ROLE OF ANGIOPLASTY IN INFRAPOPLITEAL ARTERIAL OCCLUSIVE DISEASE

Thesis

Submitted for the partial Fulfillment of the
Requirements of M.Sc. Degree in
General Surgery
By

Mohamed Hassan Abd-Elmawla
(M.B., B.Ch.)

Under the Supervision of

Prof. Dr. **MOHAMED HOSNY**
Professor of General & vascular Surgery,
Faculty of Medicine, Cairo University

Dr. **AYMAN REFAAT**
lecturer of General & Vascular Surgery,
Faculty of Medicine, Benisuef University

Dr. **AHMED GAMAL**
lecturer of General & Vascular Surgery,
Faculty of Medicine, Cairo University

Faculty of Medicine
Cairo University
2008

بسم الله الرحمن الرحيم

"ويسئلونك عن الروح قل الروح من أمر ربي
وما أوتيتم من العلم إلا قليلا"

صدق الله العظيم
(الآية: ٨٥، سورة الإسراء)

ACKNOWLEDGEMENT

"First of all, I am deeply thankful to GOD by the grace of whom this work was possible"

It is my pleasure to express my deepest gratitude and sincere thanks to Prof. ***Dr. Mohamed Hosny,*** *Professor of General&Vascular Surgery, Faculty of Medicine, Cairo University, for his generous concern, sincere supervision, valuable suggestions and cooperation, continuous advise and support saving no effort or time in reading each word in this work. To him I will always be grateful.*

My deepest gratitude, appreciation and thanks to ***Dr. Ayman Refaat*** *Lecturer of General and Vascular Surgery, Faculty of Medicine, Beni-suef University, for his sincere supervision, cooperation, continuous support throughout this work.*

The credit of bringing this work to light goes to ***Dr. Ahmad Gamal ELden,*** *Lecturer of General and Vascular Surgery, Faculty of Medicine, Cairo University. His continued help and guidance made it possible to bring this work to its final shape. No words can express my feelings towards him.*

.

Finally, I should thank my senior staff especially Assistant Lecturers, Dr.Khaled shawky and Dr.sheref mokhtar , my colleagues at the General Surgery Department, Faculty of Medicine, Cairo University and Beni-Suef University who helped me a lot throughout this work.

MOHAMED HASAN

July,2008

Contents

1- Introduction.
2- Review of literature.
- RELEVANT ANATOMY OF POPLITEAL AND INFRAPOPLITEAL ARTERIES:
a- Gross anatomy
b- Microscopic anatomy

- Aetiology:
I-Atherosclerosis.
II-Non atherosclerotic.
III-Uncommon arteriopathies.
- Clinical manifestations.

- Diagnosis of peripheral arterial occlusive disease:
A- Clinical evaluation.
B- Non invasive studies.
C- Invasive studies.
D- Alternative Imaging Modalities.

- Treatment of peripheral arterial occlusive disease.
1-Medical treatment.
2-Surgical intervention.
3-Endovascular intervention.
-Technique.
-Endovascular devices.
- Complications of PTA.
-Angioplasty of infrapopliteal arteries.

3- Patient and methods.
4- Results.
5- Discussion.
6- Summary and conclusions.

List of figures

Figure NO.	Subject	Page NO.
1,2,3	Anatomy of popliteal and infrapopliteal A.	6,7,8
4	Clinical picture of ischemic ulcerated foot	35
5	Ankle brachial pressure index measurement	42
6	Double and single wall puncture needle	64
7	Micropuncture needle and sheath setup	65
8	Guiding catheter and haemostatic valve	66
9	Guide wire shapes	68
10	Peripheral catheter shapes	69
11	Palmaz stent in deployed and undeployed state	71
12	Comparison of stent reconstruction.	72
13	Expansion of Palmaz stent.	74
14	Wall stent	75
15	Cutting balloon angioplasty	95
16	No. of males and females.	108
17	Risk factors of atherosclerosis	109
18	Indication of intervention	110
19	Lesions positions.	112
20	Mean ABI in follow up.	113
21	TASC classification of patients	113

