# The relation between left ventricular hemodynamics and severity of atherosclerotic coronary artery disease

Thesis

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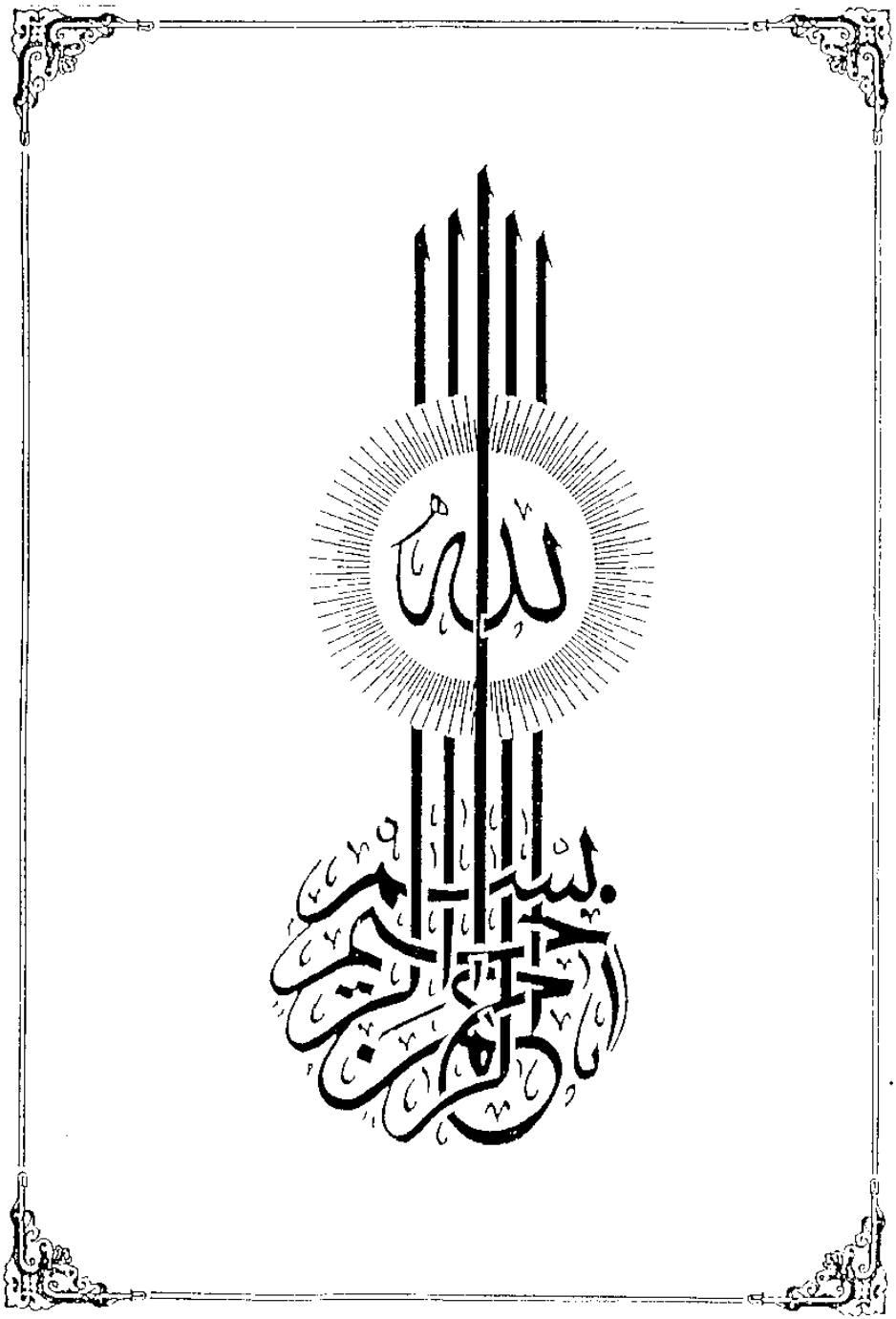

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# *INTRODUCTION AND AIM OF THE WORK*

## INTRODUCTION and AIM of WORK

The severity of atherosclerotic coronary artery disease is not always proportional to the severity of altered left ventricular function. Obviously, the good outcome of surgical grafting of diseased coronary arteries is directed towards two major goals, aleviation of chest pain and improvement of left ventricular function.

