

CORONARY ARTERY DOMINANCE PATTERN IN EAST-GODAVARI DISTRICT: A CADAVERIC STUDY

Arindom Banerjee¹, Anirban Das Gupta²

¹Professor & HOD, Department of Anatomy, Konaseema Institute of Medical Sciences and Research Foundation, Amalapuram.

²Professor, Department of Anatomy, Konaseema Institute of Medical Sciences and Research Foundation, Amalapuram.

ABSTRACT

With the advent of coronary angiography, coronary artery diseases can be well combated; but with time sedentary life style and stress as our constant partner have kept coronary artery disease as one of the major causes of death. Revascularization procedures demand a sound knowledge of the course of coronary arteries and their branches, both normal and their quite common variations. In this regard, posterior inter-ventricular artery (PIVA) deserves a special importance; PIVA determines the coronary dominance depending on its parent artery. Dominance can be right, left or of balanced type. Balanced type means that PIVA is derived from both right & left coronary arteries. Circulation can occur when both the coronary arteries emit a branch in that area. These and other variations form a very important repertoire of information based on which coronary bypass surgery and angioplasty can be safely and effectively performed. The aim of this study therefore is to document the coronary dominance pattern in this East Godavari district of Andhra-Pradesh.

60 adult human hearts were collected from museum of Anatomy department during the tenure of 5 years (2009 to 2014) and were preserved in 10% formalin. The hearts were dissected carefully to observe the posterior inter-ventricular artery in the posterior inter-ventricular sulcus of each heart and dominance pattern was recorded.

In our present study right dominance type was the commonest (46 out of 60) followed by left dominance (10 out of 60). Only 4 out of 60 were of the balanced type.

Present study, though not of the only member of its kind will definitely add up to the already existing vast knowledge, based on which various diagnostic and therapeutic intervention of coronary artery diseases can be done effectively and safely.

KEYWORDS

Coronary artery, Coronary dominance, Bypass surgery, Angioplasty.

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INTRODUCTION: The heart is supplied by two coronary arteries, right and left. The coronary arteries are the branches of ascending aorta. The two arteries form an oblique inverted crown, consisting of an anastomotic circle in the atrio-ventricular sulcus connected by marginal and inter-ventricular loops intersecting at the cardiac apex.^[1] In 'right dominance', (70%) the posterior inter-ventricular artery is derived from the right coronary artery. In 'left dominance' (10%) the posterior inter-ventricular artery is derived from the left coronary artery. These people are likely to be affected by coronary diseases, because the entire left ventricle and left ventricular septum are under the nutritional control of the left coronary artery and obstruction of the left coronary artery may produce output failure of systemic circulation. In the 'balanced' pattern, (20%) posterior inter-ventricular branches are derived from both coronary arteries. Individuals with 'balanced' type of coronary distribution are least affected by coronary diseases.^[2]

There are many types of classification of coronary circulation. The first type was introduced by Banchi in 1904. Hettler defined the following types: left coronary artery dominance, right coronary artery dominance and co-dominance.^[3]

Left dominance seems to be associated with higher mortality due to acute infarction and a higher incidence of arteriosclerosis. A recent post-mortem analysis showed a decreasing prevalence of left dominance with the increase of age, suggesting a worse prognosis for subjects with this dominance pattern.^[4] The database of a registry of patients undergoing cardiac catheterisation for acute coronary syndromes has demonstrated higher all-cause mortality in patients with left dominance.^[5] In addition, a non-invasive study with computed tomography coronary angiography screening of the coronary arteries in a heterogeneous group of patients with chest pain (with or without coronary artery disease) showed left dominance to be an independent predictor of non-fatal myocardial infarction (MI) and all-cause mortality.^[6]

According to World Health Organization (WHO), coronary heart diseases constitute the main cause of death worldwide. Variation in the morphological pattern of coronary arteries and their major branches is an important factor in the assessment and treatment of coronary heart disease. The number of branches, their location and the myocardial mass irrigated are factors that determine the

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Corresponding Author:

Dr. Arindom Banerjee,

Professor & HOD, Department of Anatomy, College Block,

KIMS & RF, NH-214, East Godavari District,

Amalapuram-533201, Andhra Pradesh.

E-mail: arindomdoc@yahoo.co.in

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choice of therapy in all coronary artery bypass grafting (CABG) surgeries; thus surgery is preceded by a detailed analysis using angiographies.^[7]

AIMS & OBJECTIVES: The aim of this study is to document the prevalence of coronary dominance pattern retrospectively from cadaveric hearts in this region of East-Godavari district of Andhra-Pradesh.