List of tables

Table NO.	Subject	Page NO.
1	Rutherford classification of PAD	31
2	Relations between APSV& arterial stenosis	44
3	Infrapopliteal TASC	58
4	American Heart Association guidelines	107
5	Patient demographics and co-morbidity	110
6	Clinical indications	111
7	Lesions positions.	112
8	Clinical improvement .	116

List of abbreviation

ABPI	**Ankle brachial pressure index.**
ABSV	**Ankle peak systolic velocity.**
ABPI	**Ankle brachial pressure index**
ACT	**activated clotting time.**
ANCA	**Antineutrophil cytoplasmic antibodies**
AT	**Anterior tibial.**
ACT	**activated clotting time.**
CFA	**Common femoral artery**
CLI	**Critical limb ischemia**
CE MRA	**Contrast enhanced MRA.**
CTA	**Combutarized tomography of angiography**
CAD	**Coronary arterial disease.**
CW Doppler	**continuous-wave Doppler.**
COPD	**Chronic obstructive pulmonary disease**
CRF	**Chronic renal failure.**
FDA	**Food and Drug Administration.**
HDL	**High density lipoproteains**
HLA	**Human leucocytic antigen.**

Hgb A1c level	**glycosylated hemoglobin level**
HMG CoA	**hepatic 3-methylglutaryl coenzyme.**
ICD,ACD	**The initial and absolute claudicating distance.**
LDL	**Low density lipoproteins**
MI	**myocardial infarction.**
MRA	**Magnetic resonance angiography.**
PAD	**Peripheral arterial disease.**
PVD	**Peripheral vascular disease.**
PT	**Posterior tibial.**
PVC	**polyvinyl choloride**
PTA	**Percutaneous transluminal angioplasty.**
RCT	**Randomized controlled trial.**
SES	**Sirolimus (rapamycin) eluting stent**
SFA	**Superficial femoral artery.**
SVS-ISCVS	**Society of Vascular Surgery– International Society for Vascular Surgery.**
TAO	**Thromboangiitis obliterans.**
TASC	**TransAtlantic Inter-Society Consensus.**
TcpO2	**The transcutaneous oxygen tension .**
VS-1	**visceral selective –1**
WHO	**World Health Organization.**

ABSTRACT

The number of percutaneous transluminal angioplasty (PTA) procedures performed in iliac, femoral, and popliteal vessels has increased several folds in the past decade. The practice of infra-popliteal PTA is likely to increase as more clinicians develop the skills, because it is perceived as a low-risk procedure with a potentially beneficial outcome, which does not jeopardize subsequent alternative treatment.

The most common and accepted indication for PTA of infrapopliteal vascular disease is in limb salvage patients with chronic critical limb ischemia (CLI) defined in the Rutherford Becker classification as categories 4,5, and 6 . This patient population often has limited surgical options. In addition even short-term patency rates can have the significant clinical benefits of limb salvage and wound healing.

Infrapopliteal percutaneous transluminal angioplasty (PTA) is currently indicated in patients with critical limb ischaemia (CLI). Patients with CLI are typically elderly with multiple co-morbidities and limited life expectancy and therefore, a procedure, which is minimally invasive with reduced morbidity and mortality but lesser long-term patency, may be more appropriate than a more invasive procedure with better long-term patency,so this thesis discuss role .of angioplasty in infrapopliteal arterial occlusive disease ,results values, and complications.

Key words:
-Infra-popliteal
-Occlusive disease
-Role of angioplasty

Introduction

Atherosclerosis of the peripheral vessels which causes peripheral vascular disease (PVD) is the most common cause of symptomatic stenosis in human vascular tree. The pathogenic mechanisms that lead to PVD are similar to those of coronary artery disease (CAD). The risk factors are also similar and include a positive family history, cigarette smoking, diabetes, hypertension, hyperlipidemia, advanced age, and physical inactivity**(Anand and Creager,2002).**

