Original Research Article

A STUDY OF POSTERIOR INTERVENTRICULAR ARTERY IN ADULT HUMAN CADAVERIC HEARTS

Lekshmy Vijay .V.G *[1], Siva Sree Ranga [2].

*[1] Assistant Professor, Department of Anatomy, Sree Mookambika Institute of Medical Sciences, Kulasekharam, Tamilnadu, India.

[2] Associate Professor, Department of Anatomy, Sree Mookambika Institute of Medical Sciences, Kulasekharam, Tamilnadu, India.

ABSTRACT

Background: Posterior interventricular artery (PIVA), usually a branch of right coronary artery supplies both the ventricles and the posterior $1/3^{rd}$ of the interventricular septum. In some cases, PIVA can also arise from the left coronary artery. Origin of posterior interventricular artery determines the cardiac dominance. The present study is aimed to assess the cardiac dominance by assessing the number, origin and termination of the posterior interventricular artery in the human cadaveric hearts. The blood supply of the inferior myocardium depends on the dominance. Hence the awareness of these variations plays an important role in treating the inferior wall infarcts.

Materials and Methods: This study was carried out in the Department of Anatomy, Sree Mookambika Institute of Medical Sciences. A total of 112 adult human cadaveric hearts were collected and the parameters such as the number, origin and the termination of the posterior interventricular artery were noted.

Results and Discussion: In the present study, the PIVA is seen in all the hearts. Out of 112 cases, the right coronary dominance was seen in 94 cases (84%), and left coronary dominance was seen in 18 cases (16%). And the level of termination of PIVA is more, ie; 42 out of 112 specimens (37.5%) are ½ way down the PIVS.

Conclusion: 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 the coronary artery pattern. Prognosis of inferior wall infarcts are related to coronary dominance. So the study of PIVA may be helpful in coronary artery angiography and bypass surgeries.

KEY WORDS: Coronary artery, Posterior interventricular artery, Dominance, Right dominance, Left dominance.

Corresponding Author: Dr. Lekshmy Vijay .V.G , Assistant Professor, Department of Anatomy, Sree Mookambika Institute of Medical Sciences, Kulasekharam, Tamilnadu, India.
Phone: +91-9447608909 **E-Mail:** nakulalekshmy@gmail.com

INTRODUCTION

Heart is supplied by two coronary arteries - right coronary artery (RCA) and left coronary artery (LCA). Posterior interventricular artery (PIVA), usually a branch of RCA supplies both the ventricles and posterior $1/3^{rd}$ of the interventricular septum. In some cases, PIVA can also arise from the LCA.

Variations and anomalies are frequently seen due to the complexity involved during the development of coronary arteries [1]. The term 'dominant' is used to refer to the coronary artery giving off the posterior interventricular artery (PIVA) [2]. Variations in the branching pattern of coronary arteries can affect the blood supply to the heart. Anomalies or variations of

arterial anatomy can have an impact in the blood supply of the affected organ, the clinical presentation and prognosis of its diseases, and even the development and distribution of atherosclerosis. The aim of the present study is to know the anatomy of PIVA which may be helpful in coronary artery angiography and bypass surgery.

Coronary artery disease is one of the major cause of death in the developing countries. Awareness of such variations in PIVA will be helpful for impressive achievements during cardiac surgeries. So to improve the operative outcome cardiac surgeries demand enhanced understanding of basic cardiac and coronary anatomy [3]. Knowledge of coronary arteries, their branches, distribution, termination, presence of myocardial bridges (MB), dominance and anastomosis is essential to understand Coronary artery diseases [4]. The advanced diagnostic and therapeutic interventional procedures necessitate the sound knowledge of coronary artery pattern. Prognosis of inferior wall infarcts are also related to coronary dominance.

MATERIALS AND METHODS

Fig. 1: Showing PIVA terminates at ½ way down the PIVS.

Fig. 2: Showing PIVA terminates at 3/4th way down the PIVS.

The arteries were dissected from the origin to their end, avoiding damage to both the heart and the vessels. This study was conducted on 112 adult human cadaveric hearts of unknown age and sex in the department of Anatomy, Sree Mookambika Institute of Medical Sciences. The specimens thus collected were serially numbered from 1 to 112, which were fixed in 10% Formalin solution. We ensured that all selected hearts were with intact posterior interventricular artery. Hearts with gross pathological deformities were excluded from our study. The visceral pericardium was removed to expose the coronary arteries. The Right and Left coronary arteries were noted along with the branching pattern of PIVA. The data was tabulated and compared with earlier studies. The parameters evaluated are: the number, origin and termination of the posterior interventricular artery.

RESULTS

In this study 112 adult human cadaveric hearts were assessed and was observed for the number, origin and termination of the posterior interventricular artery. According to that the coronary dominance was also noted.

In majority of the cases ie; 94 cadaveric hearts shows PIVA arising from the RCA (84%) and in 18 of 112 cases (16%), PIVA arises from the LCA [Table-1].