METHODS AND METHODS: The present cross sectional study was carried out from data collected through cadaveric dissection during routine teaching for first year MBBS undergraduate students at the Department of Anatomy, Konaseema Institute of Medical Sciences and Research Foundation, Amalapuram over a period of three years.

A total of 60 adult human hearts irrespective of sex without having any obvious pathology were collected, numbered, and preserved in 10% formaldehyde solution. 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. Then the visceral pericardium was removed carefully. The sub-pericardial fat on the hearts were dissected meticulously to see the coronary arteries and its branch in the posterior inter-ventricular sulcus.

RESULTS: In the 60 adult human hearts which were dissected, 46 (76.67%) of the hearts showed right predominance of heart, i.e. Posterior Inter-ventricular artery (PIVA) is given by RCA (Figure 1), while 10 (16.67%) of them showed the left predominance (Figure 2) and 4 (0.07%) hearts were of balanced type (Figure 3). Among the left dominant heart in all 10 heart specimens, the PIVA were the branch of left circumflex artery [Table 1].

Predominance pattern	Number of hearts	Percentage (%)
Right dominance	46	76.67
Left dominance	10	16.67
Balanced type	4	0.07

Table 1: Showing the coronary dominance based on the origin of PIVA

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) ^[15]	225	108(48%)	41(18%)	76(34%)
Jain SP, Hazary H (1958) ^[16]	30	17(56.6%)	3(10%)	10(33.4%)
Paulsen S, Vetner M (1973) ^[17]	400	283(70.8%)	38(9.5%)	79(19.7%)
Hadziclimovic H (1978) ^[18]	60	42(70%)	6(10%)	12(20%)
DiDio LJ, Wakefield TW (1975) ^[19]	55	40(73.5%)	11(19.4%)	9(16.36%)
Cavalcanti JS, et al (1995) ^[9]	100	88(82%)	11(12%)	-
Kalpana R. (2003) ^[8]	100	89(89%)	11(11%)	-
Present study	60	46(76.67%)	10(16.67%)	4(0.07%)

Table 2: Showing comparison of present study with similar previous studies

Although the left coronary artery always supplies a greater mass of myocardium than does the right, it is not usually the 'Dominance' that can be a significant determinant of prognosis in acquired coronary artery disease. In most

DISCUSSION: Normally in human heart, if the PIVA is a branch of RCA, it is termed as right predominance which occurred in 76.67% of hearts in our present study while left predominance was seen in 16.67% of the total hearts. In 0.07% of the hearts we found balanced type. A similar study done by Kalpana in 2003 observed right predominance is 89% and left predominance in 11% of the hearts but there was no balanced type. ^[8] According to Cavalcanti left dominance was observed in 11.82% of specimens and right dominance in 88.18%. ^[9] In a study by Abuchaim DC et al ^[7] in 25 human hearts the most common form of coronary circulation was found to be the right dominant. In a study in swine by Vieira TH et al ^[10] the arterial pattern was found to be right dominance based on crux cordis and the subsinuosal interventricular branch. In a study on pigs by Sahni D et al ^[11] the RCA was found to be dominance in all hearts. In a genetic study with respect to the dominance pattern of coronary blood supply, two of three monozygotic twin pairs differed, while all dizygotic twin pairs were found to be concordant. ^[12]

Though right dominant circulation was more prevalent in our patients, Coronary Artery Disease was more frequent among those with left dominant circulation. This finding is in conformity with what is reported in the published literature. In another study it was found that the extent of coronary atherosclerosis does not depend on the type of dominant coronary artery ^[13] but in patients with Acute Coronary Syndrome, left dominance is a significant and independent predictor of increased long-term mortality. ^[5] Similarly the origin of the SA node artery is not related to coronary arterial dominance, but the origin of AV node artery is dependent on coronary arterial dominance. The presence of myocardial bridging is more related to coronary dominance, especially in the left coronary circulation. ^[14]

The results of the present study is compared with that of the previous researchers in Table 2.

individuals with left dominance the right coronary artery is usually small and often fails to reach the acute (right) margin of the heart so that an acute, proximal occlusion could have disastrous consequences, as the potential for rapid

development or re-opening of collateral vessels is likely to be diminished.

