Peri-Operative Beta Blocker and Its Effect on Coronary Artery Bypass Graft Patients Outcome after Surgery

Thesis

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By

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List of Abbreviations

Abb.	Full term
AF	*Atrial fibrillation*
AV	*Atrioventricular*
CABG	*Coronary artery bypass graft*
CPB	*Cardio-Pulmonary Bypass*
ECG	*Electrocardiography*
Hgb	*Hemoglobin*
LAD	*Left anterior descending*
LCX	*Left circumflex artery*
OM	*Obtuse marginal*
PCI	*Percutaneous coronary intervention*
PDA	*Posterior descending artery*
POAF	*Post-operative AF*
POAs	*Postoperative arrhythmias*
RCA	*Right coronary artery*
SA	*Sinoatrial*
SO_2	*Oxygen saturation*
SP	*Septal perforator*

INTRODUCTION

Beta-adrenergic receptor blockers have been studied for minimizing the effects of catecholamines by blocking their activation of beta receptors. They are used to prevent or treat hypertensive crises, tachycardia, ischemic cardiomyopathy and arrhythmias. Several studies have shown the efficacy of such drugs in decreasing postoperative morbidity and mortality.

(Bosco and Braz, 2001).

It is proved that beta-adrenergic antagonists (β-blockers) attenuate the extent of injury to myocardium during periods of ischemia and reperfusion. The negative inotropic and chronotropic effects of these drugs are thought to have beneficial effects to the ischemic myocardium by reducing myocardial oxygen consumption, decreasing sympathetic tone, reducing myocardial usage of substrates, and stabilizing cell membranes ***(Bessho and Chambers, 2001).***

Beta-blocker therapy in the perioperative period has the potential to reduce perioperative cardiovascular complications such as myocardial ischemia, stroke and heart failure by neutralization of tachycardia and catecholamine induced hypertension. The function of ventricles can be improved by

early beta-blocker administration during Cardio-Pulmonary Bypass (CPB) ***(Jie et al., 2011)***.

Beta-blocker therapy should be maintained throughout the perioperative period to keep the desired drug effects and to prevent the risk of hyperactivity of the sympathetic nervous system with abrupt discontinuation of the drugs due to the up regulation of receptors ***(Stoelting et al., 2015).***

Aim of the Work

This study aimed to evaluate the benefit of perioperative beta-blocker therapy in improving the outcome of CABG surgery regarding intra- and postoperative arrhythmias and ventricular function.

REVIEW OF LITERATURE

Anatomical consideration and pathophysiology

Coronary circulation is the circulation that supply the heart muscle (myocardium). Coronary arteries supply oxygenated blood to the myocardium, and cardiac veins drain deoxygenated blood away. Insufficiency of coronary circulation can quickly cause myocardial infarctions, in which the heart muscle is affected and damaged by ischemia. The two main coronary arteries are the left main and the right coronary arteries originating from the aortic root (fig.1 and 2) ***(Longo et al., 2011)***.

The left main coronary artery supplies blood to the left side of the heart muscle (the left atrium and left ventricle). The left main coronary divides into branches:

1. The left anterior descending (LAD) artery branches off the left coronary artery and supplies blood to the front of the left side of the heart.

2. The left circumflex artery (LCX) branches from the left main coronary artery and encircles the heart muscle. This artery supplies blood to the lateral wall and back of the heart.

The right coronary artery (RCA) supplies blood to the right ventricle, the right atrium, the sino-atrial (SA) and atrio-ventricular (AV) nodes, which regulate the heart rhythm. The right coronary artery divides into smaller branches, including the right posterior descending artery (PDA) and the acute marginal artery. Together with the LAD, the RCA helps supply blood to the middle and septum of the heart. ***(Betts, 2013)***

Smaller branches of the coronary arteries include obtuse marginal (OM), septal perforator (SP), and diagonals.

Cardiac veins drain the deoxygenated blood from the heart muscle, these include the great cardiac vein, the middle cardiac vein, the small cardiac vein, the smallest cardiac veins, and the anterior cardiac veins. Cardiac veins drain blood with a poor level of oxygen and metabolites, from the myocardium to the right atrium. Most of the blood of the coronary veins returns through the coronary sinus ***(Fuster et al., 2001).***

