Role of Natural Arterial Conduits in Coronary Artery Bypass Graft Surgery

An Essay Submitted in Partial Fulfillment for
The Masters Degree in General Surgery

By

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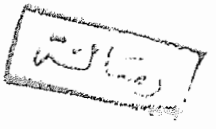

Faculty of Medicine
Ain Shams University
1992

قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا
عَلَّمْتَنَا إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ.

صَدَقَ اللهُ العَظِيمُ
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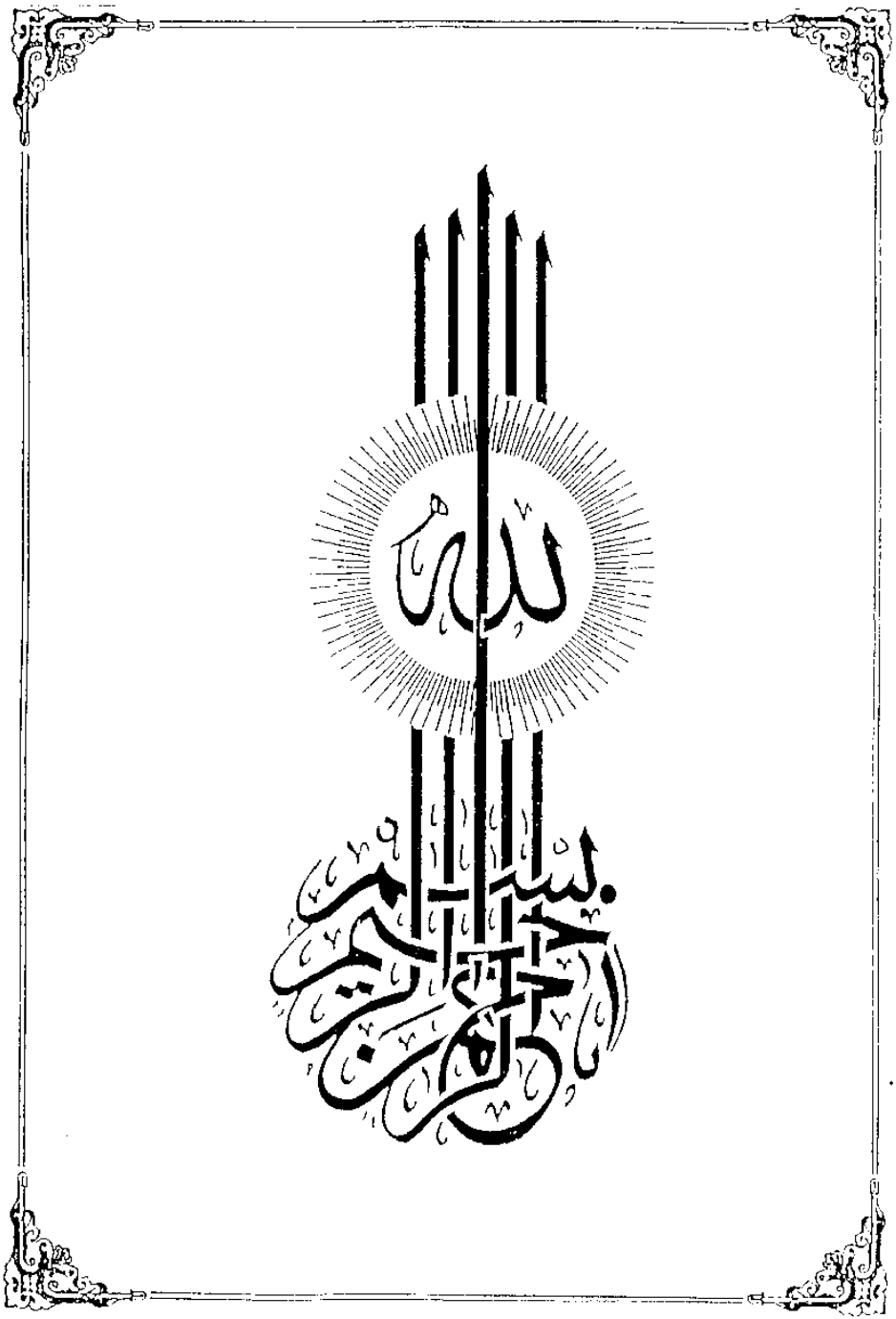

To My Father

To My Wife

No words are enough to express
my indebtedness except "I is mostly We"

IN MEMORIUM

It's with sadness and a feeling of great loss hat I record the death of my Father-In-Law.

His moral support was among his many ontributions to help me throughout my life.

Many thanks again is for his soul.

Sami Shaheen

CONTENTS

ACKNOWLEDGEMENT

I am greatly honoured to express my deep gratitude and thanks to my ***Prof. Dr. Mohamed Bassioni****, Prof. of Cardiothoracic Surgery, Ain Shams University, for his fatherly guidance, goodness and kindness during the supervision of this essay.*

A special thanks and respect to ***Assist. Prof. Dr. Tarek Zaghloul****, for his honest, helpful assistance and meticulous suggestions.*

I am also in great debt to ***Dr. Safwat Lotfy****, for his expert advice, constant support, kind supervision, and great help in performing this work.*

I will never forget my ***Prof. Dr. Ahmed Magdy*** *and* ***Dr. Salah Khattab*** *for their moral support and encouragement during this study.*

No wards can be sufficient to express my gratitude and indebtedness to ***Dr. Mahmoud Abdel Aziz****, for his interest in finishing this work and valuable suggestions.*

Finally, I would like to thank all the innocent colleagues with whom I worked and from whom I learned a great deal, hoping that this work might be of help in highlighting on the topic of coronary artery bypass grafting.

