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Original Research Article

Evaluation of Coronary Artery Dominance in Cadavers from the Indian Population

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Abstract

Background: As Coronary artery disease is one of the most common heart diseases and also the major cause of death in developing countries. The aim of the present study is to evaluate the coronary dominance pattern which will help the cardiac physicians and surgeons for better diagnosis and management of coronary artery diseases.
Methods: The study was planned on 30 heart subjects. These selected hearts are without any obvious pathology referred with cardiac conditions was enrolled into the study in NMCH, Patna. The coronary arteries were dissected and analysed for the origin of sinoatrial Nodal artery and Observations were noted. The hearts identified with the congenital anomalies were excluded from study.
Conclusion: From the above study it can be concluded that the most common is the right coronary dominance compared to left and balanced dominance as seen in this study. The present study is in comparison with the data generated by previous authors. This knowledge of normal anatomy and variations of coronary dominance will help interventional cardiologist, cardio-thoracic surgeons and radiologist to plan and provide proper management to patients.

Keywords: Coronary Artery, Dominance, Coronary Artery Disease, Left, Right, Both, etc.

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Introduction

Coronary circulation is the circulation of blood in the blood vessels that supply the heart muscle (myocardium). Coronary arteries supply oxygenated blood to the heart muscle, and cardiac veins drain away the blood once it has been deoxygenated. Because the rest of the body, and most especially the brain, needs a steady supply of oxygenated blood that is free of all but the slightest interruptions, the heart works constantly and sometimes works quite hard. Therefore its circulation is of major importance not only to its own tissues but to the entire body and even the level of consciousness of the brain from moment to moment. Interruptions of coronary circulation quickly cause heart attacks (myocardial infarctions), in which the heart muscle is damaged by oxygen starvation. Such interruptions are usually caused by ischemic heart disease (coronary artery disease) and sometimes by embolism from other causes like obstruction in blood flow through vessels. Coronary arteries supply blood to the myocardium and other components of the heart. Two coronary arteries originate from the left side of the heart at the beginning (root) of the aorta, just after the aorta exits the left ventricle. There are three aortic sinuses (dilations) in the wall of the aorta just superior to the aortic semilunar valve. Two of these, the left posterior aortic sinus and anterior aortic sinus, give rise to the left and right coronary arteries, respectively. The third sinus, the right posterior aortic sinus, typically does not give rise to a vessel. Coronary vessel branches that remain on the surface of the artery and follow the sulci of the heart are called epicardial coronary arteries.[1] The left coronary artery distributes blood to the left side of the heart, the left atrium and ventricle, and the interventricular septum. The circumflex artery arises from the left coronary artery and follows the coronary sulcus to the left. Eventually, it will fuse with the small branches of the right coronary artery. The larger anterior interventricular artery, also known as the left anterior descending artery (LAD), is the second major branch arising from the left coronary artery. It follows the anterior interventricular sulcus around the pulmonary trunk. Along the way it gives rise to numerous smaller branches that interconnect with the branches of the posterior interventricular artery, forming anastomoses. An anastomosis is an area where vessels unite to form interconnections that

normally allow blood to circulate to a region even if there may be partial blockage in another branch. The anastomoses in the heart are very small. Therefore, this ability is somewhat restricted in the heart so a coronary artery blockage often results in myocardial infarction causing death of the cells supplied by the particular vessel. [1]

The right coronary artery proceeds along the coronary sulcus and distributes blood to the right atrium, portions of both ventricles, and the heart conduction system. Normally, one or more marginal arteries arise from the right coronary artery inferior to the right atrium. The marginal arteries supply blood to the superficial portions of the right ventricle. On the posterior surface of the heart, the right coronary artery gives rise to the posterior interventricular artery, also known as the posterior descending artery. It runs along the posterior portion of the interventricular sulcus toward the apex of the heart, giving rise to branches that supply the interventricular septum and portions of both ventricles. [1] The left and right coronary arteries occasionally arise by a common trunk, or their number may be increased to three; the additional branch being the posterior coronary artery (which is smaller in size). In rare cases, a person will have the third coronary artery run around the root of the aorta. Occasionally, a coronary artery will exist as a double structure (i.e. there are two arteries, parallel to each other, where ordinarily there would be one).

The artery that supplies the posterior third of the interventricular septum – the posterior descending artery (PDA) determines the coronary dominance. [2]

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 circumflex artery (CX), a branch of the left artery, then the coronary circulation can be classified as "left-dominant".

