



Early Outcome of Complete versus Incomplete Revascularization in Patients with Multi Vessels Disease Undergoing Coronary Artery Bypass Grafting

Thesis

*Submitted for Fulfillment of M.Sc. Degree in
Cardiothoracic Surgery*

Presented By

***Akram Ahmed Mahmoud Elshafey**
M.B.B.CH*

Supervisors

Prof. Dr. Mohsen Mohamed Abdelkreem

*Professor of Cardiothoracic Surgery
Faculty of Medicine - Ain Shams University*

Prof. Dr. Yasser Mahmoud Elnahas

*Assistant Professor of Cardiothoracic Surgery
Faculty of Medicine, Ain Shams University*

Dr. Tamer Shahat Hikal

*Lecturer of Cardiothoracic Surgery
Faculty of Medicine, Ain Shams University*

***Faculty of Medicine
Ain Shams University
2019***

Acknowledgment

*First, all thanks are to **ALLAH** by the grace of whom, this work was possible.*

I am greatly indebted to my supervisors for their advice, cooperation, support and encouragement throughout the preparation of the work,

*I wish to acknowledge with considerable appreciation to **Prof. Dr. Mohsen Mohamed Abdelkreem**, professor of Cardiothoracic Surgery, Faculty of Medicine, Ain Shams University, for his great support and the tremendous effort he has done during this work,*

*I would like to express my profound gratitude & appreciation to **Prof. Dr. Yasser Mahmoud Elnahas**, Assistant Professor of Cardiothoracic Surgery, Faculty of Medicine, Ain Shams University, for suggesting & supervising this work, his constant support & kind guidance.*

*And also my great and deep thanks to **Dr. Tamer Shahat Hikail**, Lecturer of Cardiothoracic surgery, Faculty of Medicine, Ain Shams University for his great help, valuable instructions during this work and kind support in revising it.*

My thanks are also to my colleagues in Cardiothoracic Surgery Department and in different departments in Shibin Elkom Teaching Hospitals for their help.

Finally, I would like to thank my Mother, my sister and my brother for their great care & help.

Akram Elshafey

2019

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قالوا

لسبب أنك لا تعلم لنا
إلا ما علمتنا أنك أنت
العليم العظيم

صدق الله العظيم

سورة البقرة الآية: ٣٢

List of Contents

Title	Page No.
List of Tables	i
List of Figures	ii
List of Abbreviations	iv
Introduction	1
Aim of the Work.....	10
Review of Literature	
☞ Anatomy and Physiology of the Coronary Arteries	11
☞ Acute Coronary Syndrome (ACS)	21
☞ Revascularization of Coronary Arteries	47
Materials and Methods	66
Results	75
Discussion	92
Summary	98
Conclusion and Recommendations	101
References	103
Arabic Summary	—

List of Tables

Table No.	Title	Page No.
Table (1):	Canadian Cardiovascular Society (CCS) classification of Angina pectoris	23
Table (2):	Definitions of complete revascularization ^[65]	61
Table (3):	Socio-demographic characteristics of studied groups	75
Table (4):	Clinical & past history of the studied groups.....	76
Table (5):	Laboratory parameters of the studied groups.	77
Table (6):	Objective diagnostic tests (preoperative data) of the studied groups.....	78
Table (7):	Comparison between the two studied groups regarding intra operative data.	79
Table (8):	Comparison between the two studied groups regarding post-operative data.....	82
Table (9):	Comparison between pre- & post- LVEF the two studied groups.	86
Table (10):	Association between post-operative data among studied groups & their socio-demographic characters.	87
Table (11):	Association between hospital mortality among studied groups & their socio-demographic characters.	89
Table (12):	Association between hospital mortality among studied groups & their clinical history.	91

List of Figures

Fig. No.	Title	Page No.
Figure (1):	Coronary arteries of the heart	13
Figure (2):	Anterior view of coronary arteries	16
Figure (3):	Types of acute coronary syndrome.....	24
Figure (4):	Blockage of coronary artery by atheroma	26
Figure (5):	Revascularization Strategy in UA/NSTEMI	42
Figure (6):	Organization of ST-segment elevation myocardial infarction patient pathway describing pre- and in-hospital management and reperfusion strategies within 12 h of first medical contact	44
Figure (7):	Coronary revascularization	47
Figure (8):	Barriers to achieving complete revascularization	62
Figure (9):	Coronary artery bypass	64
Figure (10):	Cannulation of the heart (1 & 2 show arterial & venous cannulation – (3) shows cardioplegia line.....	70
Figure (11):	Venous grafts attached to the aorta.	71
Figure (12):	Comparison between the two studied groups regarding bypass time.....	80
Figure (13):	Use of support Inotropes among studied groups.....	80
Figure (14):	Comparison between the two studied groups regarding cross clamp time (min).....	81
Figure (15):	Mean mechanical ventilation duration (hours) among studied groups.	83
Figure (16):	Mean ICU duration (hours) among studied groups.....	83
Figure (17):	Mean hospital stay duration (days) among studied groups.	84

List of Figures (Cont...)

