

## A Study of Dominance Patern In Coronary Circulation In Cadaveric Human Hearts

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**Abstract:** Anatomy of coronary arteries and its variation is significant for proper interpretation of coronary angiographies as well as for procedures like surgical myocardial revascularization. Dominance pattern of heart has important clinical significance. Left dominance is found to have significantly higher mortality than right dominance and the balanced pattern, as major part of the heart is supplied by LCA in such cases [5]. In right dominant heart where the RCA supplies AV node, an occlusion of RCA will have higher risk of AV block [6]. Balanced pattern is associated with less mortality. In this present study we aim to study the dominance pattern in coronary arteries by tracing the origin of posterior interventricular artery (PIVA). 100 adult human hearts irrespective of age, sex, socio economic status or religion were collected from cadavers in Anatomy department and also from bodies that came for post-mortem in Forensic department that were preserved in 10% Formalin at our institute were used for the study. Results analysed and discussed. The data obtained from this study will help Cardiologists and Cardiovascular surgeons in proper correlation of angiograms and also in planning of treatment strategy in coronary heart diseases.

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### I. Introduction :

According to WHO coronary heart diseases constitute the main cause of death in the industrialised world [1]. The increased disease burden necessitates an in-depth study of coronary arteries and the dominance pattern for better management of the disease. Anatomy of coronary arteries and its variation is significant for proper interpretation of coronary angiographies as well as for procedures like surgical myocardial revascularization [2]. Heart is supplied by two coronary arteries left and right and their branches, which are located between epicardium and myocardium. These vessels arise from the bulbous aorta as two branches of ascending aorta [3]. The right and left coronary arteries form an oblique inverted crown, in which the anastomotic circle in the atrioventricular groove is connected by marginal and inter ventricular (descending) loops intersecting at the cardiac apex[4].

The term dominant artery is used to refer to the coronary artery that gives the posterior interventricular artery (descending branch which supplies the posterior part of the interventricular septum and often the part of the posterolateral wall of the left ventricle [4]. Origin of PIVA from the RCA is termed right dominance and its origin from LCA (circumflex branch) is termed left dominance. Origin of PIVA from both RCA and LCA is known as balanced or co- dominant pattern.[4] Dominance pattern of heart has important clinical significance. Left dominance is found to have significantly higher mortality than right dominance and the balanced pattern, as major part of the heart is supplied by LCA in such cases [5]. In right dominant heart where the RCA supplies AV node, an occlusion of RCA will have higher risk of AV block [6]. Balanced pattern is associated with less mortality. In this present study we aim to study the dominance pattern in coronary arteries by tracing the origin of posterior interventricular artery (PIVA).

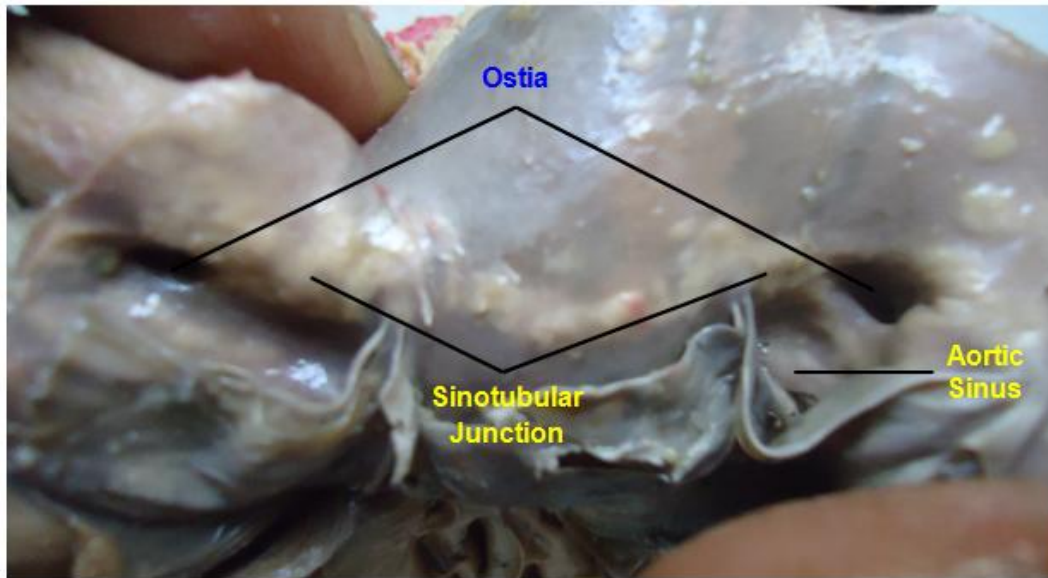
### II. Methodology :