Therapeutic goals for PVD include relief of symptoms and preservation of organs and tissues, aggressive risk-factor reduction and pharmacologic treatments are the keystones in patient care. Once the affected luminal diameter is compromised by 75% or more, the risk of ischemia and limb loss becomes high. After this point, medical therapy, such as antiplatelet and vasodilators, become less effective, and revascularization becomes necessary. In the past, surgical revascularization has been performed with an acceptable risk ***(De Sanctis, 2001).***

The work of pioneers, such as Dotter and Gruntzig, has opened up a novel era of percutaneous revascularization with techniques such as percutaneous transluminal angioplasty (PTA) which are less invasive option in the management of PVD. Over the past 30 years, PTA has experienced steady growth and recently, it has become the first-line therapy for PVD. Increased emphasis on containing and reducing the healthcare expenditures has also enhanced the use of PTA (as compared with surgical procedures), which can be performed as a same-day procedure that saves overall costs ***(Garacic and Creager,2001)***.

Introduction

Infrapopliteal percutaneous transluminal angioplasty (PTA) is currently indicated in patients with critical limb ischaemia (CLI). It may be performed after femoral angioplasty or bypass surgery, to improve outflow and hence patency of the proximally treated segment. Patients with CLI are typically elderly with multiple co-morbidities and limited life expectancy and therefore, a procedure, which is minimally invasive with reduced morbidity and mortality but lesser long-term patency, may be more appropriate than a more invasive procedure with better long-term patency ***(Halperin ,2002).***

It is ideal for this group of patients who are high-risk surgical candidates. The improvements in guide-wire and catheter technology and recanalization techniques mean that very long stenoses or occlusions, and multiple lesions can be treated successfully. And so, at the current time, PTA is the treatment of choice for infrapopliteal occlusive disease; experience with the use of stents in this territory is increasing. ***(Rosenfield et al.,1996).***

PTA is a low-risk and minimally invasive procedure, which rarely compromises a later surgical procedure, and at the same time preserves the saphenous vein for coronary or lower extremity distal bypass surgery ***(Kalra et al ,2001).***

Repeated PTA, unlike repeated surgical bypass operations, can be easily performed in case of restenosis .For all these reasons, many vascular units now consider endovascular treatment as the first treatment option in critical limb ischaemia and reserve surgical revascularization for those where endovascular treatment has failed ***(Gray et al.,2003).***

Review of literature

Relevant anatomy of the popliteal and infrapopliteal segments

A-Gross anatomy:

The anatomic boundary separating the superficial femoral and popliteal artery is the adductor hiatus. From this opening in the adductor magnus, the popliteal artery coarses distally between the femoral condyles and passes deep to the soleus muscle, where the artery soon gives the anterior tibial branch. The popliteal artery divides into two separate bifurcations below the knee. The term “trifurcation” is a misnomer because the popliteal artery trunk divides into three separate branches in only 0.4% of cases ***(Bardsley and Staple,1970).***

The artery first bifurcates into anterior tibial and tibioperoneal branches between 3 and 7 cm below the knee joint. The second bifurcation occurs between 2 and 3 cm more distally, where the tibioperoneal trunk divides into posterior tibial and peroneal branches. The anterior tibial artery passes anterolaterally and leaves the deep posterior fascial compartment through an opening in the interosseous membrane on the medial side of fibular neck. The artery enters the anterior compartment between the tibialis anterior and extensor digitorum longus muscles. It is joined early by the deep peroneal nerve, which enters the anterior compartment after winding around the lateral aspect of fibular head**(fig.1).** The neurovascular structures pass through the entire anterior compartment, coursing behind the extensor hallucis longus muscle in the distal extent to reach the dorsum of the foot.The tibioperoneal trunk lies in the deep posterior compartment on the posterior surface of the tibialis posterior muscle. Distal to the the bifurcation of the tibioperoneal trunk, the posterior tibial artery branch is accompanied by the tibial nerve and follows an oblique

medial course to reach the medial malleolus. In the distal half of the leg, these neurovascular structures lie on the posterior surface of the flexor digitorum longus muscle, just beneath the thin fascia of the deep posterior compartment**(fig.2).** The peroneal artery courses laterally towards the ankle and lies near the medial surface of the fibula. In the distal extent, the peroneal artery lies between the tibialis posterior and flexor hallucis longus muscle ***(Ouriel ,1994).***

