Major Adverse Cardiac Events (MACE) after Coronary Artery Bypass Grafting at Ain-Shams University Main Hospital

Thesis

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By

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DEDICATION

To my FATHER,

I have never sought a way, but I have found my Father before me there paving it for me. Thanks for inspiring my life, for being affectionate, kind and caring.

To my MOTHER,

A small word and few letters, but contains the greatest meanings of love, kindness, bestowal and sacrifice; rivers that are inexhaustible and do not dry, always flowing with a lot of sympathy and spiritual support. Thanks.

To my SISTER,

A gift to the heart, a friend to the spirit, a golden thread to the meaning of life. She is simply amazing.

Contents

List of Abbreviations

AF : Atrial fibrillation

AM : Acute marginal

AMI : Acute myocardial infarction

ARF : Acute renal failure

AV : Atrioventricular

CABG : Coronary artery bypass graft surgery

CAD : Coronary artery disease

CCU : Coronary care unit

CE : Coronary endarterectomy

CHD : Coronary heart disease

CHF : Congestive heart failure

COPD : Chronic obstructive pulmonary disease

CPB : Cardiopulmonary bypass

GCV : Great cardiac vein

HDL : High-density lipoprotein

IABP : Intra-aortic balllon pump

ICU : Intensive care unit

LITA : Left internal thoracic artery

IMA : Internal mammary artery

ITA : Internal thoracic artery

LAD : Left anterior descending

LCX : Left circumflex

LDL : Low-density lipoprotein

LM : Left main

LV : Left ventricular

LVEF : Left ventricular ejection fraction

MACE : Major adverse cardiac events

MCV : Middle cardiac vein

MI : Myocardial infarction

MICABG : Minimally invasive coronary artery bypass graft surgery

MIDCAB : Minimally invasive direct coronary artery bypass

OM : Obtuse marginal branches

OPCAB : Off-pump coronary artery bypass

PCI : Percutaneous coronary intervention

PDA : Posterior descending artery

PTCA : Percutaneous transluminal coronary angioplasty

RCA : Right coronary artery

SA : Sinoatrial

SCD : Sudden cardiac death

SMCs : Smooth muscle cells

SVG : Saphenous vein graft

TIA : Transient ischemic attack

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Introduction

Coronary artery disease (CAD) is a major health problem worldwide, and it is expected to be the leading cause of death by 2020. With advances in both coronary artery bypass graft (CABG) surgery and percutaneous coronary intervention (PCI), mortality from CAD has significantly decreased. Moreover, PCI or PCI with stenting and CABG are associated with a long-term safety profile and improving patient outcomes. However, the poor prognosis and high cost of medical care for patients with CAD impose a considerable burden on both their families and society. Therefore, identifying risk factors that affect the prognosis of patients undergoing revascularization is necessary. **(Ting et al., 2017)**

Coronary artery bypass grafting (CABG) is defined as "open-heart surgery in which a section of a blood vessel is grafted from the aorta to the coronary artery to bypass the blocked section of the coronary artery and improve the blood supply to the heart." (**Diodato et al., 2014)**

Coronary artery bypass graft surgery is recommended for patients with obstructive coronary artery disease whose

survival will be improved compared to medical therapy or percutaneous coronary intervention (PCI). In addition, patients with angina refractory to medical therapy may receive a recommendation for CABG if PCI cannot be performed. (**Sary et al., 2017)**

Although the fundamental basis of CABG is to reestablish perfusion to the myocardium, there are several different approaches to accomplish this goal. The first factor considered is the utilization of cardiopulmonary bypass or "on pump versus off pump." Initially, most cardiac surgeries were performed on a beating heart, but with the development of cardiopulmonary bypass and cardioplegia, most CABGs were performed on pump. (**Diodato et al., 2014)**

The use of cardiopulmonary bypass distinguishes cardiac surgery from other types of surgeries. It also introduces a unique set of potential postoperative complications. These include vasospasm, altered platelet-endothelial cell interactions, and a generalized inflammatory response due to blood contacting the synthetic surfaces of the bypass equipment. The result is low flow in the microcirculation of the heart, brain, and other organs, which may lead to organ dysfunction. **(Silvestry, 2017)**

Multiple conduits may be employed to establish cardiac revascularization. In the 2011CCF/AHA Guidelines for Coronary Artery Bypass Graft Surgery advocated the use of arterial grafts for anastomosis to the LAD. The LIMA is the vessel of first choice. IMAs usually are patent for many years postoperatively (10-year patency >90%) because of the fact that <4% of IMAs develop atherosclerosis, and only 1% have atherosclerotic stenosis of hemodynamic significance. (**Diodato et al., 2014)**

Reversed saphenous vein grafts (SVGs) are commonly used in patients undergoing CABG. Their disadvantage is a declining patency with time: 10% to as many as 25% of them occlude within 1 year of CABG; an additional 1% to 2% occlude each year during the 1 to 5 years after surgery; and 4% to 5% occlude each year between 6 and 10 years postoperatively. Therefore, 10 years after CABG, 50% to 60% of SVGs are patent, only half of which have no angiographic evidence of atherosclerosis. (**Diodato et al., 2014)**

Although the overall results of CABG have improved in recent years, revascularization of the heart is still associated with a risk of perioperative and postoperative

death and morbidity. Patients undergoing CABG are now older and a larger number have had previous myocardial infarction (MI), stroke, or heart surgery. Consequently, morbidity and mortality after CABG surgery is expected to increase despite procedural advances. **(Nalysnyk et al., 2003)**

Patients with a history of cardiovascular disease are at high risk of developing secondary major adverse cardiac events (MACE) and patients undergoing CABG maybe at higher risk of developing these major adverse cardiac events. Major adverse cardiac events are important causes of morbidity and mortality in CAD patients under-going CABG. The detection and treatment of the risk factors for MACE are critical to improve health and longevity. As expected, the traditional risk factors (e.g. age, sex, total cholesterol, low-density lipoprotein (LDL) cholesterol, high-density lipoprotein (HDL) cholesterol, hypertension, diabetes, and smoking). **(Ting et al., 2017)**

Aim of the Work

The incidence of Major adverse cardiac events (MACE) in patients after coronary artery bypass graft (CABG) varies widely across studies and patient populations, and this heterogeneity must be controlled when using the literature to indicate safety.

This study aims to define risk factors associated with the occurrence of MACE in patients undergoing isolated elective CABG at Ain Shams Main University Hospital, in the period between January 2014 and April 2016 and followed-up for a minimum of two years till April 2018; to report postoperative incidence of MACE in hospital and up to two years after surgery.

Review of Literature

Anatomy of the heart:

The human heart has a weight of approximately 250-300 g and a size similar to a closed fist. The heart is positioned in the thorax surrounded by a fibrous sac, the pericardium. The external layer of the heart tissue is called the epicardium and the innermost layer in connection to the ventricles the endocardium. The tissue between the two mentioned layers, is the myocardium; it is responsible for ventricular contraction and consists of muscular tissue.

The heart is divided into a left and a right side by the septal wall. Each side of the heart consists of two chambers, the atrium and the ventricle, separated by an atrioventricular (AV) valve: the mitral and the tricuspid valves on the left and right sides, respectively. **(Tortora et al., 2003)**

The left-side of the heart delivers oxygen-rich blood to the body (systemic circulation) passing through the aortic valve to the aorta, whereas the right-side pumps blood through the pulmonary valve and the pulmonary artery for an oxygen refill in the lungs (pulmonary circulation).