100 adult human hearts irrespective of age, sex, socio economic status or religion were collected from cadavers in Anatomy department and also from bodies that came for post-mortem in Forensic department that were preserved in 10% Formalin at our institute were used for the study. Visceral pericardium was removed and sub epithelial fat was dissected to note the origin of coronary arteries, their branching pattern, extent, termination and also the origin of branch in the posterior inter-ventricular groove to determine the dominance pattern. The variations were noted and painted with red fabric colour and photographed. Relevant data were recorded and analysed.

### III. Results :

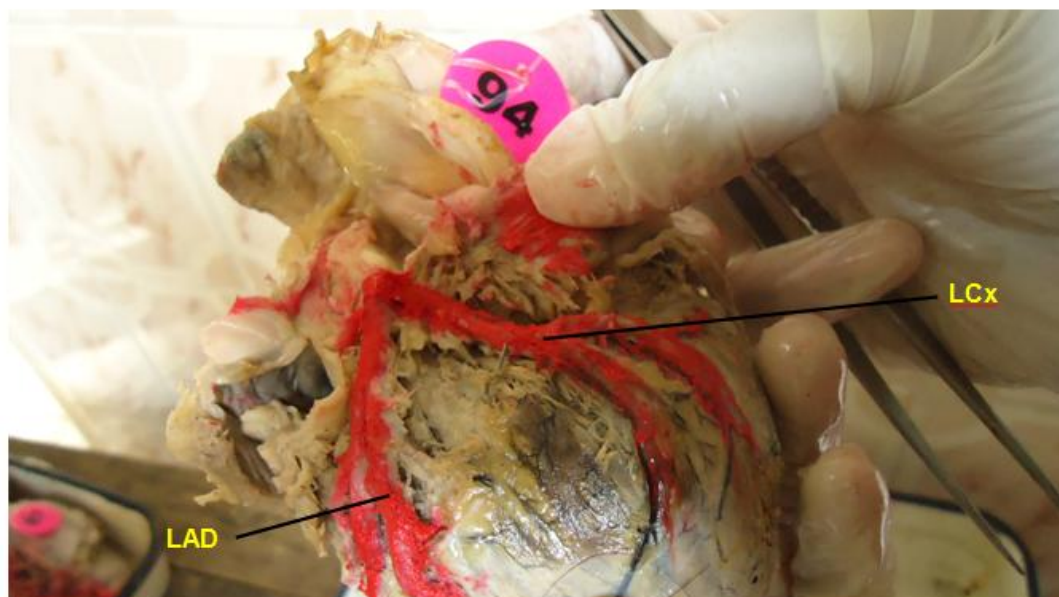
In the present study 100 heart specimens were dissected and observed for the origin and termination of right and left coronary arteries and their dominance pattern was determined by observing the origin of posterior interventricular artery.

In all the specimens the RCA arose from Right coronary sinus which is normal. The level of ostia was below STJ in 94% and at STJ in 6% of the cases [Fig 1]. The LCA arose from left aortic sinus in all specimens which is normal. The Ostia were below STJ in 91% and at STJ in 9% of the cases



**Fig No.1: Dissected specimen Showing Coronary Ostia at the Level of Sinotubular Junction**

The RCA was found to terminate at the right cardiac border in 3 (3%) specimens. It extended between the right border and the crux in 14 (14%) specimens. It ended at crux in 16 (16%) specimens. In 65 (65%) specimens it crossed the crux to end between the crux and the left cardiac border. In 2 (2%) specimens the RCA extended up to left cardiac border replacing the LCX which was found to be absent. In 48 specimens (48%) LCA bifurcated in to LAD and LCx and in 45 specimens (45%) LCA trifurcated in to LAD , LCx and Ramus Intermedius or median artery in between. [Table 1]