The common nomenclature relating the severity of disease by the number of vessels affected is not always correct.

A left main stem lesion of 60% or a proximal LAD lesion of 70% before the first septal perforator is perhaps more severe than a 3-vessel disease in the distal segments (6).

It is logic to state the best way to determine the severity of disease, is to evaluate the myocardial blood flow in toto or in the regional area suspected for ischaemia. Unfortunately, determination of myocardial blood flow is tedious, needs elaborate technique and quite a competent laboratory.

So many patients are rejected for coronary bypass grafting on grounds of a poor left ventricular function knowing that the latter is primarily due to a severe yet graftable coronary artery lesion, so the patient should not be deprived of his chance of surgical correction.

The aim of this work is to study the severity of coronary artery disease in relation to the left ventricular hemodynamics in a trial to fortell the operability of a certain patient with coronary atheroselorotic artery disease.

# Review of Literature:

## RADIOLOGICAL ANATOMY of CORONARY ARTERIES

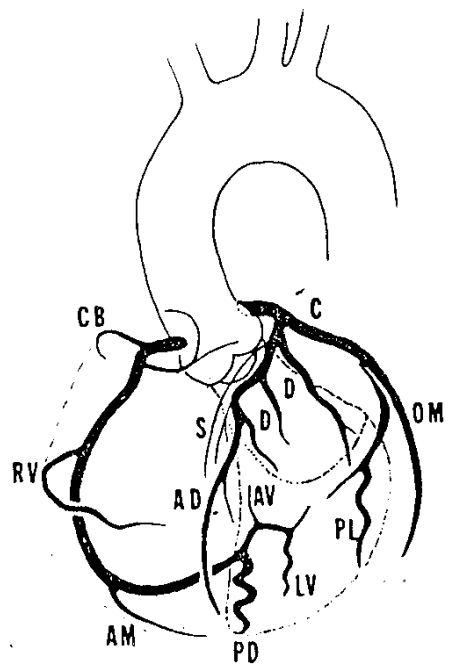
In order to describe the coronary arteries from the radiological point of view, there are three basic factors that should be kept in mind :

1- The position of the heart within the thorax.
2- The relationship between different radiological views used with the position of the heart within the thorax.
3- The general anatomy of coronary arteries & their normal variants.

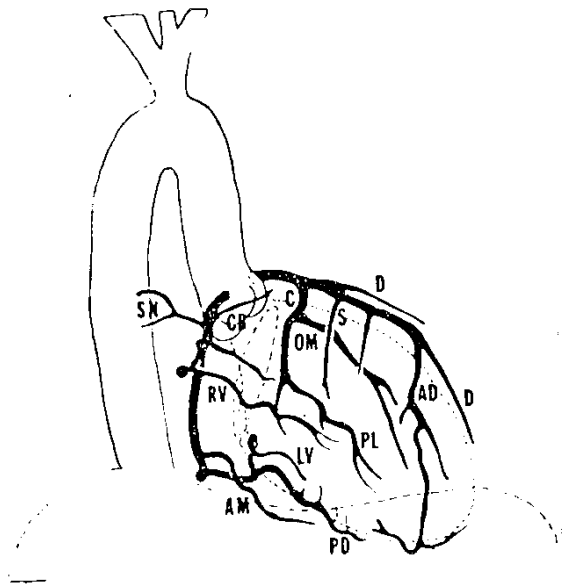
### The Right Coronary Artery :

It originates from the right sinus of Valsalva (usually its right half) which is on the lowest part of ascending aorta and is best seen in the left anterior oblique view (LAO) as illustrated in figure (1) in which it is directed toward the sternum, and then curves downward following the right atrioventricular groove toward the crux cordis (1). However, in the right anterior oblique view (RAO) as illustrated in figure (2) the change of direction is of acute angle and not smooth or shallow.

