THE RELATION BETWEEN CORONARY DOMINANCE AND MULTIVESSEL INVOLVEMENT

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ABSTRACT

Background: Triple-vessel disease (TVD) is a type of CAD since it involves significant stenosis in any three of the major coronary arteries**.** Currently, there is not much literatures about the relationship between coronary artery dominance and multivessel disease. Therefore, we conducted this study to investigate the type of dominance and number of vessels involvedarteries by coronary angiogram in and around the puducherry population.

Aims and objectives: To study the coronary dominance patterns with co morbid conditions such as the number of vessels involved in each.

Materials and Methods: 200 adult coronary angiogram were studied during angiography. The Dominance is identified by the origin of posterior interventricular artery. Coronary artery disease is considered significant if the stenosis is >70% in the luminal diameter of anterior interventricular artery, right coronary artery and circumflex artery.

Results: In this study, Single vessel disease was found to be common among all types of dominance being 54.8% in right dominance, 52.2% in left dominance and 59.3% in co dominance. AIVA or LAD was the most commonly affected single vessel irrespective of the type of dominance. (50 to 75%)

Conclusion: Single vessel disease was found to be common in all types of dominance when compared to double vessel or triple vessel diseases. The Anterior Inter ventricular artery was the most common vessel involved in all types of dominance followed by RCA and circumflex artery.

KEYWORDS: Coronary Arterial Disease, Triple Vessel Disease, Coronary Dominance, Coronary Arteries.

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INTRODUCTION

The arterial supply of heart is provided by the right and left coronary arteries which lie just deep to the epicardium normally embedded in fat.

The Right Coronary Artery(RCA) arises from the

anterior aortic sinus of the ascending aorta \It gives a large branch, the Posterior Interventricular artery(PIVA) which lies in the posterior interventricular sulcus and then ends by anastomosing with the circumflex branch of left coronary artery [1]. The right coronary artery supplies the right atrium, most of the right ventricle, part of left atrium, part of the left ventricle (on the diaphragmatic surface), the sinoatrial node (SA node) in 60% and atrioventricular node (AV node) in 80% , the interatrial septum and the postero-inferior one-third of the interventricular septum.

The Left Coronary Artery(LCA) arises from the left posterior aortic sinus of the ascending aorta. It divides into its two terminal branches, anterior inter ventricular artery (AIVA) and circumflex artery (CX)[2]. Distribution pattern of the left coronary artery enables it to supply most of the left atrium, left ventricle, anterior two thirds of interventricular septum including the atrioventricular bundle and its branches, SA node in 40% and AV node in 20%.

Determination of dominance pattern: In the right coronary dominance, the PIVA arises from the RCA and RCA extends past the PIVA in the atrioventricular groove, giving off one or more posterolateral branches to the inferior surface of the left ventricle. In this case, the distal part of circumflex artery (CX) is very small or absent.

In the left coronary dominance, the PIVA and all the posterolateral branches arise from the CX artery; the RCA is small and terminates before reaching the crux; it does not supply any blood to the left ventricular myocardium.

In the co dominance, the PIVA arises from both RCA and CX artery [3,4] Coronary artery disease (CAD): It is considered as significant when there is >70% stenosis in the luminal diameter of any of the following vessels in angiogram [5].

1. Anterior interventricular artery or left anterior descending artery (AIVA/LAD)

2. Circumflex artery (CX)

3. Right coronary artery (RCA)

Total coronary occlusion is identified as an abrupt termination of the pericardial vessel. Multiple lesions are present when three and more segments had significant lesions in the same vessel.

Triple-vessel disease (TVD) is a type of CAD since it involves significant stenosis in any three of the major coronary arteries (i.e., the right coronary artery, left anterior descending artery, and left circumflex artery [6]. TVD is associated with increased rates of major adverse cardiac effects and mortality than single-vessel disease (SVD) and double-vessel disease (DVD). Currently, there is not much literatures about the relationship between coronary artery dominance and multivessel disease[7]. Therefore, we conducted this study to investigate the type of dominance and number of vessels involved. In addition to these the location of stenosis in the involved vessels also studied.

Aim:

1. To study the coronary dominance patterns with co morbid conditions such as the number of vessels involved in each

2. To study the location of stenosis in patients with CAD

MATERIALS AND METHODS

Sample size: 200 adult patients of either gender

The study was carried out in the Cath lab of Department of Cardiology at Pondicherry Institute of Medical Sciences over a period of one year. Written informed consent was obtained from all the patients. The age, gender, occupation, socio demographic profile, height, weight, body mass index and personal history like diabetes, hypertension, use of drugs, smoking and addiction were noted.

