Value of Post Myocardial Infarction Erectile Dysfunction as A Predictor of Underlying Peripheral Arterial Disease

Thesis

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Moheb Morad Sobhy

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List of Abbreviations

Abb.	Full term
ABI	*Ankle Brachial Index*
ACS	*Acute Coronary Syndome*
ALI	*Acute Limb Ischemia*
BMI	*Body Mass Index*
BP	*Blood Pressure*
CAD	*Coronary Artery Disease*
CLI	*Chronic Limb Ischemia*
CTA	*Computed Tomography Angiography*
CTn	*Cardiac Troponin*
CVD	*Cardio-Vascular Disease*
DEB	*Drug Eluting Balloon*
DES	*Drug Eluting Stent*
DSA	*Digital Subtraction Angiography*
DUS	*Duplex Ultrasound*
ED	*Erectile Dysfunction*
FGF	*Fibroblast Growth Factors*
GnRH	*Gondatropin-Releasing Hormone*
IC	*Intermittent Clauducation*
ICAM-1	*Intercellular Cell Adhesion Molecule 1*
IL	*Interleukin*
ILEF	*International Index of Erectile Function*
IPA	*Internal Pudendal Artery*
LBBB	*Left Bundle Branch Block*
LDL	*Low Density Lipoprotein*
LH	*Luteinizing Hormone*
MCP-1	*Monocyte Chemoattractant Protein-1*
M-CSF	*Macrophage- Colony Stimulating Factor*
MDCT	*Multi-Detector Computed Tomography*
MI	*Myocardial Infarction*

List of Abbreviations (Cont...)

Abb.	Full term

NO.....: Nitric Oxide
PAD.....: Peripheral Arterial Disease
PCI.....: Percutaneous Catheter Intervention
PDE5I.....: Phosphodiesterase-5 Inhibitors
PSA.....: Protein Specific Antigen
PSV.....: Peak Systolic Velocities
ROS.....: Reactive Oxygen Species.
SHIM.....: Sexual Health Inventory For Men
SMCs.....: Smooth Muscle Cells
TGF-β.....: Transforming Growth Factor Beta
TNF-α.....: Tumor Necrosis Factor Alpha
URL.....: Upper Reference Limit
VCAM-1.....: Vascular Cell Adhesion Molecule 1

INTRODUCTION

Acute myocardial infarction (MI) The term acute myocardial infarction (MI) should be used when there is evidence of myocardial necrosis in a clinical setting consistent with acute myocardial ischaemia. Under these conditions any one of the following criteria meets the diagnosis for MI:

- Detection of a rise and/or fall of cardiac biomarker values [preferably cardiac troponin (cTn)] with at least one value above the 99th percentile upper reference limit (URL) and with at least one of the following:

Symptoms of ischaemia, New or presumed new significant ST-segment–T wave (ST–T) changes or new left bundle branch block (LBBB), development of pathological Q waves in the ECG, Imaging evidence of new loss of viable myocardium or new regional wall motion abnormality, Identification of an intracoronary thrombus by angiography or autopsy[1].

Post myocardial infarction patients associated with low functional capacity, fatigue, and dyspnea significantly affecting their life quality, finally leading to decrease their occupational performance, economic problems, decrease independence, impaired sexual performance and altered roles in family and community[2].

Sexual performance is very important determinant of life quality as erectile dysfunction reduces the quality of life in patients with recent myocardial infarction by decreasing libido and sexual satisfaction[3].

Erectile dysfunction (ED) is very common in heart disease patients especially after acute myocardial infarction (AMI)[4.5.6].

Erectile Dysfunction (ED) can be defined as persistent inability to achieve and / or maintain a penile erection sufficient for satisfactory sexual performance[7].

Patient-centered questionnaires are widely used tools for the diagnosis of erectile dysfunction (ED) and the assessment of ED treatment efficacy, most commonly used ED-related questionnaires, including the International Index of Erectile Function (IIEF) which also known as Sexual Health Inventory for Men (SHIM)[8].

Erectile dysfunction (ED) has been linked as a potential early indicator of both CAD and Peripheral arterial disease (PAD)[9].

Peripheral artery disease (**PAD**): manifests as insufficient tissue perfusion initiated by existing atherosclerosis. PAD is used to include all vascular sites other than coronary, cerebral vessels and aorta, including mainly lower extremity vessels.

Atherosclerosis in the peripheral arteries is a chronic, slowly developing condition causing narrowing of the arteries. Depending on the degree of narrowing at each vascular site, a range of severity of symptoms may occur, while many patients will remain asymptomatic throughout their life. Occasionally acute events occur, often associated with thrombosis and/or embolism and/or occlusion of a major artery[10.11].

PAD is typically diagnosed by finding an ankle-brachial index (ABI) less than 0.90, which is the systolic blood pressure at the ankle divided by the systolic blood pressure of the arm[12,13].

