

Main Left Coronary Artery System – Angiographic Anatomy.

Dr. Jyoti P. Kulkarni¹, Dr. Lopa Mehta².

¹(Department of Anatomy, D.Y.Patil Medical College/ DPU University, India)

²(Department of Anatomy, Seth G.S medical College/ Mumbai University, India)

Abstract : The role of an anatomist is to make understand the human anatomy by medical and allied students. It should help the practitioners in their professional life. Role of anatomy in medical education is changing as the health care management is evolving. Nomenclature and method of evaluation of heart & its vessels according to clinicians is uniform. But the Anatomists differ. A uniform terminology should be accepted to take part in multidiscipline discussion. Ultimately teachers of anatomy failed because we did not present new anatomy dictated by the new technology i.e CT scan, MRI, USG, 2D echo. Main left coronary artery system is the commonly affected vessel. Usually it is the first vessel to show blockages. An attempt is made in this study to determine the variations shown by main left coronary artery and its branches on angiographic study.

Keywords: Left coronary artery, Angiographic anatomy, ostium, Bypass, Angioplasty.

I. INTRODUCTION

Main left Coronary artery is best viewed in the standard 30° right anterior oblique view. It is one of the shortest amongst the most important vessels of the body. In this view it is directed frontally and to the left. While still in space between the aorta and pulmonary artery, it divides into two branches, left anterior descending and the circumflex. The best projection to observe the division of the left main into its branches is the left oblique view. In this projection two principal rami the circumflex and left anterior descending run along the opposite borders of the cardiac shadow, whereas the diagonal branch of left anterior descending lies in the angle subtended by them. Left anterior descending artery has the most constant origin course and distribution. In antero posterior view and shallow (10° – 15°) right anterior oblique view it forms an angle of almost of 90° as it runs around the pulmonary artery and begins its downward course along the anterior interventricular sulcus. This 90° angle is often highlighted by the origin of the diagonal branch. Cine angiographic feature typical of this vessel and its septal branches is, its relative lack of motion as compared to circumflex and right coronary artery. Branches of left anterior descending in order of their origin are - First diagonal (D1), First Septal (S1), Right ventricular branch, Second diagonal (D2), the Apical branch. In case the main left coronary artery trifurcates then D1 arises from the main left coronary artery. In this case it is called as ramus intermedius. The origin of S1, which is usually, a large branch, serves to separate the first 1/3 of the left anterior descending from its middle 1/3. The lesions of the left anterior descending are described in relation to origin of first septal, either proximal or distal to it. It originates at right angle to left anterior descending and is best seen in the right anterior oblique view. Circumflex coronary artery departs from the main left coronary artery at sharp angle, best seen in left oblique view. Its branches in order of origin are - Branch to sinoatrial node, Atrial circumflex branch, Obtuse marginal branch, Posterior lateral branch, Posterior descending branch, Branch to atrio ventricular node (in dominant or co dominant cases). The largest and the most constant branch of the circumflex is the obtuse marginal. It appears to run parallel to left anterior descending in the right anterior oblique view. It moves widely with systole and diastole i.e. towards apex in systole and away from it in diastole. This motion is especially evident in right anterior oblique view. In preponderant left coronary artery, the circumflex continues beyond posterior lateral branches to reach posterior interventricular groove and terminates into posterior descending. It also gives a branch to the AV node in this case. Branch to AV node appears as a slender vessel departing the circumflex at a 90° angle in a direction opposite to the posterior descending artery² (Figure 1).

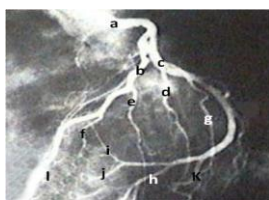


Figure 1. - a)Main left coronary artery, b)Left anterior descending artery, c)Circumflex coronary artery, d)Ramus intermedius branch, e) First Diagonal branch, f) Second diagonal branch, g)Obtuse Marginal branch, h)Posterior descending artery, i)Branch to AV node, j)Branch to AV node, k)Posterior ventricular branch, l)Septal branches.

II. AIMS AND OBJECTIVES

In the present era people are opting for coronary angioplasty and coronary artery Bypass surgery almost on the counter in countries rich and poor. On reviewing the available literature, a wide range of variations in the

coronary arteries was found. Hence the aim was to study the variations in the branching pattern of left coronary artery and its dominance pattern on cineangiographic films. To correlate the above studies and their clinical implication in Indian population.

III. MATERIALS AND METHODS

Observation on 107 consecutive antemortem coronary angiograms of random adult population in whom the coronary angiograms were indicated and were performed by the cardiologist at KEM Hospital, G.S Medical College, Mumbai, was done. The dye used was Trazograph 76% (Na-Diatrozate, an iodine based dye). Judkins catheter for left coronary artery was used. Catheterisation was done by Seldingers technique, by percutaneous puncture of the femoral artery by the cardiologist in those patients in whom angiography was indicated. In this study parameters which could be measured with the available facilities were variation in the origin of Main left coronary artery, variation in the branching pattern of Main left coronary artery, and Dominance pattern.

