FUNCTIONAL SIGNIFICANCE OF CORONARY COLLATERALS IN ISCHAEMIC HEART DISEASE

ESSAY

Submitted for partial fulfilment of the

Master Degree in Cardiology

By

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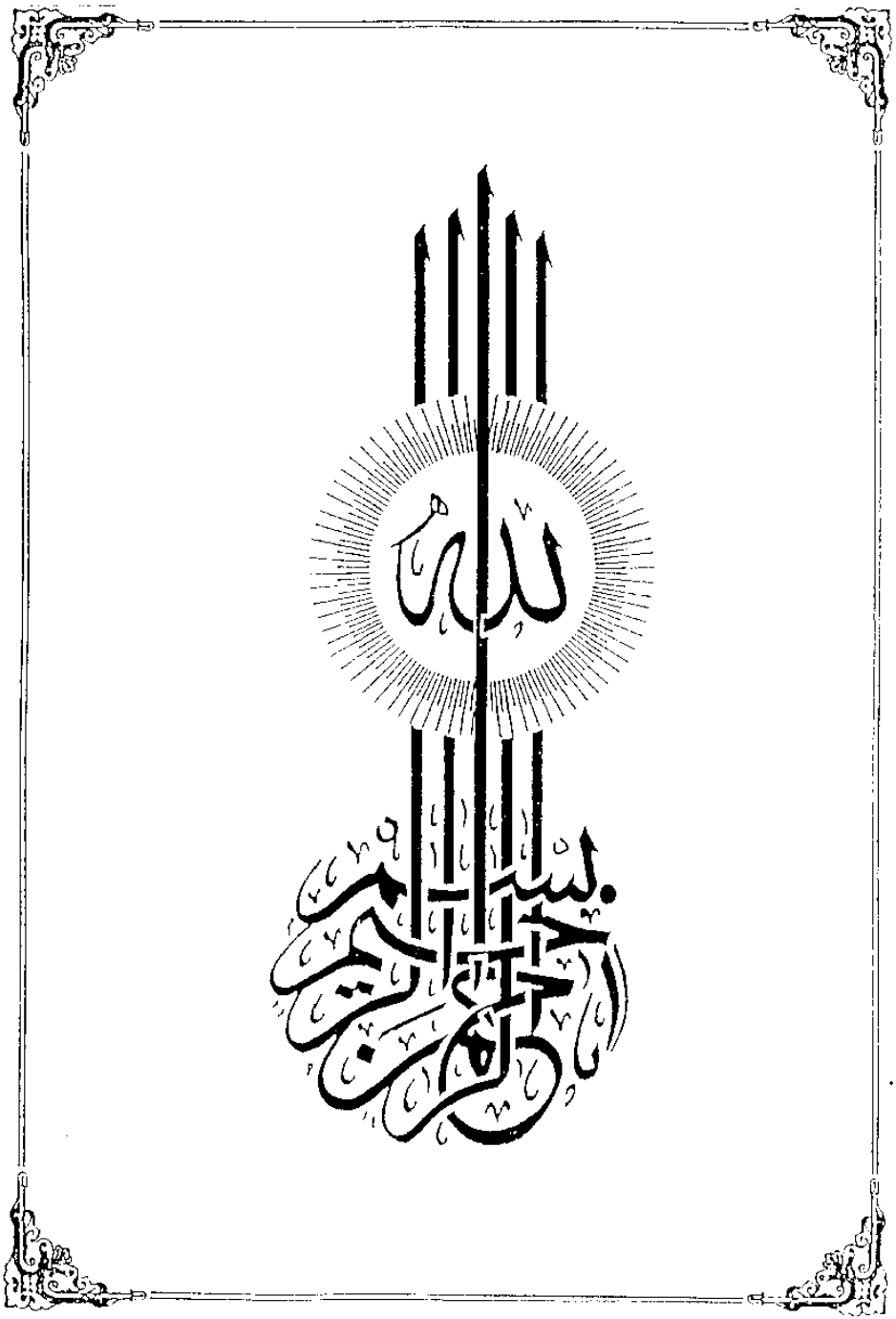
(1987)

ACKNOWLEDGEMENT

It is a great honour to express my deep gratitude and appreciation to Professor Dr. Mahmoud EL-Sherbini, Professor of Cardiology, Ain Shams University, for his help, advice and supervision.

I am indeed grateful to Dr. Adel EL-Etreby, Lecturer of Cardiology, Ain Shams University, for his generous guidance, faithful encouragement and sincere help.

Finally, I would like to thank my colleagues and staff of Cardiology and Cardio thorathic Surgery Departments, Ain Shams University for their kind help and guidance.



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ABBREVIATIONS

C x A = Circumflex Coronary Artery.

ECG. = Electrocardiogram.

IAVs. = Interconnecting Anastomotic Vessels.

Lt. = Left.

LV. = Left Ventricle.

MI. = Myocardial Infarction.

Rt. = Right.

RCA. = Right Coronary Artery.

VF. = Ventricular Fibrillation.

INTRODUCTION

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The existance of coronary collaterals has been well recognized for many years, since Ricard Lower who is given the credit for having first postulated the existance of these auxilliary vessels in 1869.

(Newman, 1981)

The use of selective coronary angiography is of great help in visualizing the site and the extent of these colatrtarals. However, by this technique only collaterals ranging between 100-200 in diameter located in the epicardium can be visualized.

(Donald and Randolph, 1980)

The exact function of these collaterals is still a matter of controversy and several researches dealt with this subject.