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".

Approximately 70% of the general population are right-dominant, 20% are left-dominant and 10% are co-dominant[2] A precise anatomic definition of dominance would be the artery which gives off supply to the AV node i.e. the AV nodal artery. Most of the time this is the right coronary artery. As Coronary artery disease is one of the most common heart diseases and also the major cause of death in developing countries. The aim of the present study is to evaluate the coronary dominance pattern which will help the cardiac physicians and surgeons for better diagnosis and management of coronary artery diseases.

Methodology

The study was planned on 30 heart subjects. These selected hearts are without any obvious pathology referred with cardiac conditions was enrolled into the study in Nalanda medical college Patna, Bihar. The coronary arteries were dissected and analysed for the origin of Posterior interventricular artery and Observations were noted. The hearts identified with the congenital anomalies were excluded from study.

Results and Discussion

Table 1: Coronary Dominance in the Selected Population

Dominance	No. Of subjects	Percentage
Right Coronary Artery	21	70
Left Coronary Artery	7	23
Both Right & Left coronary Artery	2	7
Total	**30**	**100**

Table 2:

Authors	Study Area	Right Coronary Artery (%)	Left Coronary Artery	Both Right & Left coronary Artery
Hussein Ali Fakhir et al [13]	Iraq	76	13	11
Fazliogullari Z et al [14]	Turkey	42	14	44
Fazlul Aziz Mian et al [15]	Pakistan	60.5	19.5	20
Jose Roberto Ortale et al [16]	Brazil	88	8	4
MA El Sayed [17]	Egypt	80	10	10
Hirak Das et al [18]	Assam	70	18.5	11.5
Vasudeva Reddy J et al	South India	86.5	11.25	2.5

Coronary heart disease is the leading cause of death in the developing countries and one of the causes is anomalous origin of coronary arteries. [3] Hence, clinicians and anatomists have been examining coronary artery variations for a long time. In particular, from the 1960s, when the use of selective coronary

angiography began, the number of investigations on this topic has increased. However, there is still no consensus on the normality or abnormality of coronary arteries. While it is generally accepted that the human heart has two main coronary arteries (right and left), some claim that the condition of possessing three or four coronary arteries is normal. [4] In general, coronary artery variations are regarded as major or minor, important or unimportant. Minor anomalies are not clinically evident and are usually accepted as normal changes. The major anomalies that are accepted as variations are reported in less than 1% of the general population. [4] Hence, knowledge of these normal variations is important for cardiothoracic surgeons and radiologists while performing therapeutic and diagnostic procedures. The dominance of coronary artery is determined by the posterior interventricular artery (PIVA). It is termed as right dominance if PIVA is a branch of RCA, left dominance if PIVA is a branch of LCA and co-dominant if PIVA is given by both by RCA and LCA. Dominance pattern of heart has important clinical significance. Left dominance was found to have significantly higher mortality than right dominance and mixed type. [5]

Dominance also showed a role in left anterior descending artery stenosis. It was observed that in left dominance, the LAD usually wraps around the apex of the heart, supplying the major portion of the myocardium. In contrast, in right dominance, it was the posterior interventricular branch of the RCA that supplied the 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. [6] Dominance also plays an important part in inferior infarcts of the heart. Inferior infarcts though less frequent than anterior infarcts are more important as they can cause varying degrees of atrioventricular block in approximately 30 % of cases. The dominant RCA usually supplies AV node. Therefore inferior infarcts caused by occlusion of RCA will have higher risk of AV block. [7] Dominance pattern of heart has an important clinical significance. It has an impact on coronary blood flow volume in the left circumflex and right coronary arteries but not in the left anterior descending (LAD) coronary artery. These findings suggest that the extent of myocardial perfusion area is associated with coronary blood flow volume. [8] LAD artery in left coronary dominance is usually long wrapping around the apex of the heart supplying major portion of myocardium, and angiographic interventions in such cases have important clinical implications. Ilia et al has concluded in his study that lesions in LAD would have more profound clinical importance in left dominant heart than right dominant heart. [9] Hirak das et alstudied coronary dominance in population of Assam in 70 hearts and found right dominance in 70%, left dominance in 18.75% and co-dominance in 11.43%. [10] Dr Hussein Ali Fakhir et al studied the coronary artery dominance by angiography and their relationship with coronary artery disease in 657 Iraqi patients consecutively suffering from coronary artery disease. The right coronary artery was dominant in 76.4%, left dominant in 12.6%, co dominant in 10% cases. No significant difference in type of coronary dominance in relation to sex and age. [11] Schlesinger in his study correlated the thrombosis and angina pectoris with coronary arterial pattern and concluded that the coronary artery disease is more prevalent in left coronary arterial dominance. [12] Left coronary dominance have high mortality while performing cardiac catheterisation for acute coronary syndromes. Left coronary dominance is the only predictor of peri procedural myocardial infarction following the implantation of second generation drug eluting stents and was also associated with higher rate of myocardial infarction during follow up. Left coronary dominance and co-dominance had higher mortality in hospitals after performing percutaneous intervention for acute coronary syndrome. [13]

