Target vessel revascularization of diabetic foot according to angiosomes

Thesis Submitted for Partial Fulfillment of Master Degree in general Surgery

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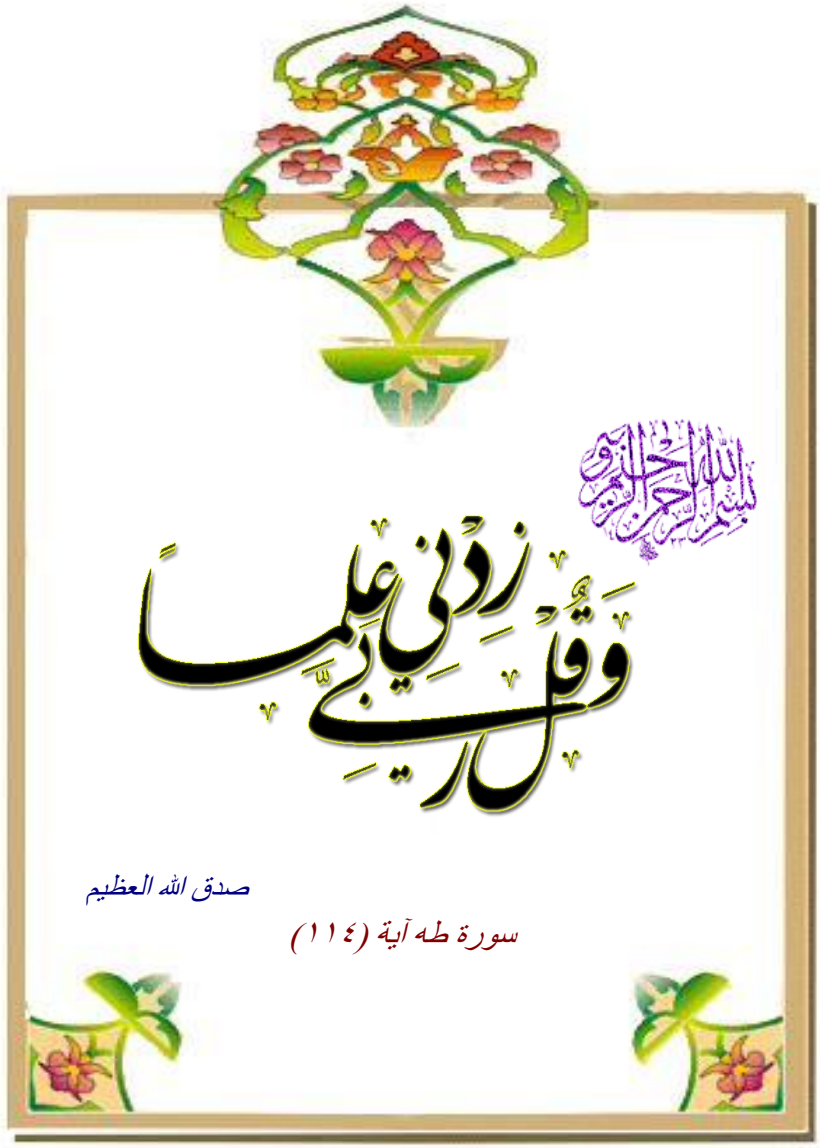

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CONTENTS

LIST OF ABBREVIATIONS

PAD : Peripheral arterial disease

CLTI : Chronic limb threatening ischemia

PAOD : Peripheral arterial occlusive disease

BMT : Best medical treatment

ABI : Ankle brachial index

CFA : Common femoral artery

SFA : Superficial femoral artery

PFA : Profunda femoris artery

ATA : Anterior tibial Artery

PTA : Posterior tibial Artery

SMC : Smooth muscle cell

PTFE : Polytetrafluoroethylene synthetic graft

HBO : Hyperbaric oxygen

TCOM : Transcutaneous oxygen measurements

PSV : Peak systolic velocity

VR : Velocity ratio

MRA : Magnetic resonance angiography

DSA : Digital subtraction angiography

IVUS : Intravascular ultrasound

CV : Cardiovascular

LEAD : Lower extremity artery disease

PG : Prostaglandins

CTA : Computed Tomographic Angiography

IHD : Ischemic heart disease

Rt : Right

Lt : Left
DR : Direct revascularization
IR : Indirect revascularization
CR : Combined revascularization
MAP **:** Mitogen-activated Protein
PKC : Protein Kinase-C
SHP-1 : Src Homology-2 domain-containing Phosphatase-1
BKA : Below knee amputation
NSAIDs : Non-steroidal anti-inflammatory drugs

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INTRODUCTION

Peripheral arterial disease (PAD) is a major world-wide health problem that affects 12%–14% of the general population. There are several risk factors that contribute for the development and progress of PAD including diabetes mellitus, hypertension, hyperlipidemia and smoking. **(Misra., 2012).**

Chronic limb threatening ischemia (CLTI) is defined as patients with ischemic rest pain or with ischemic skin lesions, either ulcers or gangrene. The term CTLI should only be used in relation to patients with chronic ischemic disease and symptoms that lasts for more than 2 weeks. **(Dormandy and Rutherford., 2000).**

CLTI due to infra-popliteal arterial disease is associated with a higher rate of limb loss. These patients have a higher mortality rates compared to patients whose limbs can be saved. Therefore, aggressive limb salvage attempts are justified in CLTI patients. **(Faglia et al., 20٠٧).**