Assigning anatomical definition to any coronary artery or its branches by any interventionist demands a sound anatomical knowledge of both normal and variant courses of coronary arteries and their branches. As our medical science takes a rapid pace towards development, constant addition of knowledge, however small, from various parts of world is mandatory for helping this development. Present study provides data from East Godavari region regarding prevalence of coronary circulation dominance, which may prove of some help to anatomists, radiologist and interventionists.

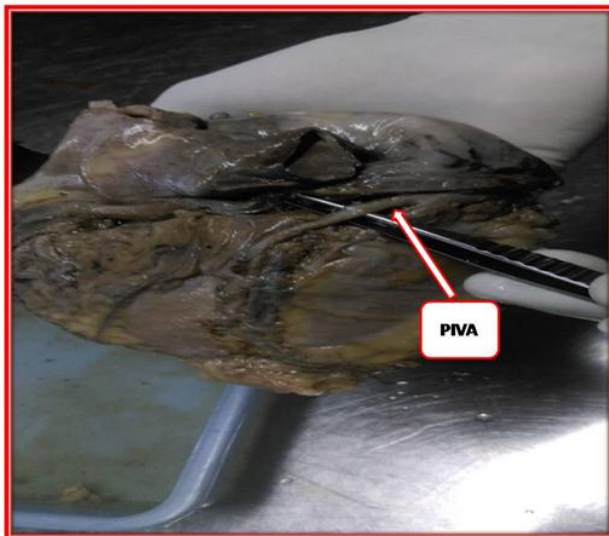


Fig. 1: Shows the posterior inter-ventricular artery (PIVA) arising from the right coronary artery and passing down along the posterior inter-ventricular sulcus. This is an example of right dominance

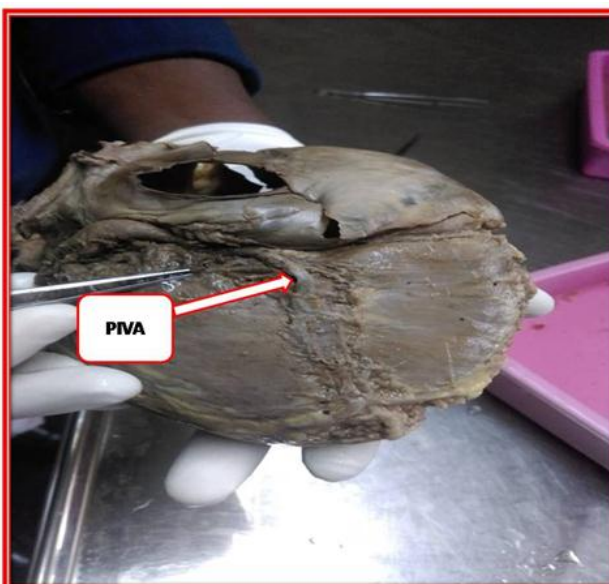


Fig. 2: Showing the posterior inter-ventricular artery (PIVA) arising from the left coronary artery and passing down along the posterior inter-ventricular sulcus. This is an example of left dominance

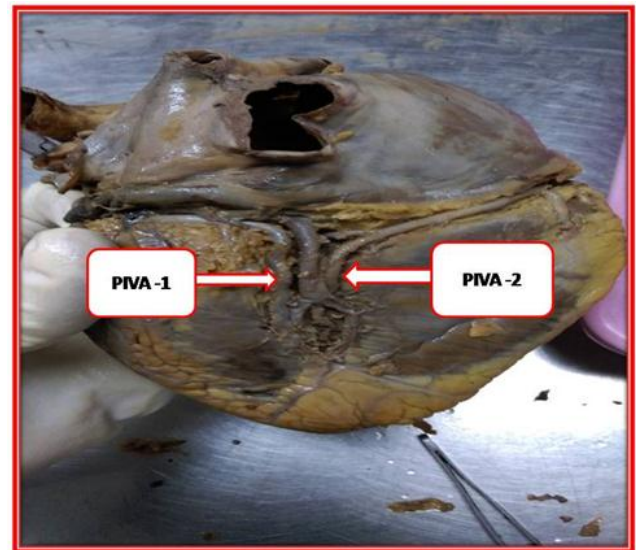


Fig. 3: Showing two posterior inter-ventricular arteries (PIVA). PIVA -1 arises from the left coronary artery and PIVA -2 from the right coronary artery. Both are passing down along the posterior inter-ventricular sulcus. This is an example of balanced type of coronary circulation. The middle cardiac vein is present in between the two PIVA

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