Conclusion

From the above study it can be concluded that the most common is the right coronary dominance compared to left and balanced dominance as seen in this study. The present study is in comparison with the data generated by previous authors. This knowledge of normal anatomy and variations of coronary dominance will help interventional cardiologist, cardiothoracic surgeons and radiologist to plan and provide proper management to patients.

References

1. Betts, J. Gordon. Anatomy & physiology. 2013; 787–846. ISBN 1938168135. Retrieved 11 August 2014.
2. Fuster, V; Alexander RW; O'Rourke RA. Hurst's The Heart (10th ed.). McGraw-Hill. 2001;53. ISBN 0-07-135694-0.
3. Kaur D., Singh K., Nair N., Kalra A.S. Morphology and morphometry of coronary ostia in south Indian adult human cadaveric hearts. Int. J. Biol. Med. Res. 2012; 3:2169-2171.
4. Angelini P. Normal and anomalous coronary arteries: definitions and classification. Am. Heart J. 1989;117: 418-434.
5. Goldberg A, Southern DA, Galbraith PD, Traboulsi M, Knudtson ML, et al. Coronary dominance and prognosis of patients with acute coronary syndrome. Am Heart J. 2007; 154: 11 16–22.
6. Ilia R, Rosenshtein G, Marc WJ, Cafri C, Abu-Ful A, Gueron M. Left anterior descending artery length in left and right coronary artery dominance. Coronary Artery Disease. 2001; 12: 77–78.
7. Amin K, Javed M, Mehmood A, Zakria M.

Acute Inferior Wall Myocardial Infarction: Frequency of AV Blocks. The Professional. 2004 Jan, Feb, Mar; 11(1): 31-37.
8. Sakamoto, Takahashi S, Coskun AU, Papafaklis MI, Takahashi A, Saito S et al. Relation of distribution of coronary blood flow volume to coronary artery dominance: American Journal of cardiology. May 2013;111(10):1420-4.
9. Ilia R, Rosenshtein G, Marc W J, Cafri C, Abu – Ful A, Gueron M. Left anterior descending artery length in left and right coronary artery dominance. Coronary Artery Diseases 2001; 12 (1):77-8.
10. Hirak Das, Geeta Das et al. A study of coronary dominance in the population of Assam. Journal of Anatomical Society of India 2010; 59(2):187-91.
11. Dr. Hussein Ali Fakhir, Pattern of coronary artery dominancy by coronary angiography in Iraqi patients & the relationship with coronary artery disease. Journal of college of education 2012; 3(2):180-189.
12. Schlesinger, M. J. Relation of the anatomic pattern to pathologic conditions of the coronary arteries. Arch.Pathol.30:443, 1938.
13. Nisha I. Parikh, Emily F. Honeycutt, Matthew T. Roe et al. Coronary Artery dominance and death in Acute Coronary Syndromes. Circ Cardiovasc Qual Outcomes, journal of American heart association November 2012(5) p1-7.
14. Fazliogullari Z et al. Coronary artery variations and median artery in Turkish cadaver hearts. Singapore Med J 2010; 51(10) : 775.
15. Fazlul Aziz Main et al. Coronary Artery Dominance: What pattern exists in Pakistani Population? Annals of Pakistan Institute of Medical Sciences 2011; 7(1): 3-5.
16. Jose Roberto Ortale et al. The posterior ventricular branches of the coronary arteries in human artery. Arquivos Brasileiros de Cardiologia 2004; 82(5):468-471.
17. Madiha Awad El Sayed. Anatomical study of right coronary artery with special reference to its interventricular branch. Alexandria faculty of medicine 2008, vol.44 (2); 536-54 7.
18. Hirak Das, Geeta Das et al. A study of coronary dominance in the population of Assam. Journal of Anatomical Society of India 2010; 59 (2): 187-91.