Original research article

Role of cadaveric study of coronary arteries in understanding the coronary artery diseases: an observational study

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Abstract

Aim: The present study was undertaken to study the arterial pattern of the coronary arteries and their branches in cadavers which helps in understanding the coronary artery diseases. **Materials and methods:** A total of 60 formalin fixed adult heart specimens were collected from the Department of Anatomy, irrespective of age, sex, socio-economic status, religion and education status. Visceral pericardium was stripped and subepicardial fat was removed to study the coronary artery and its branching pattern. The branches were dissected manually and carefully till their termination. The coronary artery which gives the PIV artery and determines the coronary preponderance was examined in detail. **Results:** It was observed that in hearts where the RCA and circumflex artery terminated at the crux, the PIV artery took a L-shaped turn and continued along the posterior interventricular sulcus. If the main artery crossed the crux then the PIV artery was found to arise as a side branch. PIV artery took its origin from RCA in 34(56.67%) hearts and called right preponderance. In 15 (25%) hearts PIV artery originated from circumflex artery, a branch of LCA and called left preponderance. PIV artery arose from both RCA and circumflex artery in 11 (18.33%) hearts. These were called balanced. **Conclusion:** Arterial pattern and its variations are important to prevent false interpretation of the arterial angiograms in management of coronary artery diseases.

Keywords: Arteries, Branches, Coronary, Dominance

Introduction

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, hypertension, diabetes mellitus and increased type a personality.[1] Importantly coronary artery anomalies are a cause of sudden death in young athletes in the absence of additional heart abnormalities. The prevalence in India had increased rapidly from 1% in 1960 to 9.7% in 1995 in urban population.[2,3] 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. There are also wide regional variations which have not been dealt with enough in the standard books. Thus a region specific study of the coronary arteries would help both cardiac surgeons and radiologists in dealing better with the coronary heart disease.[4] Variability in the origin of the posterior inter-ventricular artery (PIVA) is expressed by the term "Dominance". The term right or left "Coronary Preponderance" or "Dominance" was used to show which coronary artery irrigates the heart's

diaphragmatic surface, based on the origin of the 3 posterior inter-ventricular artery (PIVA). Origin of the PIVA from the RCA was termed 'right dominance'; from the circumflex artery was called 'left dominance'. Origin from both the RCA and the circumflex artery was known as balanced pattern. The same parameters had been used in this study to determine dominance.[4] Various terminologies were used such as 'right', 'mixed' and 'left inferior'.[5] The present study was undertaken to study the arterial pattern of the coronary arteries and their branches in cadavers which helps in understanding the coronary artery diseases.

Materials and methods:
A total of 60 formalin fixed adult heart specimens were collected from the Department of Anatomy, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India, for 2 years, irrespective of age, sex, socio-economic status, religion and education status, after taking the approval of the protocol review committee and institutional ethics committee.

Methodology
Visceral pericardium was stripped and subepicardial fat was removed to study the coronary artery and its branching pattern. The branches were dissected manually and carefully till their termination. The coronary artery which gives the PIV artery and determines the coronary preponderance was examined in detail.

Results
It was observed that in hearts where the RCA and circumflex artery terminated at the crux, the PIV artery took a L-shaped turn and continued along the posterior interventricular sulcus. If the main artery crossed the crux then the PIV artery was found to arise as a side branch. PIV artery took its origin from RCA in 34(56.67%) hearts and called right preponderance. In 15 (25%) hearts PIV artery originated from circumflex artery, a branch of LCA and called left preponderance. PIV artery arose from both RCA and circumflex artery in 11 (18.33%) hearts. These were called balanced or co –dominance.
Termination of RCA was seen at right border in 5 hearts, between right border and crux in 14, at crux in 9, between crux and left border in 32 and at left border in none of the hearts.
Similarly termination of circumflex artery was seen at right border in none, between right border and crux in 6, at crux in 14, between crux and left border in 31 and left border in 9 hearts.

Table 1: Showing Dominance pattern

Dominance	No of Hearts=60	Percentage (%)
Right dominance	34	56.67
Left dominance	15	25
Balanced	11	18.33

Table 2: Showing comparisons of dominance pattern

Authors	Right preponderance	Left preponderance	Balanced
Schelesinger(1940) [15]	48%	18%	34%
James (1961)	90%	10%	-
Cavalcanti (1995)	69.09%	11.82%	19.09%
Bezbaruah (2003)	76%	20%	4%
Kalpana (2003) [16]	89%	11%	-
Das (2010)[14]	70%	18.57%	11.43%
Present study	56.62%	25%	18.33%

Discussion

The coronary artery dominance 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 coronary artery. These findings suggest that the extent of myocardial perfusion area is associated with coronary blood flow volume.[6]

Left anterior descending artery (LAD) 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 significance. 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.[7]

A study conducted by Eren et al indicated that, although right dominance circulation is more common in general population, both the coronary diseases and coronary artery variations are more common in individuals with left dominance circulation.[8] The study done by Vasheghani-Farahani et al demonstrates a relationship between angio- graphic CAD severity, and the involved arterial territory and dominancy patterns.The right- dominant patients tend to have three-vessel disease, stenosis of more than 50% in right coronary artery and left circumflex territories, more than the left-dominant patients.[9] According to Makarovic et al several studies have confirmed the relevance of left coronary artery dominance in the outcome and prognosis of obstructive CAD. Therefore, it is conceivable that the type of coronary artery dominance also has an effect on the occurrence and outcome of non obstructive CAD.[10]

In patients with acute coronary syndrome, left dominance is a significant and independent predictor of increased long-term mortality according to Goldberg et al.[11] Murphy et al has noted in their study that patients with left dominance have a shorter left main coronary artery than patients with right dominance. The increased prevalence of a dominant left coronary arterial system in aortic stenosis suggests that this may be part of a developmental complex. They also have an increased risk of perioperative myocardial infarction if there is associated obstructive coronary artery disease.[12] The presence of bridges appeared to be related to coronary dominance, especially in the left coronary circulation according to Loukas et al.[13] In patients with ST-segment elevation myocardial infarction (STEMI), a left-dominant coronary artery system is linked with higher risk of 30-day mortality and early reinfarction compared with right dominance, according to a study published by Veltman et al.[14] In 2010, Das et al said that in right dominant RCA usually supplies AV node. Hence any inferior wall infarct caused by occlusion of the RCA will have higher risk of AV block.[15] Previously many studies have been conducted by both Indian and foreign authors, where dominance was a part of their study. Most of the studies have reported a higher percentage of right preponderance including the present study. But the study by Schelesinger[16] in 1940 shows 48% right dominance which is less when compared with others. Presents study shows that PIV artery took its origin from RCA in 34(56.67%) hearts and called right preponderance. In 15 (25%) hearts PIV artery originated from circumflex artery, a branch of LCA and called left preponderance. PIV artery arose from both RCA and circumflex artery in 11 (18.33%) hearts. These were called balanced or co–dominance. Present study was compared with similar studies done previously (Table 2). Results of the present study was compared statistically with the study done by Das et al (n=70). On comparison right dominance was statistically insignificant (z = 0.88, p = 0.42), left dominance was statistically insignificant (z = 0.39, p = 0.72) and balanced pattern was also statistically insignificant (z = 0.77, p = 0.36)

Conclusion

Arterial pattern and its variations are important to prevent false interpretation of the arterial angiograms in management of coronary artery diseases.

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