed that in left dominance, the LAD usually wraps around the apex of the heart, supplying major portion

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of the myocardium. In contrast, in right dominance, it was the posterior interventricular branch of the right coronary artery that supplied most of the myocardium. As such, lesions in LAD would have more profound clinical importance in a left dominant heart than in a right dominant one [16].

Dominance also plays an important role in inferior infarcts of the heart. Inferior wall infarcts although less extensive than anterior infarcts are more important as they can cause various degrees of atrioventricular block in approximately 30 % of cases. The dominant RCA usually supplies the atrioventricular (AV) node. Therefore an inferior wall infarct caused by occlusion of the RCA will have higher risk of AV block [17].

Conclusion

Right coronary artery (RCA) supplies to major area of diaphragmatic surface of the heart through posterior interventricular artery. Dominance pattern of heart has important clinical significance. The dominant RCA usually supplies the atrioventricular (AV) node. Therefore an inferior wall infarct caused by occlusion of the RCA will have higher risk of AV block.

Conflicts of Interests: None

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