In all the cases the branching pattern of coronary arteries, variations if any and the dominance pattern were identified based on the origin of Posterior Interventricular Artery

Coronary angiography was performed by qualified and experienced Cardiologists by femoral approach using the modified Seldinger technique. The femoral artery was punctured with a needle 3 cm below the inguinal ligament while the leg was adducted and slightly externally rotated. The exact position of artery was guided by the palpation of the femoral arterial pulse, and the needle is inserted at an angle of 45°. After arterial puncture, a fine guidewire was inserted through the needle and

fed into the artery. The catheter was then inserted over the guidewire and manipulated via the iliac artery into the aorta, up the aortic arch and was placed in the ascending aorta. The brachial or radial artery may be used for percutaneous access to the circulation. Once the catheter was located in the ascending aorta, a variety of guidewires (straight tip, left and right curved catheters and pigtail catheters) were used to enter the coronary vessels for selective arteriography and interventions. Angiography was performed with standard high osmolality contrast medium Omnipaque(Iohexol) 350mgI/ml with cine angiography.

Standardized angiographic projections were chosen for the assessment of each arterial segment. For LAD - right anterior oblique projection with caudal angulation, for Cx artery – left anterioroblique projection with caudal angulation, and for the right coronary artery (RCA) - left anterior oblique projection with cranial angulation were used. The segmentation of coronary arteries was done according to the study by Marek Krzanowski[8].

The proximal segment of the LAD is below the pulmonary trunk towards the interventricular groove up to the origin of first diagonal branch. The middle segment of LAD reaches up to the apex in the interventricular groove. The remaining part is termed as the distal LAD.

The circumflex artery leaves the coronary sulcus at its lowermost point the left part of the sulcus between aorta and lowermost point of the sulcus may be divided into two sections of approximately the same length, and segments of the circumflex artery within respective sections of the sulcus may be considered proximal and middle CX .The remaining part is termed as distal segment of CX.

The proximal segmentof the right coronary artery is between its origin and the right margin of the heart. It gives off anterior atrial and ventricular branches. The middle segment of the right coronary artery is between the right border and crux and supply the diaphragmatic aspect of the right ventricle. The remaining part is termed as distal segment of RCA [8].

Statistical analysis:SPSS (Statistical Package for Social Sciences) 17.0 version for windows

statistical software. The test of significance used was Chi Square test to compare two categorical variables and also to compare categorical variables under dichotomous variable among the groups. p value (Probability value) less than 0.05 was considered as significant.

RESULTS

Single vessel disease was found to be more common. Out of 112 patients 62 (55.35%) had single vessel disease, 33 (29.46%) had double vessel disease and 17 (15.17%) had triple vessel disease. Single vessel disease was found to be common among all types of dominance being 54.8% in right dominance, 52.2% in left dominance and 59.3% in co dominance. Double vessels and triple vessels diseases were less in all types of dominance.
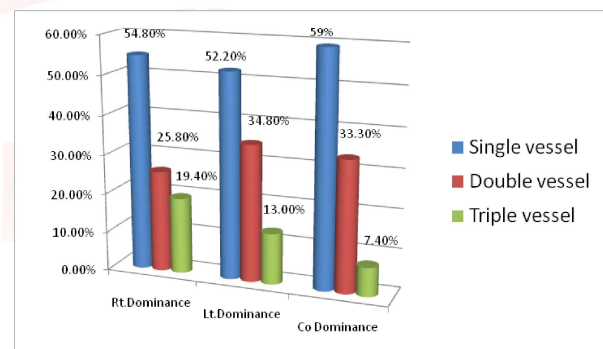

Fig. 1: Coronary dominance correlated with number of diseased vessels.

AIVA or LAD was the most commonly affected single vessel irrespective of the type of dominance. (50 to 75%). RCA and CX artery were involved in less numbers in all types of dominance. This association was statistically insignificant.
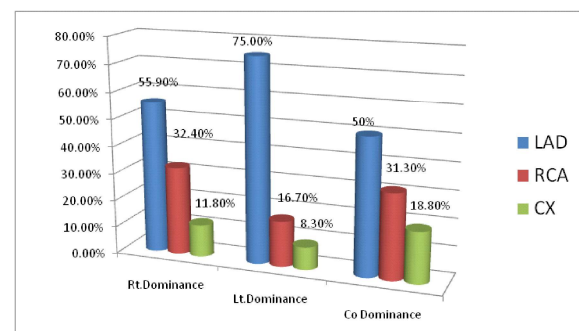

Fig. 2: Coronary dominance correlated with the single vessel affected.