Recently, various investigations have been performed including radioneoclide and Thallium-201 imaging which is considered the most valuable method in assessing the coronary collateral circulation and myocardial perfusion.

(Pierre etal, 1979)

The importance of coronary collaterals in myocardial ischaemia has been proven. Besides, its

value against the development of transmural myocardial infarction, it also limits the infarcted size and decreases the incidence of life-threatening arrhythmias.

(Albert etal, 1982)

The aim of this work is to extensively review the functional significance of coronary collaterals in ischaemic heart disease.

ANATOMY OF CORONARY ARTERIES

Anatomy of the Coronary arteries.

It is important that the surgeon and the cardiologist be entirely familiar with coronary artery anatomy, both in its usual configuration and in its variations then they must be able to correlate this anatomy with pathological abnormalities in these vessels demonstrated by coronary arteriograms

The major coronary arteries follow predictable courses and are easily identified but because of the variability in both size and course of smaller coronary vessels, there is no standard nomenclature for smaller branches.

Right Coronary artery:-

* Origins:-

Normally originates from right sinus of valsalva at an angle of about 35 degree from the sternum with the aorta being the vertex of this angle.

The right coronary ostium may originate anywhere in the sinus of valsalva but usually in the upper half or upper third of the sinus.

(Ceballos etal, 1981)

* **Course:-**

During Catheterization the fat in the right atrioventricular sulcus can help indentifying the position of the right coronary artery.

The horizontal portion of the proximal right coronary artery lies beneath the right atrial appendage; then vertical portion of the artery courses down the atrioventricular groove to make a right angle turn along the diaphragmatic surface of the heart, in the left anterior oblique view the right coronary artery has the shape of the letter "C", this is allowing to devide it to proximal, middle and distal portions. At the crux of the heart, the distal right coronary artery devides into the posterior descending branch and posterior left ventricular branch.

(Stephen, 1984)

* **Branches:**

Right Coronary artery branches are easily identified in the right anterior oblique view.

1) In about 50% of cases the first branch from the right coronary artery is the right conus artery, which supplies blood to the out flow portion of the right ventricle, and potentially it is an important source

of collaterals to left anterior descending artery, forming a ring around the right ventricular infundibulm (the circle of vieussens) in the remaining 50% of cases the conus artery arise as separate branch from the aorta, so injection into the conus artery may have been mistakenly interpreted as occluded right coronary artery.

(Soto etal, 1977)

2) The sinoatrial artery is usually the 2nd important branch that arise from the proximal part of right coronary artery. it arises from the right coronary artery in 55% of cases and in the rest arise from the proximal circumflex coronary artery and passing through the interatrial septum. It terminates by encirculing the superior vena cava with anterior and posterior terminal branches.

3) Right ventricular branches from the middle portion of the right coronary artery which appear as sharp curves in the left oblique projections, usually one ventricular branch is larger than the others and supplies the major part of right ventricular free wall and occasionally it extends toward the apex to become accessory posterior descending artery which supplies septal branches. It is commonly referred to as acute marginal branch when the left anterior

descending artery is occluded. It also serves as an important collateral vessel to the anterior descending artery.

(Quentin etal, (1976)

4) In about 3% of cases, a small artery originates near the conus artery, which supplies the superior portion of the interventricular septum "right superior septal perferator artery" then goes deeply into the myocardium and ends with straight branches parallel to the interventricular septum.

(Bream etal, 1981)

5) The posterior left ventricular branch of the right coronary artery. It may be absent, with its territory supplied by distal branches of the left circumflex artery, or it may be so large that most of the left circumflex artery is vestigial, with the posterior left ventricular branch of the right coronary artery supplying the entire left ventricular lateral wall.

6) Posterior descending artery; which arises from the distal portion of the right coronary at the crux of the heart and courses in the interventricular groove toward the posterior apical part of the heart giving branches to the diaphragmatic or inferior; surface of both right and left ventricles as well as posterior septum branches to the interventricular surface.

This artery arises either from right coronary or left circumflex coronary artery.

The posterior descending artery may ascend around the apex to supply one third of the anterior interventricular septum.

7) The Av-nodal branch that arises from the distal portion of the right coronary artery and passes superiorly for about 1 C.C.

Termination of the right coronary artery is usually by giving posterior descending and posterior left ventricular branches. At the crux of the heart behind the origin of posterior descending artery; the right coronary forms a U-turn form in which 90% of cases arise the A-V nodal artery on either sides of it. The U-bend is present whether the posterior descending artery arise from right caronary or left circumflex arteries.

(Quentin etal, 1976)

Left Main Coronary Artery:-

The main left coronary artery originates from the left posterior sinus of valsalva and passes behind the base of the pulmonary artery. Varying in length from millimeters to 4 or 5 cm. It is shortest in persons where the left system is dominant or when

the circulation is balanced.

It may arise above the sinus from the aorta or rarely in or below the aortic valve.

(Quentin etal, 1976)

It usually does not taper; tapering when seen is a pathological finding. It is usually seen in the left anterior oblique view to disclose the full length of this artery and its ostium. Angled views help to show the ostium and bifurcation.

Branches:

Generally the left main coronary artery bifurcates into two branches, the left anterior descending artery and left circumflex coronary artery, rarely it trifurcates and the third branch is a large diagonal branch named the "ramus medianus".

A) **Left Anterior Descending Coronary Artery:-**

This vessel orginating from the bifurcation of the left main coronary artery. Rarely, it arises from a seperate origin of the aorta. It then passes in the anterior interventricular groove toward the apex of the heart, and it may leave the interventricular groove and crosses over the left ventricle.

(Quentin etal, 1976)