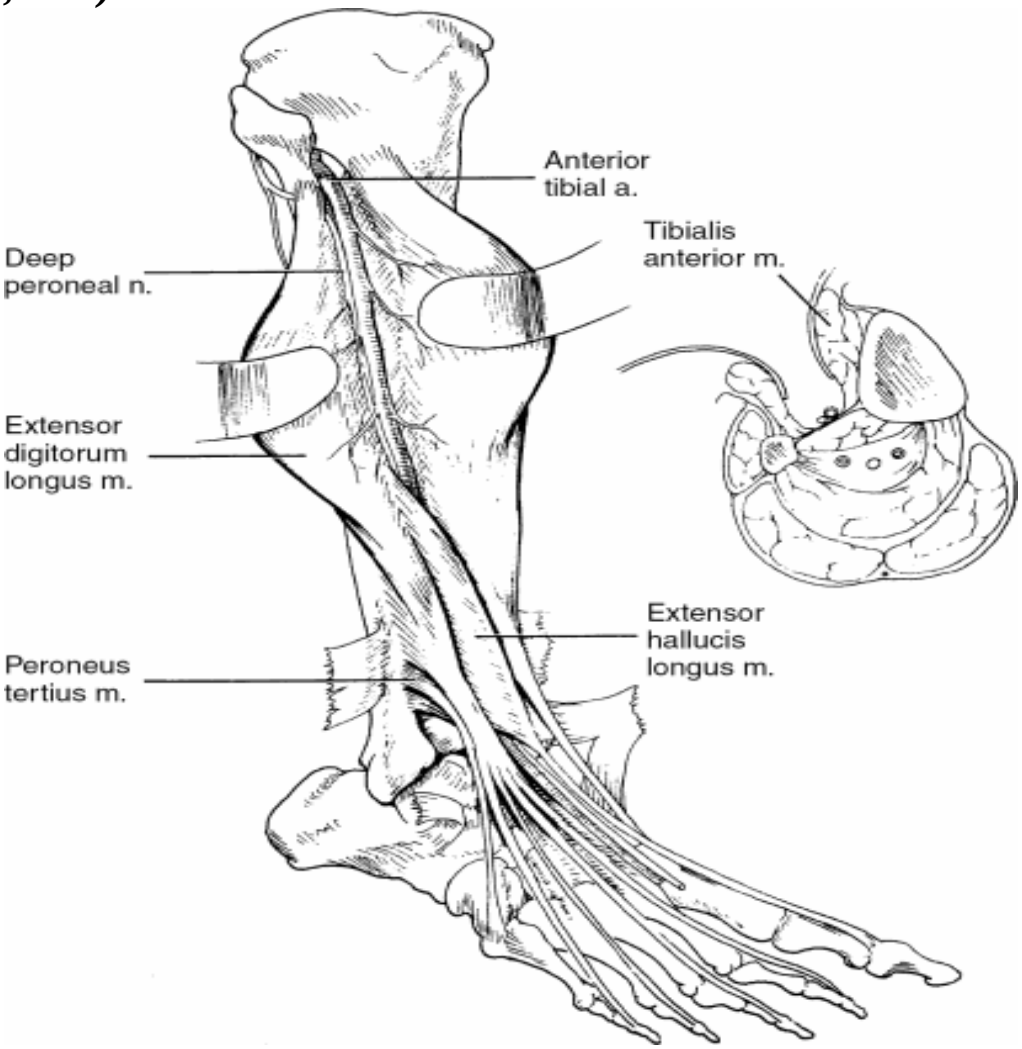

Fig. 1 : The anterior tibial artery and deep peroneal nerve lie between the extensor digitorum longus and tibialis anterior muscles in the anterior compartment(From Valentine RJ, wind GG, anatomic exposure in vascular surgery,2003, p481).