IV. OBSERVATION

The main left coronary artery usually originates from the left posterior aortic sinus. However in present study it was absent in 3 out of 107 cases. In these cases the left anterior descending artery and the circumflex coronary artery took origin from the independent ostium. The ostium for the left anterior descending artery was located in the left posterior aortic sinus in all three cases (Figure2).

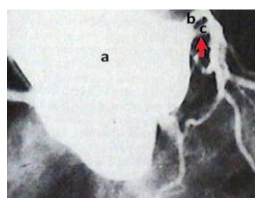


Figure 2. – a) Ascending aorta, b) Left anterior descending artery arising from separate ostium from left posterior aortic sinus. C) Circumflex coronary artery arising from separate ostium from left posterior aortic sinus.

In the case of circumflex coronary artery 2 out of 3 cases had a separate ostium located in the left posterior aortic sinus, while one case had a separate ostium located in the anterior aortic sinus. In this case the circumflex coronary artery took a retroaortic course. (Figure 3).

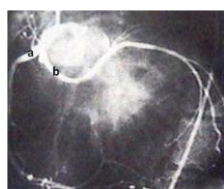


Figure 3. – a) Right coronary artery, b) Circumflex coronary artery taking a retroaortic course.

In 13 out of 107 cases the posterior descending artery and the branch to AV node was seen arising from circumflex coronary artery. That means the circumflex was dominant in these 13% of cases. In 10 out of 107 cases the posterior descending and branch to AV node was seen arising from both the circumflex coronary artery as well as right coronary artery. The main left coronary artery terminated by trifurcation in 11.54% of cases i.e 12 out of 107 cases, thus giving rise to ramus intermedius branch running on the obtuse margin of heart (Figure 1).

V. DISCUSSION

In present study the main left coronary artery was found to trifurcate in 11.54% of cases thus giving rise to ramus intermedius. The main left coronary artery was absent in 2% of cases. In these cases the Left anterior descending and the circumflex originated independently from the left posterior aortic sinus. The overall prevalence of ectopic origin of the circumflex from the right sinus of Valsalva is reported to be 1.6% - 1.2%³. In a study done by Kimbris Demetrios, S. it was found to be 0.64%³. The discovery of coronary artery variations in patients undergoing coronary angiography is about 0.6% to 1%⁴. In childrens hospital Ohio state, University Coloumbus a case of left coronary artery arising from the anterior aortic sinus was reported which took a course in front of the right ventricular outflow tract and was associated with the Tetralogy of Fallot. The angiographic pattern associated with this condition was unusual and in many views looked deceptively normal⁵. Roynard JL Cattan reported a case of origin of the left anterior descending artery arising from the common right trunk taking a course between aorta and pulmonary trunk and this could be a rare cause of myocardial ischemia at rest⁶. An isolated anomaly of the left anterior descending arising from the right sinus of valsalva is very rare. Inability to visualise this vessel from the left sinus of Valsalva warrants a careful search of the right sinus⁷. Shirani and

Roberts reported the incidence of the origin of Circumflex from the anterior aortic sinus with retroaortic course to be 0.33%⁴. Yarnaka and Hobbs found the incidence of congenital coronary artery anomalies, in the angiographic studies to be about 1.3%⁴ based on 126,595 cases, where in 1,686 were found. They classified these anomalies as benign and potentially serious anomalies. Coronary endothelial sprouts occur at around the 5th week of intra uterine life from the bulbus cordis which has not yet differentiated into the aorta and the pulmonary trunk. The first evidence of coronary vessel development is the appearance at the beginning of the fifth week of intrauterine life of a structure like blood islands just under the epicardium in the sulci of the developing heart^{8,12}. According to the theory of Ogden J. there is a dual origin of coronary arteries – Proximal and distal. The distal portion develops first. It is comprised of a retiform vascular network, similar to the capillary network that forms in the other parts of body. This network develops in the interventricular and atrioventricular grooves and forms a complete ring around the developing vessels (Peritruncal ring), and communicates with the heart chamber and the extracardiac great vessels. Further development of some vessels and regression of others; the final coronary pattern develops. This theory adequately explains the variations of coronary vasculature^{9,12}. Coronary vascular endothelial maturation closely parallels the development of the embryonic epicardium. The first coronary endothelial cells migrate from the region of the developing liver and establish contact with the sinus venosus. Vascular precursors cells and small vessels then invade the sinus venosus wall, ventricular and atrial myocardium, and mesenchymal border of the aortic annulus. Initially multiple connections between the coronary vascular plexus and the aortic myocardium are present; however only two connections persist. Coronary endothelial cells do not participate in the formation of the intramyocardial vascular net work. The orderly development of the coronary arterial branching pattern and elastic lamina is dependent upon the neural crest cells. The maturation of coronary vasculature represents both angiogenesis and vasculogenesis. It is suggested that the developing capillary vessels in the sulci induce the sprouting of coronary veins and arteries^{10,11,12}. Knowledge of variations in the angiographic anatomy of left coronary artery is of immense value during interpretation of coronary angiography procedures, and managing congenital and acquired paediatric heart diseases.

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