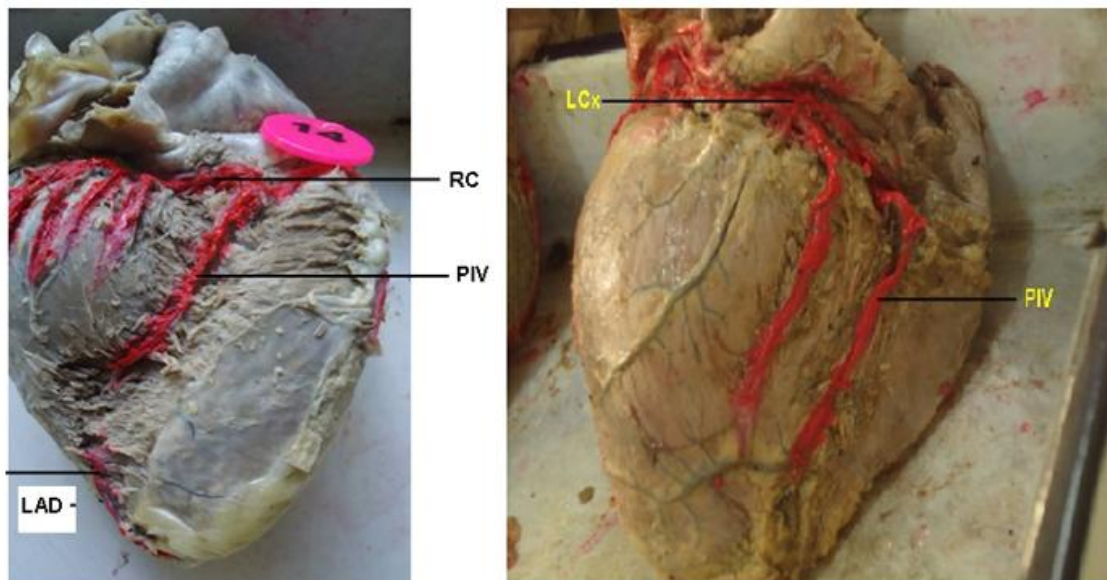
**Fig 2 : Dissected heart Showing Showing Bifurcation of LCA.**

DIVISION	NUMBER OF SPECIMENS	PERCENTAGE (%)
No division	2	2%
Bifurcation	48	48%
Trifurcation	45	45%
Quadrifurcation	3	3%
Pentafurcation	2	2%

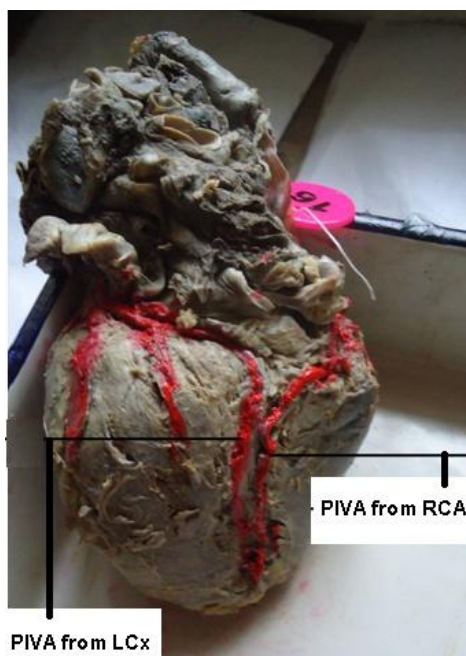
**Table 1:** Termination of LCA in the study specimens.

In 65 specimens (65%) S.A Nodal Artery (SANA) arose from the RCA, in 22 specimens (22%) SANA arose from the LCx and in 13 specimens (13%) SANA arose from both RCA and LCx. Conus artery arose from the RCA in 68 specimens (68%) and in rest 32 specimens (32%) Conus artery arose separately branch from right aortic sinus.

