Efficacy of use of Intraarterial Verapamil Through the Radial Sheath to Reduce Radial Artery Occlusion after Transradial Catheterization

Thesis

Submitted for Partial Fulfillment of
a Master Degree in ***Cardiology***

By

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2020

سورة البقرة الآية: ٣٢

Acknowledgments

First and foremost, I feel always indebted to ***Allah*** *the Most Beneficent and Merciful.*

I wish to express my deepest thanks, gratitude and appreciation to ***Prof. Dr. Ahmed Fathy Tamara****, Assistant Professor of Cardiology, Faculty of Medicine, Ain Shams University, for his meticulous supervision, kind guidance, valuable instructions and generous help.*

Special thanks are due to ***Dr. Ahmed Yehia Ramadan Salama****, Lecturer of Cardiology, Faculty of Medicine, Ain Shams University, for his sincere efforts, fruitful encouragement.*

I am deeply thankful to ***Dr. Shehab Adel Mohamed Kamal El Etriby****, Lecturer of Cardiology, Faculty of Medicine, Ain Shams University, for his great help, outstanding support, active participation and guidance.*

I'd like to express my deepest appreciation and greatest thanks to ***Dr. Mahmoud Mohamadin Ahmed Tantawy,*** *lecturer of Cardiology, MUST University, for his generous supervision and sincere support, direction and valuable guidance throughout the journey of this work.*

Sherif Mohamed Kamel Sharaf

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Abb.	Full term
HBA1C:	Hemoglobin A1C
ACC:	American Colleague of Cardiology
ACE:	Angiotensin-converting enzyme
AHA:	American heart association
ARB:	Angiotensin receptor blocker
CABG:	Coronary artery bypass grafting
SCAD:	Stable coronary artery disease
CCB:	Calcium channel blocker
ECG:	Electrocardiogram
ESLD:	End-stage liver disease
HBV:	Hepatitis B virus
HCV:	Hepatitis C virus
HIV:	Homan immunodeficiency virus
IMR:	Index of microcirculatory resistance
INR:	International normalized ratio
LAD:	Left anterior descending artery
LDL:	Low-density lipoprotein
LM:	Left main artery
LV:	Left ventricle
MI:	Myocardial infarction
NO:	Nitric Oxide
OM:	Obtuse marginal artery
PCI:	Percutaneous coronary intervention
PCSK9:	Proportion convertase subtilisin/ Kexin type 9

List of Abbreviations (Cont...)

Abb.	Full term
PET:	Positron Emission Tomography
PT:	Patient time
PTCA:	Percutaneous transluminal coronary angioplasty
PTT:	Patient thromboplarlin time
RCA:	Right coronary artery
RCT:	Randomized controlled trials
SCAD:	Stable coronary artery disease
STEMI:	ST-segment elevation myocardial infarction
TFA:	Transfemoral approach
TR band:	Terumo europe band
TRA:	Transradial approach
TTDE:	Transthoracic Doppler echocardiography

INTRODUCTION

Radial access has become the preferred route for performing coronary angiogram and interventions due to its safety ***(Archbold et al., 2004)***. Fewer access site complications, shorter hospital stay and patient comfort in terms of early ambulation are factors in favor of this approach over the traditional femoral route ***(Mitchell et al., 2012)***.

With the radial route, a meta-analysis found a 78% reduction in major bleeding complications as compared to the femoral route ***(Bertrand et al., 2012)***. In the RIVAL study the incidence of major vascular complications was 1.4% with the radial approach as compared to 3.7% in the femoral access group ***(Zankl et al., 2010)***.

The radial artery occlusion is the most common vascular complication after transradial cardiac catheterization. Despite TRA increasing acceptance, radial artery occlusion (RAO) continues to be one of the limitations of transradial access and potentially limits the radial artery as an access site in the future ***(Avdikos et al., 2017)***.

Several strategies have been used to decrease the incidence of RAO including the use of anticoagulation, use of intra-arterial nitroglycerine, use of smaller sheath, maintenance of patency during hemostasis, or shortening the duration of compression ***(Dharma et al., 2015)***.

It is known that Intra-arterial administration of vasodilating agents with different mechanisms of action (i.e., verapamil 2.5mg and nitroglycerin 200mic) prior to inserting the sheath has been shown to reduce the incidence and severity of radial artery spasm during the procedure ***(Parbhoo et al., 2014)***. Currently, there is no data whether vasoactive pharmacological therapy such as verapamil administered intra‐arterially at the end of the procedure may reduce the incidence of RAO.

