



MORPHOLOGY OF POSTERIOR INTERVENTRICULAR ARTERY

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Abstract-

Background: Coronary artery disease is one of the major causes of death in developing countries. The advanced diagnostic and therapeutic interventional procedures necessitate the sound knowledge of coronary artery pattern. Heart is supplied by two coronary arteries, right coronary artery (RCA) and left coronary artery (LCA). Posterior interventricular artery (PIVA), branch of RCA and or LCA is considered as the most important branch of RCA which supplies both the ventricles and posterior one third of interventricular septum. The aim of the present work is to study anatomy of PIVA which may be helpful in coronary artery angiography and bypass surgery.

Materials and Methods: 108 hearts were dissected to study coronary arteries from origin to termination. The PIVA was dissected from origin to termination. Its origin, termination, number, dominance and preponderance of heart, anastomosis and presence of myocardial bridge (MB) were studied.

Results:

1. In majority of hearts PIVA was arising from RCA.
2. Maximum number of hearts showed single PIVA.
3. PIVA b/o RCA and b/o LCA was terminated in posterior interventricular septum (PIVS) in upper one third in 19 and 1 heart, at midpoint in 4 and 2 hearts and at apex in 60 and 17 hearts respectively.
4. MBs were present on PIVA b/o RCA.

Conclusion- The anatomical knowledge of PIVA will be helpful for cardiac surgeons for refining numerous imaging techniques and coronary artery bypass grafting.

Keywords- Coronary artery disease, Posterior interventricular artery, coronary artery, anastomosis

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Introduction

Incidence of coronary artery disease (CAD) in urban areas is increasing day by day and it has become one of the major causes of death. Knowledge of coronary arteries, their branches, distribution, termination, presence of myocardial bridges (MB), dominance and anastomosis is essential to understand CAD. Posterior interventricular artery (PIVA) is one of the important branches of right coronary artery (RCA) or and left coronary artery (LCA) which supplies both the ventricles and posterior one third of interventricular septum.

Variations in the morphology of PIVA attract the attention of cardiac surgeons. Awareness of such variations in PIVA will be helpful for impressive achievements during cardiac surgery. So to improve operative outcome cardiac surgeries demand enhanced understanding of basic cardiac and coronary anatomy [1]. A project was undertaken to study morphology of PIVA in terms of their branches,

distribution, termination, presence of myocardial bridges (MB), dominance and anastomosis.

Materials and Methods

108 hearts of unknown sex were obtained from dissection bodies from Anatomy department of B.J. Medical and K.J. Somaiya Medical College and they were preserved in 10% formalin. The coronary arteries were dissected along with their branches and traced sub-epicardially from origin to termination. The PIVA was studied in detail in terms of origin, termination, number, dominance and preponderance of heart, anastomosis and presence of myocardial bridges (MB).

Results

PIVA was arising from RCA in 83 hearts [Fig-1], [Fig-2], from LCA in 20 hearts [Fig-3], [Fig-4], [Fig-5] and from both arteries in 5

hearts [Fig-6].

Single PIVA (b/o RCA) was seen in 58, double in 13 [Fig-2] and triple in 12 hearts. Single PIVA (b/o LCA) was seen in 13 [Fig-3], double in 4 [Fig-4] and triple in 3 hearts [Fig-5].

PIVA b/o RCA and b/o LCA was terminated in PIVS in upper one third in 19 and 1 heart, at middle part [Fig-1] in 4 and 2 hearts [Fig-2], [Fig-3] and at apex in 60 [Fig-2] and 17 hearts [Fig-3] respectively.

It was observed that in 2 hearts MB was present on PIVA b/o RCA [Fig-7].

Right dominance was seen in 76.8 % of cases.

Discussion

Clinicians and anatomists have been examining coronary artery variations for a long time. From 1960, when the selective coronary angiography began, the total numbers of investigations on this topic have increased. However there is still no consensus on the normality or abnormality of coronary artery rather variation in the branching pattern of coronary artery is the peculiarity of coronary artery.