In 84% of cases it reaches the level of the crux cordis and gives rise to the posterior descending, left atrial, atrioventricular node, and left ventricular branches. In 12% it ends with the branch to the acute margin. In the remaining 4% of the cases, two posterior descending branches are




**Fig(1)** Coronary arteries in left anterior oblique view :LAO [After **Gensini** (1)]




Fig(2) Coronary arteiogram in right anterior oblique view RAO [After Gensini (1)]

present, one from the right and the other from the circumflex. The lumen diameter of the main stem usually exceeds 2-5 mm. The main stem is divided into three segments :

The proximal begins at the ostium and ends halfway between the ostium and the acute margin. Usually, but not always, an important right ventricular branch arises at this site.

The middle segment ends at the acute margin, and the distal segment goes from the acute margin to the posterior interventricular sulcus.

Branches of The Right Coronary Artery :

1- Conus branch : which is the first branch in 60% of patients. In the remaining 40% it originates as a seperate vessel 1 mm from the ostium of the main right coronary artery. It goes forward and upward, surrounding the pulmonary artery. In pathological cases it originates Vieussen's annules when it connects to a branch of the anterior descending artery.

2- The sinus node branch is the second branch (3). It goes backward and upward along the epicardium of the right atrium, to the sinus node. In 59% of cases, it arises from the right coronary artery, while in 39% it arises from the left circumflex. In the remaining 2% of cases, two sinus node branches are present, one from the right and the other

from the circumflex coronary artery. Actually the sinus branch divides into two distinct rami, one points upward and supplies blood to the sinus node, the other which runs posteriorly is essentially a left atrial branch.

3- The right ventricular branches (1). These vessels are variable in length and number and supply the right ventricle. Frequently one of these branches is more important than the others and arises at the junction of the proximal and middle segments of the right main stem.

The acute marginal artery is the most important and constant right ventricular branch. It arises from the right coronary artery just before or at the acute margin of the heart, it is directed toward the apex.

The length of the right ventricular branches varies significantly, and they may extend up to the anterior inter-ventricular sulcus, supplying collateral circulation to the anterior descending artery in case of disease.

In some hearts an important right ventricular branch arises almost at the origin of the right coronary artery, or even in a separte orifice in the right sinus of Valsalva.

4- The right atrial artery : originates at the level of the acute marginal branch but travels in the opposite direction toward the right border of the heart. James (4) has called

attention to a characteristic inverted U-curve formed by the right coronary artery at the level of the interventricular sulcus as it passes under the posterior descending vein. At this U-curve the right coronary artery terminates into its terminal branches.

5- The posterior descending branch : It is the most important branch of the right coronary artery which, with its septal branches, is the only source of blood supply to the postero superior wedge of the interventricular septum. Bianchi and Spalteholz (1) classify coronary circulation into "right preponderant" and "left preponderant", according to which artery crossed the crux. When both arteries reached the crux without crossing it, the circulation was considered balanced. Actually in 84% of cases, the posterior descending is a branch of the right coronary artery and in 70% of them, it runs along the posterior interventricular sulcus up to its midportion and even further, toward the direction of the apex. The posterior descending can be distinguished from the other branches by the fact that several short septals leave the posterior descending at a $90^{o}$ angle directed toward the thickness of the postero-superior wedge of the interventricular septum.

6- The AV-node branch (5) is characteristically a slender and very straight vessel which appears to run almost vertically in the left oblique view, directed toward the center of the heart shadow. It arises from the right coronary artery in

88% of cases.

7- The left ventricular branches : Usually the right coronary artery does not terminate with the posterior descending, even though this is the most important branch. Indeed, more than one branch originating just distal to the crux and runs along the posterior aspect of the left ventricle, supplying the diaphragmatic part of the free left ventricular wall.

8- Left atrial branch : is the most distal branch, which runs along the posterior atrio ventricular groove, curving upward from the crux cordis, superiorly, posteriorly, and away from the right coronary artery.

In a small percentage of cases, 3% the main stem of right coronary artery divides, even before reaching the acute margin, into two branches of nearly equal caliber. The superior and more centerally located one runs along the atrioventricular groove, reaches the posterior aspect of the heart and gives origin to the posterior descending branch. The inferior ramus, instead, runs diagonally along the anterior surface of the right ventricle to the acute margin in order to reach, again with an oblique path, the posterior aspect of the right ventricle.

Left coronary artery

The main stem of the left coronary artery emerges from