AIM OF THE WORK

The main objective of this study is to evaluate whether administration of verapamil at the end of a transradial procedure may preserve the patency of the radial artery. It is hypothesized that the addition of verapamil at the end of a TRA procedure may preserve the patency of the radial artery, thereby reduce the incidence of RAO.

Chapter 1

STABLE CORONARY ARTERY DISEASE

Definition:

Stable coronary artery disease refers to a reversible supply/ demand mismatch associated with ischemia, a history of myocardial infarction, or the presence of plaque documented by catheterization or computed axial tomography angiography. Patients are considered stable if they are free of symptoms or their symptoms are controlled by medications or revascularization. It may be simply defined as syndrome of recurrent, transient episodes of chest pain reflecting demand-supply inadequacy ***(Montalescot et al., 2013).***

Etiology:

Cardiovascular risk factors, particularly high blood pressure. High blood pressure is a cause and consequence of epithelial tissue harm, atherosclerosis, microvascular transforming, rarefaction and interstitial fibrosis. Obesity and smoking may also be relevant. Importantly, many patients with SCAD do not have risk factors for vascular disease. In these patients, the etiology may involve a genetic abnormality, perturbations in neuroendocrine function (e.g. Dysregulation of the endothelial system), autonomic nervous system abnormalities, or natural changes, such as the menopause ***(Montalescot et al., 2013).***

Pathophysiology of the coronary circulation:

Epi-cardial arteries (diameter >500 μm) are predominantly capacitance vessels and offer minimal resistance to flow in the healthy state. The coronary microvasculature governs resistance to myocardial perfusion. Coronary pre-arterioles and arterioles (vessels <500 μm) contribute approximately 25% and 50% of coronary resistance, Myocardial ischaemia may result from pathophysiological processes affecting the epicardial artery, the microvasculature or both ***(Duncker et al., 2015).***

Anatomical abnormalities in the coronary circulation:

Anatomical abnormalities that assist the occurance of CAD include obstructive atherosclerotic coronary artery fistula, certain coronary artery bridges or aneurysms) should be considered ***(Mancini et al., 2013).***

Coronary microvascular disease may reflect anatomical abnormalities including microvascular remodelling (i.e., reductions in capillary luminal size) and number (i.e., rarefaction), and therefore increased microvascular resistance to myocardial blood flow (Poiseuille's law) ***(Mancini et al., 2013).***

Hypertrophic cardiomyopathy, which involves remodelling of intramural coronary arterioles ***(Mancini et al., 2013).***

Functional microvascular abnormalities:

Functional abnormalities may be considered as:

1- Enhanced vasoconstriction.

2- Impaired vasodilation secondary to endothelium-independent or endothelium-dependent mechanisms.

3- A combination of these problems. Disorders of coronary vasomotion include microvascular coronary spasm, impaired coronary artery vasorelaxation and endothelial dysfunction-related reduced myocardial blood flow. Various vasoactive substances maybe implicated

(Ong et al., 2012)

The coronary endothelium regulates vascular tone and myocardial blood flow via nitric oxide (NO)-dependent mechanisms ***(Duncker et al., 2015).***

Abnormal vasoconstrictive responses to acetylcholine infusion, consistent with impaired endothelial function, occur in patients with angina and SCAD. Abnormal endothelium-independent vasodilator function may involve resistance to NO, adenosine and prostacyclin ***(Ong et al., 2012).***

Diagnosis of stable coronary artery disease:

Non-invasive methods for detection of coronary artery function:

Traditional non-invasive tests may be normal in patients with coronary microvascular disease due to the absence of regional perfusion abnormalities typically seen in obstructive CAD. Myocardial perfusion scintigraphy has low spatial resolution, so it's relatively insensitive for detection of minimal perfusion abnormalities secondary to microvascular dysfunction. Stress transthoracic Doppler echocardiography (STDE) is typically performed in the left anterior descending, and is a cheap method of assessing flow velocity at rest and during maximal effort to estimate coronary flow but it's short on precision does not cover all of myocardial chambers ***(Rigo et al., 2003).***

The standard preferred investigation for estimation of myocardial blood flow is stress PET imaging, which permits quantitative flow derivation in mL/g/min. Clinically, PET-derived quantification of myocardial blood flow can assist in the diagnosis of diffuse and impaired coronary flow reserve, which is associated with increased risk of major adverse cardiac event. In real-world practice, the use of PET is limited by its availability, cost effective results and exposure to ionizing radiation ***(Murthy et al., 2012).***

Cardiac magnetic resonance (CMR) imaging holds the best credit as a preferred non-invasive imaging option.