As the right coronary artery approaches the crux, PIVA arises and passes forward along the interventricular sulcus for a variable distance towards the apex of the heart. If PIVA is not given by RCA, it is given by circumflex branch of LCA. PIVA arose from RCA in 86% of hearts, from left circumflex artery in 4% of the hearts and in 10% of hearts PIVA was absent [2]. PIVA is replaced by LCA in 10% of individuals [3,4] and occasionally there are none [3]. In the present study PIVA was seen in all the hearts and it was arising from RCA in 83 (76.8 %) hearts [Fig-1], [Fig-2], [Fig-7], from LCA in 20 (18.5%) hearts [Fig-3], [Fig-4], [Fig-5] and from both arteries in 5 hearts (4.6 %) [Fig-6]. In 23% of cases significant variations are seen in origin, course and distribution of PIVA, 5% early origin 3 to 4 cms proximal to crux [5]. Origin of PIVA was from LADA in one case [6].

PIVA terminates either in upper, mid part of posterior interventricular septum or at the apex. PIVA given by RCA terminated in 2, 27 and 28 [7] and 9, 46, 8 [1] hearts and PIVA given by LCA terminated in none, 5, 2 [7] and none, 7, none hearts [1] in the upper, middle part of PIVS respectively. In the present study we found termination of PIVA when given by RCA in 19, 4 [Fig-1], and 60 [Fig-2] and when given by LCA in 1, 2 [Fig-4], 17 [Fig-3] hearts in upper, middle part of PIVS and at the apex of the heart respectively.

At crux RCA gives one to three PIVAs which lie in posterior interventricular groove [3]. In 70 % of cases PIVA is single [3], in 6% is double [5]. In the present study single PIVA (b/o RCA) was seen in 58, double in 13 [Fig-2] and triple in 12 hearts [Fig-1] and single PIVA (b/o LCA) was seen in 13 [Fig-3], double in 4 [Fig-4] and triple in 3 hearts [Fig-5].

Main coronary arteries and their major branches are usually subepicardial but those in atrio-ventricular and interventricular sulci are often deeply sited, occasionally hidden by myocardium or embedded in it. The muscle overlying is myocardial bridge (MB) and underlying artery is termed as tunnel or mural artery. MB is normal variant found incidentally and does not have any definitive clinical co-relation or pathological significance and so should not be considered as indication for coronary surgery [8-10]. In the present

study it was observed that in 2 hearts MB was present on PIVA b/o RCA [Fig-7].

The dominant artery is the one which supplies the posterior diaphragmatic portion of the IVS and the diaphragmatic surface of the left ventricle [11]. If PIVA is a branch of RCA then it is called right dominance and if it is of LCA then it is called left dominance. PIVA may arise from both RCA and LCA then it is called co-dominance. We have found co-dominance in 4.6% of hearts [Fig-6]. Following table [Table-1] shows results of dominance done by various authors.