Erectile dysfunction (ED) is very common in heart disease patients after acute myocardial infarction (AMI). In addition to organic causes arising from atherosclerosis, psychological issues, such as fear of triggering a new AMI with intercourse or anxiety due to the post infarction situation, can contribute to the development of ED. The incidence of ED after myocardial infarction ranges from 38 to 78%[14]. Commonly prescribed medications such as beta-blockers, diuretics, digoxin, and lipid-lowering drugs may also be the cause of ED[15].

Polonsky et al. in (2009)[16] conducted study on 690 male patients (pts) who had been referred for stress testing, and were without known PAD were prospectively screened for ED and PAD, using the (IIEF) questionnaire, and ABI, respectively.

The study concluded that Men with ED were found to have significantly more PAD than men without ED (32% vs. 16%, $p<0.01$), and there was a stepwise increase in the prevalence of PAD with increasing ED severity (28% of men with mild ED, 33% with moderate ED, 40% with severe ED, $p<0.001$)[16].

The idea of our study is to assess the relation of erectile dysfunction in patients 6 months after acute myocardial infarction and within 12 months as a predictor of underlying peripheral arterial disease.

Aim of the Work

The aim of the study is to assess the value of Post MI erectile dysfunction as a predictor of underlying PAD.

Chapter 1
ATHEROSCLEROSIS

Atherosclerosis is a leading cause of mortality and morbidity in the western world. It has been recognized for over a century, and understanding of its pathogenesis has undergone many changes. Although the propensity for developing atherosclerosis is higher in men than in women, the incidence of atherosclerosis is on the rise in women as a result of dietary habits, smoking and mental stress. The disease tends to be more common in white than in black men[17].

Atherosclerosis is predominantly a disease of large- and medium-sized muscular arteries, and is characterized by endothelial dysfunction, vascular inflammation and the build up of lipids, cholesterol, calcium and cellular debris within the intima of the vessel wall[18].

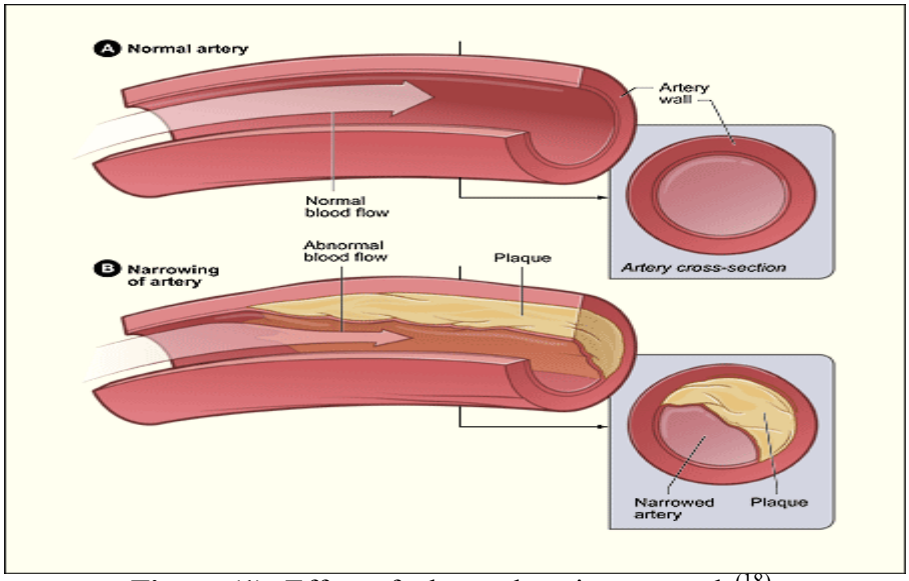

Figure (1): Effect of atherosclerosis on vessels[18].

Pathogenesis of atherosclerosis:

In contrast to the homeostasis that exists between the endothelium and smooth muscle cells (SMCs) of healthy vessels, *inflammatory activation* of vascular cells in diseased vessels corrupts their normal functions and favours processes that contribute to *the atherosclerotic plaque* development [19-24].

Consequences of inflammatory activation in vascular cells:

Endothelial cells:

- Disrupted permeability barrier
- Increased production of *inflammatory cytokines* (e.g. IL-1, TNF-α) – increases permeability
- Increased production of *leukocyte adhesion molecules* (e.g. VCAM-1, ICAM-1, E-selectin, P-selectin) – recruits more immune cells
- Decreased production of *vasodilatory molecules* (e.g. NO, prostacyclins)
- Decreased production of *antithrombotic molecules* (e.g. NO, prostacyclins)

Smooth muscles cells:

- Increased production of *inflammatory cytokines* (e.g. IL-1, TNF-α)
- Increased *extracellular matrix* synthesis
- Increased migration and proliferation into subintima