INTRODUCTION

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Like many procedures in cardiovascular surgery, surgical efforts has been made to improve coronary blood flow, but they were almost blind ones because of the lack of precise anatomic diagnosis.

In 1951, Vineberg, in Montreal, reported the direct implantation of an internal mammary artery into the myocardium. Howevery, the new blood flow was too small in amount, and limited in distribution to be effective.

In 1954, Murray and associates obviously were thinking about a direct surgical approach to coronary disease when they reported experimental studies of the anastomosis of the internal mammary artery to coronary. Shortly thereafter, Logmire and colleagues (1962), reported a series of patients in whom direct-vision coronary endarterectomy was carried out without cardiopulmonary bypass (CPB). Then, CPB began to be used to facilitate the operation when spencer and associates (1964) combined microsurgical anastomotic technqiues with cardiopulomary bypass and hypothermic cardiac arrest to achieve a controlled operative field and excellent long-term patency of IMA coronary grafts.

In May 1967, Fovoloro and Effear, at the Cleveland Clinic, began performing reversed saphenous vein bypass grafting, and described the technique of the operation in 1969. Even earlier, Garrett, at the same time working with Debakey in Houston, successfully performed a reversed saphenous vein coronary artery bypass graft to the left anterior descending artery in an unplanned way. At restudy seven years later, the vein graft was still open.

Progress was rapid after this early era, in 1968, Green reported the anastomosis of distal end of the left internal mammary artery to the anterior descending artery, using the dissecting microscope.

Because of the popularity of saphenous vein grafts in the early 1970s, the more complicated and technically demanding IMA, bypass did not emerge as a routine procedure, with few exceptions. In early 1980s. However, increased knowledge of limitations in long-term vein graft patency and serveral studies showing excellent IMA, changed the situation.

Although it became clear that IMA grafts should be used routinely, there is alternative conduits that have been investigated in order to find other adequate long-term grafts and there are comparative studies made between the morphologic condition of the left anterior descending artery and four other arterial conduits;

the internal mammary, right gasteroepiploic, inferior epigastric, splenic and radial arteries which is the subject of this work. Thus, within a very short time, the foundations were laid for the rapid spread throughout the world of the operation of coronary artery bypass grafting (Van Son et al., 1990).

ANATOMICAL CONSIDERATION

ANATOMICAL CONSIDERATION OF ALTERNATIVE ARTERIAL CONDUITS FOR CABG

INTERNAL MAMMARY ARTERY (IMA)

A major trend in coronary artery surgery in recent years has been the increasing acceptance of the internal thoracic artery not only as a suitable conduit but for, some centers, the conduit of choice for coronary revascularization (Loop et al., 1986).

The internal thoracic artery has the ability to increase in cross–sectional diameter as the demand for flow increases. Hence, with time, this artery as a bypass graft may assume a size much greater than its original size. One must be sure that the internal diameter of this vessel is 2.5 millimeters or greater, that there is free flow of more than 100 millimeters per minute and that there is no damage to the artery during operative preparation (Ochsner, 1986).

A histological pattern in the IMA is found that the proximal segment being elastomuscular, the midsegment being almost purely

elastic, and the distal segment, up to the first 1 to 2 centimeters of the superior epigastric and musculophrenic arteries, being elastomuscular again. The distal segment of the two latter arteries are purely muscular. The IMA shows the typical structure of an *elastic artery* with 9 to 12 elastic lamellæ in its media, including the internal and external elastic laminæ. Smooth muscle cells and collagen are dispersed between the elastic lamellæ (Van Son et al., 1990).

So, the IMA seems to be spared of the progressive internal thickening noted in coronary arteries with advancing age (Sims, 1983).

The vasa vasorum of the IMA supplies only the adventitia indicating that the IMA media is nourished from the lumen (Weschsler et al., 1992).

In addition, Van Son and co-workers, found that the thickness of intima plus media of IMA is 350 micrometers and usually 1.5–2.5 millimeters in diameter at the point of grafting. So, it may not deliver a sufficient blood flow for large coronary vessels. The surgeon must exercise judgement regarding the adequacy of IMA flow and which coronary artery is best suited for an IMA graft (Steen and Massa, 1991).

The internal mammary artery is a branch of the subclavian artery, usually arising opposite the thyrocervical trunk. It enters the thorax deep to the sternal end of the calvicle and subclavian vein. The phrenic nerve crosses from the internal to the medial aspect of the IMA near the IMA origin, at that point the pericardiophrenic branch of IMA joins the nerve. As the IMA descends parallel to the sternum it is related ventrally to the costal cartilages and fascia of the internal intercostal muscles. Dorsally it is covered by pleura in its most cranial portion, but caudal to the third rib it is also covered by fibers of the internal thoracic muscle. Its major branches include perforating vessels that extend anteriorly through the intercostal branches arising in the first five or six intercostal spaces that run laterally to anastomose with aortic intercostal vessels. A major bifurcation occurs between the fifth and seventh intercostal spaces, where the vessel divides into the musculophrenic and superior epigastric arteries (Loop and Bruce, 1986).