Fig. No.	Title	Page No.
Figure (18):	Mean LVEF post % among studied groups.....	84
Figure (19):	Postoperative ECG among studied groups.	85
Figure (20):	Comparison between pre- & post- LVEF among two studied groups.....	86
Figure (21):	Relation between mechanical ventilation duration(hours) and the age among two studied groups.	88
Figure (22):	Relation between LVEF post % and the age among two studied groups.....	88
Figure (23):	Hospital mortality among two studied groups.....	90

List of Abbreviations

Abb.	Full term
ACS	<i>Acute Coronary Syndrome</i>
AHA	<i>American Heart Association</i>
AMI	<i>Acute Myocardial Infarction</i>
AV	<i>Atrio-Ventricular</i>
BARI	<i>Bypass Angioplasty Revascularization Investigation</i>
BMS	<i>Bare-metal stent</i>
CABG	<i>Coronary Artery Bypass Graft</i>
CAD	<i>Coronary Artery Disease</i>
CASS	<i>Coronary Artery Surgery Study</i>
CBC	<i>Complete Blood Count</i>
CCS	<i>Canadian Cardiovascular Society</i>
CHF	<i>Chronic Heart Failure</i>
CK	<i>Creatinine Kinase</i>
CKD	<i>Chronic Kidney Disease</i>
COPD	<i>Chronic obstructive pulmonary disease</i>
CR	<i>Complete Revascularization</i>
CRI	<i>Chronic renal insufficiency</i>
cTn	<i>cardiac troponin</i>
DAPT	<i>dual antiplatelet therapy</i>
DES	<i>Drug Eluting Stent</i>
DM	<i>Diabetes mellitus</i>
ECG	<i>Electrocardiography</i>
EMS	<i>Emergency Medical Services</i>
FFP	<i>Fresh frozen plasma</i>
GDMT	<i>Guideline Determined Medical Therapy</i>
GP	<i>Glycoprotein</i>

List of Abbreviations (Cont...)

Abb.	Full term
<i>H.....</i>	<i>Hour</i>
<i>hs-cTn.....</i>	<i>Highly sensitive cardiac troponin</i>
<i>ICU.....</i>	<i>Intensive care unit</i>
<i>IR</i>	<i>Incomplete Revascularization</i>
<i>IV</i>	<i>Interventricular</i>
<i>JVP</i>	<i>Jugular Venous Pressure</i>
<i>LAD.....</i>	<i>Left Anterior Descending</i>
<i>LCA.....</i>	<i>Left Coronary Artery</i>
<i>LCX</i>	<i>Left Circumflex</i>
<i>LFT</i>	<i>Liver Function Test</i>
<i>LIMA</i>	<i>Left internal mammary artery</i>
<i>LV</i>	<i>Left Ventricle</i>
<i>MACCE.....</i>	<i>Major Adverse Cardiac and Cerebrovascular Event</i>
<i>Mg</i>	<i>Miligram</i>
<i>MI.....</i>	<i>Myocardial Infarction</i>
<i>MIDCAB</i>	<i>Minimally Invasive Direct Coronary Artery Bypass</i>
<i>Min.....</i>	<i>Minute</i>
<i>ng/mL</i>	<i>Nanogram / millimeter</i>
<i>N-STEMI.....</i>	<i>Non-ST-segment elevation myocardial infarction</i>
<i>NTG.....</i>	<i>Nitroglycerin</i>
<i>NYHA.....</i>	<i>New York Heart Association</i>
<i>PA</i>	<i>Posterior-anterior</i>
<i>PCI</i>	<i>percutaneous coronary intervention</i>
<i>pg/mL</i>	<i>picogram / milliliter</i>
<i>PTCA.....</i>	<i>Percutaneous Trans luminal Coronary Angioplasty</i>
<i>RBCs.....</i>	<i>Red blood cells</i>
<i>RCA.....</i>	<i>Right Coronary Artery</i>

List of Abbreviations (Cont...)

Abb.	Full term
<i>RCTs</i>	<i>Randomized Clinical Trials</i>
<i>RFT</i>	<i>Renal function test</i>
<i>RV</i>	<i>Right Ventricle</i>
<i>SIHD</i>	<i>Stable Ischemic Heart Disease</i>
<i>STEMI</i>	<i>ST-segment elevation myocardial infarction</i>
<i>TECAB</i>	<i>Totally Endoscopic Coronary Artery Bypass</i>
<i>TIMI</i>	<i>Thrombolysis in Myocardial Infarction</i>
<i>UA</i>	<i>Unstable angina</i>
<i>Wk</i>	<i>Weak</i>
<i>Yr</i>	<i>Year</i>

ABSTRACT

Background: There are conflicting data regarding the benefits of CR in patients with multivessel coronary artery disease.