In 76 specimens (76%) PIVA arose from the RCA indicating right dominance. In 17 specimens (17%) PIVA arose from the LCx indicating left dominance. In 7 specimens (7%) origin of PIVA was noted from both RCA and LCx indicating co dominance. [Fig A,B & C]



**Fig 3A :** Dissected Specimen showing Right Dominance Pattern. **Fig 3B)** Specimen showing Left Dominance pattern.



**Fig 3C)** Dissected specimen showing codominance pattern.

#### **IV. Discussion :**

The coronary ostia are normally located in the middle of the right and left coronary sinuses just above the free margin of semi lunar leaflets and below the sinotubular junction[7]. Kalpana et al reported 90% of right ostia below STJ, 9% at STJ and 1% above STJ. Left ostia in their study were below STJ in 80% and at STJ in 20%. Chougule et al reported right ostia below and at STJ in 80% and 10% respectively and left ostia below and at STJ in 60% and 40% respectively [8]. In the present study right coronary ostia were seen below STJ in 94% and at STJ in 6%. Left coronary ostia were seen below STJ in 91% and at STJ in 9%. The observations of the present study were found to be almost similar those of the above authors. Knowledge about location, level and size of ostia is important in successful performance of a coronary angiogram.[9]

The irrigation of sterno-costal surface is extremely regular but the diaphragmatic surface is supplied by RCA or LCx.[6] Variation of supply in this region mainly affects the diaphragmatic surface of the ventricles. The term dominance can be misleading because LCA supplies greater volume of muscle tissue of heart[4]. And hence LCA is always dominant. Schlesinger in 1940 coined term Right or Left dominance to explain which of the coronary arteries irrigated the diaphragmatic surface of the heart [4].

The right dominance of 73.5% was reported by DiDio et al [10], 70% by Das et al [11], 61.34% by Kapil Amgain et al [12], 78% by Bharambe Vaishali et al [13] and 76.8% by Sabnis AS et al [14]. Higher incidences of right dominance were observed in the following studies. 90% of right dominance was reported by James et al [15], 86.5% by Reddy VJ et al [16] and 86.66% by Usha Kannan et al [17]. Low incidences of right dominance of 48% was reported by Schlesinger et al [18], 42% by Fazliogullari et al [19] and 55% by Loukas et al [20]. In the present study right dominance of 76% was noted. Thrombosis of LCA in a right dominant heart is well compensated by PIVA given by RCA but thrombosis of RCA in a right dominant heart is prone for risk of inferior infarction and AV block as the dominant artery supplies the AV node [6].

Left dominance of 10.4% was reported by DiDio et al [10], 18.57% by Das et al [11] and 18.5% by Sabnis AS et al [14] and left dominance of 24% was reported by Kapil et al [12]. Higher incidence of left dominance of 33% was reported by Loukas et al [20]. Lower incidences of left dominance of 6.6% and 10% was reported by Usha kannan et al [17] and James TN et al.[15] In the present study 17% of left dominance was noted.

LAD wraps around the apex of the heart supplying major part of the myocardium in Left dominant hearts and hence left dominant hearts have significantly higher mortality<sup>26</sup>. Co-dominance of 7.1% was reported by DiDio et al [10] and 11.43% by Das et al [11], and Cavalcanti et al [21] reported co dominance of 19.9%. A high incidence of Co-dominance of 44% was reported by Fazliogullari et al [19]. Lower incidences of co-dominance of 2.5% was reported by Reddy VJ et al [16] and 4.8% by Sabnis AS et al [14]. In the present study co dominance of 7% was noted.

Risk of coronary heart disease is less in hearts showing co-dominance pattern as both RCA and LCA share myocardial blood supply equally.

#### **V. Conclusion :**

Clinicians and Anatomists have been examining coronary artery variations for a long time but without any consensus on the normality or abnormality of the coronary arteries. Extensive study to determine the regional and racial variations of dominance pattern of coronary arteries in different population groups is essential. The data obtained from this study will help Cardiologists and Cardiovascular surgeons in proper correlation of angiograms and also in planning of treatment strategy in coronary heart diseases.

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