Among the double vessel disease LAD and RCA were more commonly affected in all types of dominance followed by CX+RCA and less commonly LAD+CX but these correlations were statistically insignificant.
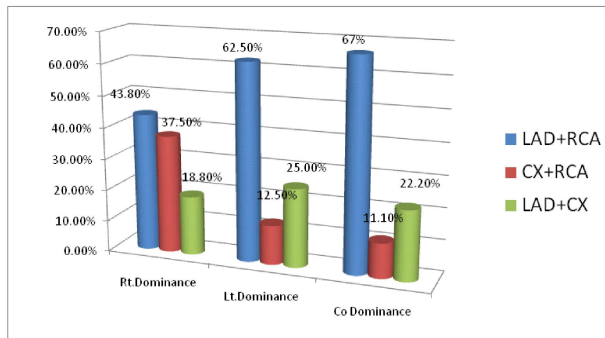
Fig. 3: Coronary dominance correlated with the double vessels affected.

Out of 62 cases of single vessel disease the most common site of stenosis was the middle segment in right dominance (47.1%) and in co dominance (50%) but proximal segment in left dominance (75%). Distal segment was involved in few cases.
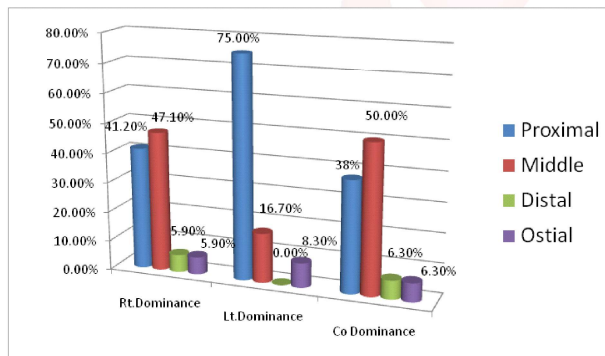

Fig. 4: Coronary dominance correlated with location of stenosis in single vessel disease.

DISCUSSION

In the present study, single vessel disease was found to be more common (Fig 1). Out of 112 patients 62 (55.35%) had single vessel disease, 33 (29.46) had double vessel disease and 17 (15.17%) had triple vessel disease. Single vessel disease was found to be common among all types of dominance being 54.8% in right dominance, 52.2% in left dominance and 59.3% in co dominance. Double vessels and triple vessels diseases were less in all dominance. This finding was consistent with the study by Samad Gaffari[9].

AIVA or LAD was the most commonly affected vessel irrespective of the type of dominance. (50 to 75%) (fig 2). This was followed by RCA and CX artery. Among the double vessel disease LAD and RCA were more commonly affected in all types of dominance but this was statistically insignificant (Fig. 3).

However a study by Hussein Ali Fakir [10]showed that there was significant association between the right dominant system and coronary occlusive disease particularly with three vessel disease (multivessel involvement) and with right coronary artery lesion.

In the study done by Parikh, Eric J.et al [11], persons with left or co dominance compared to right had a higher unadjusted prevalence of cardiogenic shock and congestive heart failure. Left dominance was associated with modestly elevated odds of in-hospital mortality. Co dominance was not significantly associated with in-hospital mortality. Coronary artery dominance may be important to consider when risk stratifying patients with ACS.

Out of 62 cases of single vessel disease the site of stenosis was the middle segment in right dominance (47.1%) and co dominance (50%) but proximal segment in left dominance (75%) (Fig. 4). More than 90% of the coronary blood flow enters the left coronary artery if it is the dominant artery, producing high shear stress at its bifurcation. A short LCA main trunk would maximize this high shear stress at its bifurcation and a study has considered this anatomic variation as a risk factor in developing coronary atherosclerosis [12].

CONCLUSION

Single vessel disease was found to be common in all types of dominance when compared to double vessel or triple vessel diseases. The Anterior Inter ventricular artery was the most common vessel involved in all types of dominance followed by RCA and circumflex artery.

In the single vessel disease, the proximal segment of the vessel was more commonly affected in left dominance; the middle segment was more commonly involved in right dominance and co dominance.

In double vessel diseases LAD and RCA were more commonly involved in all types of dominance. Further studies on coronary arteries in a greater number of angiograms of patients with CAD may give more conclusive information of the association between the two entities.

Limitation: Probably the most important limitation of this study was its relatively small patient

population, which results in a comparatively small group of patients with a left dominant coronary artery circulation. Because of the small patient groups among patients with significant CAD, statistically significant difference was not observed, presumably due to insufficient power. Larger studies are needed to elucidate the relationship between significant stenosis and the dominancy of the coronary circulation.

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Conflicts of Interests: None

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