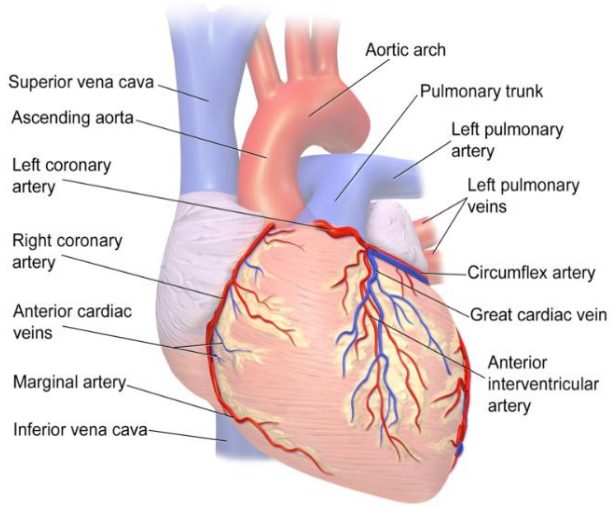

Figure 1: Anterior view of coronary circulation ***(Fuster et al., 2001).***

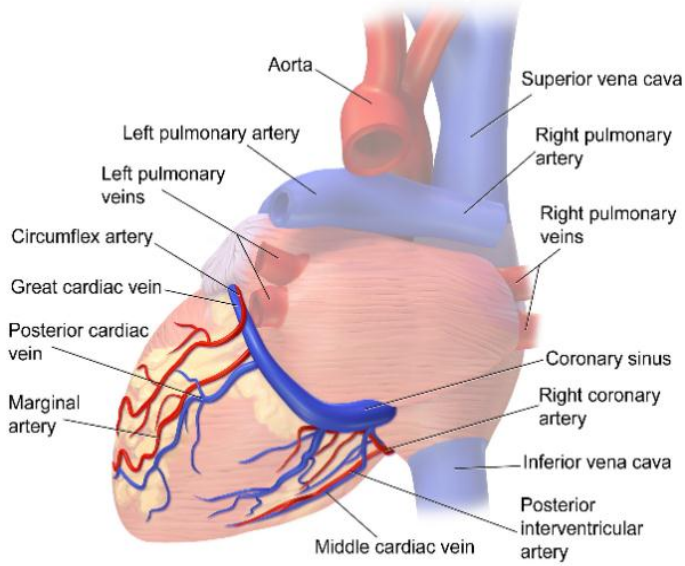

Figure 2: Posterior view of coronary circulation ***(Fuster et al., 2001).***

Pathophysiology of myocardial ischemia

Ischemic heart disease became one of the leading causes of morbidity and mortality in a worldwide epidemic.

Myocardial ischemia is characterized by an imbalance between myocardial oxygen demand and supply, causing cardiac dysfunction, arrhythmias, myocardial infarction, and sudden death.

Each coronary artery is critical for supplying the oxygenated blood to the highly active myocardium, the thickening of the arterial wall by an atherosclerotic plaque gradually encroaches on the arterial lumen and narrows the inner diameter of the artery, resulting in a limitation to blood flow thus compromising the blood supply to the myocardium (fig.3) ***(Ashley and Niebauer, 2004).***

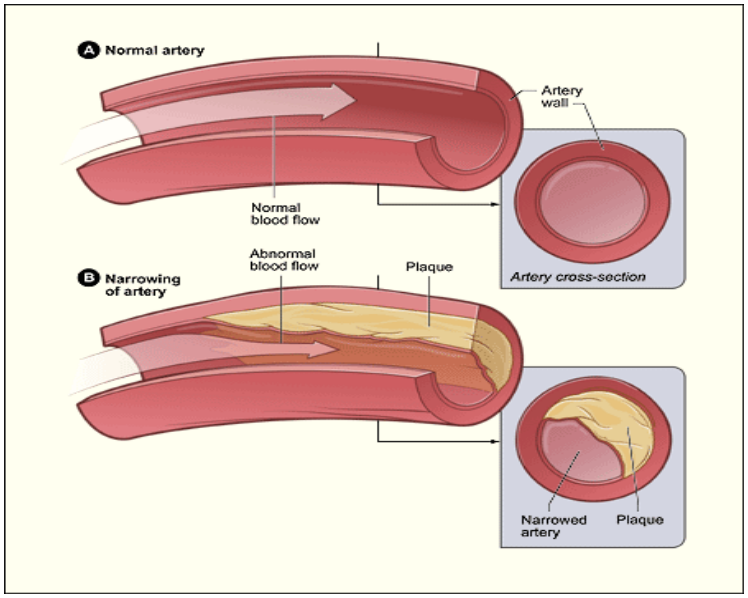

Figure 3: Effect of atherosclerosis on blood flow in the coronary artery ***(Ashley and Niebauer, 2004).***

Heart rate, myocardial contractility, and myocardial wall tension are the major determinants of myocardial metabolic activity and myocardial oxygen demand as any increases in the heart rate and myocardial contractile state result in increased myocardial oxygen consumption and increases in both afterload presented by the aortic pressure and preload presented by ventricular end-diastolic volume result in a proportional increase of myocardial wall tension and, therefore, increased myocardial oxygen demand ***(Werdan et al., 2016).***

Oxygen supply to any organ is determined by blood flow and oxygen extraction. Because the resting coronary venous oxygen saturation is already relatively low (approximately 30%), the cardiac muscles have a limited ability to increase its oxygen extraction during episodes of increased demand. Thus, an increase in myocardial oxygen demand must be provided by a proportional increase in coronary blood flow. In healthy people, the maximal coronary blood flow is roughly 4-6 times the resting coronary blood flow after full dilation of the coronary arteries ***(Boyette and Manna, 2018).***

Atherosclerosis is the most common cause of epicardial coronary artery stenosis and, hence, angina pectoris. Patients with a fixed coronary artery atherosclerotic lesion of at least 50% show myocardial ischemia during increased myocardial