Aim of the Work: to evaluate the impact of incomplete coronary surgical revascularization on patients with multi-vessels coronary heart disease in comparison to patients with complete coronary revascularization regarding early outcomes.

Patients and Methods: this prospective study was conducted at Cardiac Surgery Department; Shebin El-Kom Teaching Hospital, from January 2018 to November 2018 on 60 patients who underwent open heart surgery for coronary artery bypass grafting divided into: group A (30 patients) who underwent complete revascularization and group B (30 patients) who underwent incomplete revascularization .We excluded patients with other cardiac lesions as valvular lesions and patient with previous CABG surgery.

Results: the results of our study showed significant difference in survival rate between group A and group B. Also, improvement of left ventricular ejection fraction in patients who underwent complete revascularization, and there was a highly significant difference ($P < 0.001$) between two groups regarding cross clamp time, number of grafts done and use of inotropes.

Conclusion: complete revascularization is associated with lower rates of adverse outcomes and good prognosis.

Keywords: *Revascularization - Vessels Disease - Coronary Artery*

INTRODUCTION

Coronary artery disease remains the most common pathology with which cardiologists and cardiac surgeons are faced. In addition to the coronary anatomy, the clinical presentation and results of non-invasive studies of myocardial perfusion and function are necessary to characterize the pathophysiologic implications of the angiographic disease and its impact on prognosis and therefore to make a clinically appropriate recommendation ^[1].

The objective of coronary artery bypass grafting is to achieve complete revascularization. All significant stenosis affecting coronary artery vessels should be bypassed; ideally there should be good distal run-off ^[2].

Zimarino and colleagues in 2005 proposed a contemporary definition of 3 different types of revascularization as follows:

- 1) Complete anatomic revascularization, defined as treatment of all coronary artery segments >1.5 mm in diameter and $\geq 50\%$ diameter stenosis.
- 2) Incomplete anatomic but functionally adequate revascularization, defined as treatment of all coronary segments with $\geq 50\%$ diameter stenosis supplying viable myocardium.
- 3) Incomplete functional revascularization consequentially, defined as the inability to treat all coronary segments that supply viable myocardium and have a $>50\%$ diameter stenosis ^[3]

The Coronary Artery Surgery Study demonstrated that more complete revascularization (i.e. bypassing ≥ 3 vessels versus 1 or 2) was associated with improved survival among patients with triple vessel disease and severe preoperative angina, it has been perennially believed that complete revascularization is superior to incomplete revascularization in patients with multi-vessel disease undergoing coronary artery bypass grafting ^[4].

Predictors of incomplete revascularization include: unstable angina, diffuse disease or small vessels, inaccessible location, infarct territory and the number of lesions. In a study analysis of 140 patients, the right coronary artery was the most common artery not bypassed (52%), with 48% for the circumflex artery ^[4].

A diseased LAD territory was bypassed in all patients. The most common reasons for not bypassing the circumflex artery was small vessel and location, whereas reasons for not grafting the right coronary artery were small vessel and diffuse disease ^[5].

AIM OF THE WORK

The aim of this study is to evaluate of the impact of incomplete coronary surgical revascularization on patients with multi-vessels coronary heart disease in comparison to patients with complete coronary revascularization on early outcomes.

Chapter 1

ANATOMY AND PHYSIOLOGY OF THE CORONARY ARTERIES

Coronary arteries supply blood to the heart muscle. Like all other tissues in the body, the heart muscle needs oxygen-rich blood to function. Also, oxygen-depleted blood must be carried away. The coronary arteries wrap around the outside of the heart. Small branches dive into the heart muscle to bring it blood ^[6].

Why are the coronary arteries important?

Since coronary arteries deliver blood to the heart muscle, any coronary artery disorder or disease can have serious implications by reducing the flow of oxygen and nutrients to the heart muscle. This can lead to a heart attack and possibly death. Atherosclerosis (a buildup of plaque in the inner lining of an artery causing it to narrow or become blocked) is the most common cause of heart disease ^[2].

Anatomy of coronary circulation:

The coronary arteries, the first branches of the aorta, supply the myocardium and epicardium. The right and left coronary arteries arise from the corresponding aortic sinuses at the proximal part of the ascending aorta, just superior to the aortic valve, and pass around opposite sides of the pulmonary trunk. The coronary arteries supply both the atria and the ventricles as shown in **fig; 1** ^[6].