The termination of PIVA in the posterior interventricular sulcus (PIVS) was noted as follows [Table-2].

Table 1: Origin of Posterior Interventricular Artery.

Origin of PIVA	Specimen	Percentage
LCA	18	16%
RCA	94	84%

Table 2: Showing level of termination of PIVA originated from RCA.

Level of termination of PIVA	Specimen	Percentage
1/4th way down the PIVS	11	9.80%
1/2th way down the PIVS	42	37.50%
3/4th way down the PIVS	38	34%
Till the apex	21	18.70%

DISCUSSION

The total number of investigations on this topic have been increased since 1960, when the selective coronary angiography begins [4].

However there is still no consensus on the normality or abnormality of coronary artery rather the variation in the branching pattern of coronary artery. The LCA is the main source of blood supply to the heart [5,6], which allows maximum filling of the coronary arteries in diastole. The left dominance are variously reported by different authors. In the present study it was found in 16% of hearts [Table 1]. This finding is similar to studies done by Kosar et al [7],Fazlul Aziz Mian et al [8], Ortale JR et al [9], Kaimkhani et al [10], Abdellah et al [11] and Fazliogullari et al [12].

The location, level and size of the ostium is important for successful performance of a coronary angiogram [13]. According to Standring S in Gray's Anatomy [2], the calibre of coronary arteries range from 1.5 to 5.5 mm at their origin. 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. Usually in most of the cases, coronary artery system is considered to be right dominant. If PIVA is not given by RCA, it is given by circumflex branch of the LCA, which is a left dominant case [4]. The pattern of dominance is the most important anatomical variation, concerning the functional impact of ischemia. If the pattern is left, a great amount of myocardium depends solely on one artery for its nurturing [3]. Inferior wall infarcts of the heart is related to the dominance [14]. Obstruction of this artery may produce a massive infarct with output failure of the heart. Kuno T, Numasawa Y, Miyata H, et al [15] reported that the numbers of patients presenting with symptoms of heart failure, cardiogenic shock or cardiopulmonary arrest were significantly higher in the patients having left coronary artery dominance than in the patient with right coronary dominance. Hence according to Goldberg et al [16], left dominance is a significant and independent predictor of increased long term mortality in patients with acute coronary syndrome.

PIVA is replaced by LCA in 10% of individuals [17,18] and occasionally there are none [17]. In our present study, PIVA is seen in all the hearts. Out of 112 cases, the right coronary dominance was seen in 94 cases (84%), which is similar to the studies done by Nerantzis CE et al [19],

Kalpana R [3], James TN [20] and left coronary dominance was seen in 18 cases (16%) [Table-3].

Table 3: Comparison of origin of PIVA between the present study with other authors studied in different regions of the world.

Authors	Origin of PIVA	
	RCA	LCA
James TN (1965) [16]	80%	20%
Nerantzis CE et al (1998) [15]	88%	12%
Kalpana R (2003) [3]	89%	11%
Ortale JR et al (2004) [9]	62.50%	12.50%
Kaimkhani et al (2005) [10]	60.40%	15%
Kosar et al (2009) [7]	76%	9.10%
Fazliogullari et al (2010) [12]	42%	14%
Fazlul Aziz Main et al (2011) [8]	60.50%	19.50%
Ballesteros LE (2011) [22]	76%	6.90%
Nordon DG (2012) [23]	88%	8%
Abdellah et al (2012) [11]	77%	8%
Present study (2019)	84%	16%

Level of termination of PIVA is also noted. PIVA terminates either in upper, middle or 3/4th way down the posterior interventricular septum or at the apex. Termination of PIVA at 1/2th way down the PIVS is noted in 42 specimens out of 112 (37.5%), which is more when compared to the other sites of termination [Figure-1,2].

In all specimens, whether it terminates at or beyond the cardiac crux, the RCA was found to give arterial supply to the inferior wall of the left ventricle [21].Thorough knowledge of normal and variant anatomy of coronary arteries is a prerequisite for clinicians and cardiac surgeons for refining numerous imaging techniques and coronary artery bypass grafting. The inverse relationship between the RCA and left circumflex branch is most simply expressed as right or left dominance, depending on which artery gives rise to the PIVA [3].

CONCLUSION

Anatomical variations of the heart vessels are common. Right dominance is the most common anatomical dominance pattern in the heart. There were not much differences between this study and the other similar studies done from different populations.

The information regarding morphology of PIVA will be helpful for cardiac surgeons and interventional cardiologists for planning the

bypass surgeries and angioplasty for successful achievements. PIVA carries significant contribution during the interpretation of the coronary angiography and surgical myocardial revascularization.

ABBREVIATIONS

RCA - Right coronary artery

LCA - Left coronary artery

PIVA - Posterior interventricular artery

PIVS - Posterior interventricular sulcus

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