The diagnosis of peripheral arterial occlusive disease (PAOD) is usually made clinically depending on medical history and ankle–brachial index (ABI) measurements. According to Fountaine classification, stage I PAOD is asymptomatic. Stage II is characterized by intermittent claudication. Rest pain and ulcerations are the clinical characteristics of stages III and IV PAOD, respectively. **(Schernthaner et al., 2009).**

There are different modalities of management of chronic lower limb ischemia. Firstly, best medical treatment (BMT) that includes regular exercise, smoking cessation, blood pressure control, good control of blood sugar, regulation of lipid level and pharmacologic medications that improve the peripheral blood flow. **(Dormandy and Rutherford., 2000).**

Surgical re-vascularization is another alternative for treating chronic lower limb ischemia patients. Infra-popliteal arterial disease is not usually suitable for surgical bypass. Angioplasty is an expanding era by dilatation of narrowed or occluded arterial segment with minimal invasion. **(Dormandy and Rutherford., 2000).**

Infra-popliteal angioplasty has acceptable rates of limb salvage in patients with CLTI with high risk for surgery. The procedure has low morbidity and mortality with lower costs compared with surgical revascularization. Aggressive angioplasty should be an option when primary amputation would be the other available one. **(Werneck and Lindsay., 2009).**

The main problem is to find a way to provide sufficient blood flow to the ischemic area. This may lead to either direct revascularization of the ischemic area or indirect perfusion depending on collaterals surrounding the diseased zone. The arterial connections between different zones of the foot may not be sufficient to ensure healing and to prevent amputation**. (Kret et al., 2014).**

All this debate arouse the need for an alternative strategy, called the angiosome model, which is target vessel reperfusion, based on the pioneering work of Taylor and coworkers who performed detailed dissections with injection of dye in the vessels. They demonstrated the fact that the body consists of angiosomes. An angiosome is a 3-dimensional blocks of tissue perfused and drained by specific arterial and venous bundles. **(Attinger et al., 2006).**

AIM OF THE WORK

The aim of this work is to discuss the clinical benefit in wound healing and limb preservation after infra-popliteal endovascular revascularization guided by an angiosome model of perfusion in the healing process of ischemic diabetic foot ulcers.

SURGICAL ANATOMY OF THE LOWER LIMB ARTERIAL SYSTEMS

The common femoral artery (CFA) enters the thigh by passing behind the inguinal ligament midway between the anterior superior iliac spine and the symphysis pubis. It divides 2 to 5 cm below the inguinal ligament into profunda femoris artery (PFA) and the superficial femoral artery (SFA) which ends at the opening of the adductor magnus muscle as popliteal artery. **(Richard et al., 2003).**

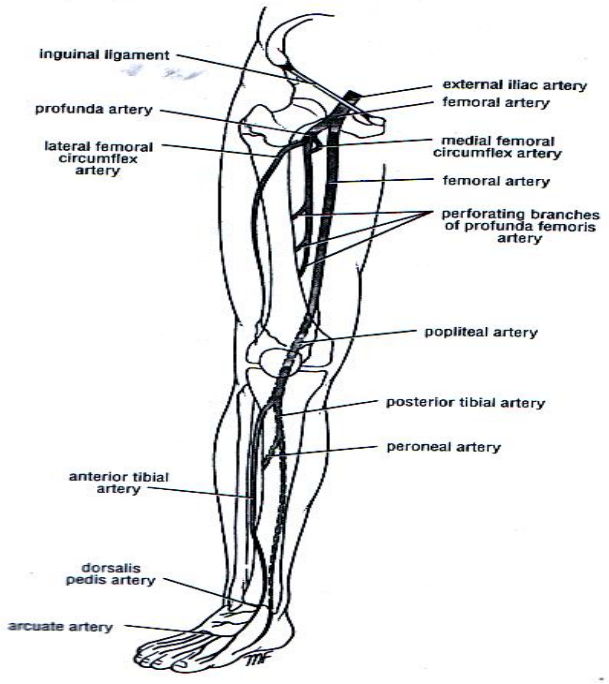

Fig. (1) Major arteries of the lower limb**.**
(Quoted from **Richard., 2003**).

The popliteal artery traverses the popliteal fossa from the opening in adductor magnus muscle and descends laterally to the distal border of popliteus muscle where it divides into the anterior tibial artery and tibioperoneal trunk. **(Gray., 2005)**.

The anterior tibial artery (ATA) supplies the anterior ankle and continues as the dorsalis pedis artery, which supplies the dorsum of the foot. It gives off the lateral tarsal artery and branches into the first dorsal interosseal artery and the arcuate artery supplying the 2 - 4 interosseal arteries**. (Clemens et al., 2010).**

The posterior tibial artery (PTA) divides into three branches. The calcaneal branch, which supply the medial and plantar portion of the heel. The medial plantar artery, supplying the medial, plantar part of the foot. The lateral plantar artery which supplies the lateral midfoot as well as the entire plantar forefoot. **(Clemens et al., 2010).**

The peroneal artery bifurcates into two branches. The anterior perforating branch, supplying the lateral anterior upper ankle. The calcaneal branch, supplying the lateral and plantar aspect of the heel**. (Clemens et al., 2010).**