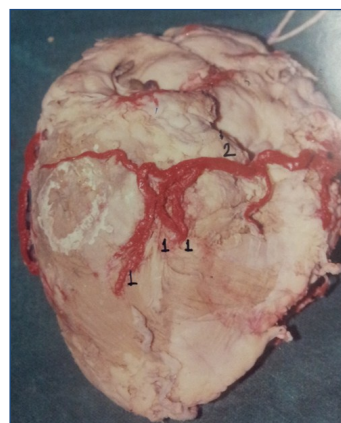


Fig. 1- Termination of three PIVAs (1) (b/o RCA) in middle part of PIVS

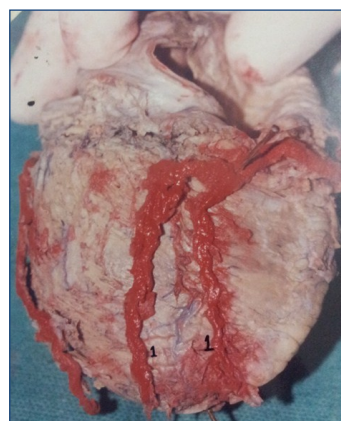


Fig. 2- Termination of two PIVAs (1) (b/o RCA) at apex of heart



Fig. 3- Termination of single PIVA (3) (b/o LCA) at apex

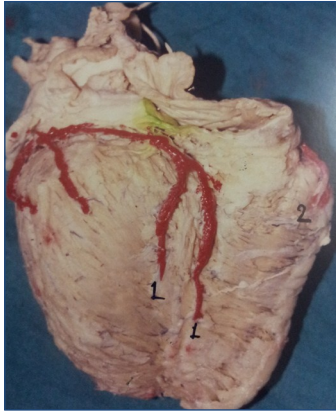


Fig. 4- Termination of double PIVA (1) (b/o LCA) in the middle part of PIVS



Fig. 5- Termination of three PIVAs (1) (b/o LCA) in the middle part of PIVS

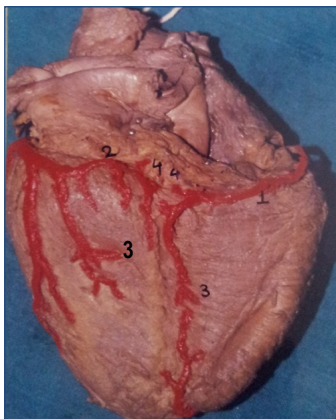


Fig. 6- PIVA (3) arising from RCA and LCA and it is forming anastomosis with LADA in middle part of PIVS

Anastomoses between RCA and LCA are abundant during fetal life, but are much reduced by the end of the first year of life. Anastomosis is commonly seen at apex, PIVS, and crux. In the present study PIVA (b/o RCA and b/o LCA) forms anastomosis with left anterior descending artery (LADA) at apex in 56 and 12 hearts respectively, at PIVS in 23 hearts [Fig-6], PIVA forms anastomosis with LADA and posterior ventricular branches was seen in 22 hearts [Fig-8]. An anastomosis, at the subepicardial level, between

the anterior and posterior interventricular branches was observed in 56.36% of the hearts [12]. The functional significance of this large anastomotic connection between normal coronary arteries is unclear but one may speculate that they have a potential role in protecting the myocardium [13].

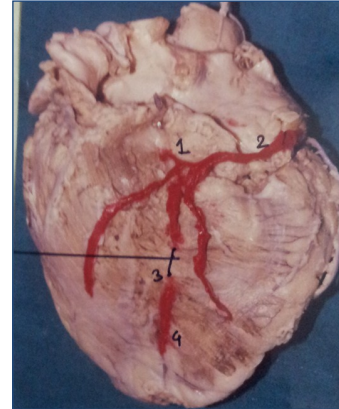


Fig. 7- Presence of MB (3) on PIVA (4) (b/o RCA)

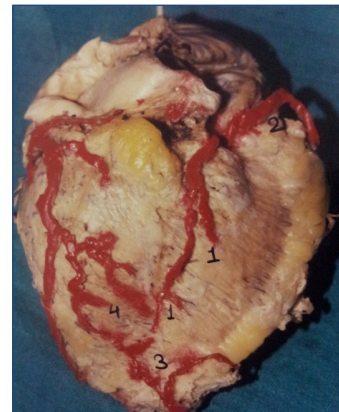


Fig. 8- Anastomosis between PIVA (1), LADA (3) and Posterior ventricular branch of LCA

Table 1- Shows comparison of study denoting dominance of heart.

Name of author	Right dominance	Left dominance	Co-dominance
Fazliogullari Z	42%	14%	44%
Cavalcanti	88.18%	11.82%	--
Kalpana R	89%	11%	--
Grays Anatomy	70%	20%	10%
Cavalcanti JS	69.09%	11.82%	19.09%
Present Study	76.80%	18.50%	4.60%

Conclusion

The information regarding morphology of PIVA will be helpful for cardiac surgeons and interventional cardiologists for planning bypass surgery or angioplasty for successful achievement. PIVA carries significant contribution during interpretation of coronary angiography and surgical myocardial revascularization.

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