Percutaneous Transluminal Angioplasty of one vessel versus more than one vessel if lesions are feasible in infrapopliteal disease

Thesis
submitted for partial fulfillment of master degree
in general surgery

by

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2010

Acknowledgement

Thank to ***ALLAH*** *who fulfilled this work through me and arranged me to encounter those fatherly supervisor professors.*

Prof Dr. Hussin Khairy, *the figure which corresponds to paternity, charity, scientific attitude. Really I am very proud of working under his leadership.*

Prof Dr. Ahmed Taha, I feel very grateful to him for his continuous encourgeament, help, and kind guidance during preparation of this work. In deed he is the pattern I am looking forward to simulate in my future life in each and every aspect of his scientific attitude.

Dr Ahmed Sayed, who is the example of coordination between guidance, supervision, extreme of donation, kindness. This work could not be presented without his help and guidance.

Finally I would like to thank ***my mother*** *who helped me a lot in my life and did everything just to make me happy. I wish she was here beside me but…* ***God bless her*** *.*

I would like to thank everyone who encouraged and helped me during the preparation of this work especially my wife, my sons" Nour and Badr" and my father.

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List of Abbreviations

Abbrev.	Meaning
ABI	Ankle Brachial Index
ABPI	Ankle Brachial Pressure Index
ACE	Angiotensin Converting Enzyme
BM-MNC	Bone Marrow Mononuclear Cells
CAPRIE	Clopidogrel Versus Aspirin In Patients At Risk Of Ischemic Events
CB	Cutting Balloon
CDI	Color Duplex Imaging
CEMRA	Contrast Enhanced Magnetic Resonance Angiography
CLI	Critical Limb Ischemia
CTA	Computed Tomography Angiography
CTO	Chronic Total Occlusion
DSA	Digital Subtraction Angiography
EPCs	Endothelial Progenitor Cells
FGF	Fibroblast Growth Factor
HDL	High Density Lipoprotein
LACI	Laser Angioplasty For Critical Limb Ischemia Trial
LDL	Low Density Lipoprotein
LMWH	Low Molecular Weight Heparin
MIC	Minimal Inhibitory Concentration
MRA	Magnetic Resonance Angiography
MRSA	Mecithilin Resistant Staph. Aureus
PAD	Peripheral Arterial Disease
PTA	Percutaneous Tranluminal Angioplasty
PTFE	Poly Tetra Fluoro Ethylen
RAVE	Regional Angiogenesis With Vascular Endothelial Growth Factor
SFA	Superficial Femoral Artery
TACT	Therapeutic Angiogenesis Using Cell Transplantation
TASC	Trans Atlantic Inter-Society Consensus
TBPI	Toe Brachial Pressure Index
TcPO2	Transcutaneous Oxygen Tension
VEGF	Vascular Endothelial Growth Factor
VRE	Vancomycin Resistant Enterococci

ABSTRACT

Patients with severe critical limb ischemia (CLI) due to tibial disease are often poor candidates for surgical revascularization and frequently end up with a lower limb amputation. Tibial angioplasty offers a minimally invasive alternative for limb salvage in this patient population. **Aim of the study** was to compare the results of angioplasty of one vessel versus more than one vessel in patients with CLI due to tibial disease. **Methods**: we retrospectively reviewed all consecutive patients with tibial disease with no concomitant proximal lesions who were treated by angioplasty. A total of 48 procedures in 48 patients (29 males and 19 females; mean age, 63.2 ± 10.5 [SD] years) were evaluated. **Results**: limb salvage rate was 85.4%. A major amputation was needed in 3 limbs (1 below-knee amputation and 2 above-knee amputations). 3 patients (6.3%) died during follow-up. **Conclusion:** In our selected patient population with ischaemic diabetic foot and isolated BTK lesions, limb salvage rate was the same in patients who had single vessel angioplasty and patients who had more than one vessel angioplasty.

Keywords:

Percutaneous Transluminal

Angioplasty of one vessel

Feasible in infrapopliteal disease

Introduction

Lower extremity occlusive disease may range from exhibiting no symptoms to limb-threatening gangrene. There are two major classifications developed based on the clinical presentations. The Fontaine classification uses four stages: Fontaine I is the stage when patients are asymptomatic; Fontaine II is when they have mild (IIa) or severe (IIb) claudication; Fontaine III is when they have ischemic rest pain; and Fontaine IV is when patients suffer tissue loss, such as ulceration or gangrene. The Rutherford classification has four grades (0-III) and seven categories (0-6). Asymptomatic patients are classified in to category 0; claudicants are stratified into grade I and divided in to three categories based on the severity of the symptoms; patients with rest pain belong to grade II and category 4; patients with tissue loss were classified in to grade III and categories 5 and 6 based on the significance of the tissue loss. These clinical classifications help to establish uniform standards in evaluating and reporting the results of diagnostic measurements and therapeutic interventions. The most recent classification on lower extremity atherosclerotic disease was based on morphological characters of the lesions. **(Norgren et al. , 2007)**

The treatment of critical limb ischemia (CLI) consumes a significant amount of health care resources. Amputation remains a common procedure and is likely to increase due to an aging population, increasing recognition of CLI and a recognized trend toward a higher occurrence of diabetes . **(Allie et al. , 2005)**

Patients requiring major amputation face a diminished quality of life, an unfavorable natural history and require extensive resources for their post amputation rehabilitation . Such resources would be better deployed in an aggressive approach to salvage affected limbs in those suffering from CLI in order to prevent progression to more serious complication . **(Hirsch et al. , 2006)**

Although surgery remains a good option for some patients with CLI , endovascular therapy offers the advantages of local anesthesia , shorter hospital stay as well as other benefits when compared with infragenicular bypass surgery. **(Goshima et al. , 2004)**

In patient with rest pain, tissue loss and ulceration, angioplasty is now commonly regarded as the first line of therapy if possible before proceeding to distal reconstruction. Many such patients have significant comorbid disease and are at high risk from general anaesthesia. Crural angioplasty can be performed without compromise to potential distal graft anastomoses and has a very low associated morbidity and mortality. **(Norgren et al. , 2007)**

The objective of below-knee limb salvge angioplasty is to restore” in – line “ flow to the foot arches if possible. Using conventional 5 Fr systems, vessels down to 3 mm diameter can be treated. The availability of low profile balloons based on 0.018 and 0.014 inch guidewire allows balloon dilatation of vessels as small as 2mm in diameter. **(Hirsch et al. , 2006)**

The same techniques of trans-luminal and subintimal angioplasty are employed in the crural vessels as elsewhere and ipsilateral antegrade access allows the best directional control in these technically difficult cases. The crural vessels are more prone to spasm and thus vasodilator drugs such as Glyceryl tri-nitrate are preferred by many interventionists. Balloon inflation times and guide wire manipulations should be kept to a minimum to reduce the risk of vessel spasm and acute closure. **(Norgren et al. , 2007)**

To our knowledge no publications addressed the need for revascularization of more than one vessel in comparison to one vessel in case of tibial disease .

Aim of the work

This study evaluates the overall efficacy of endovascular intervention for tibial vessel disease and whether treating single vessel compared with multi vessel intervention affects the outcomes.

Review of the literature

(Chapter 1)
Anatomy of infrapopliteal arteries

The Anterior Tibial Artery

The anterior tibial artery (Fig.1-1) commences at the bifurcation of the popliteal, at the lower border of the Popliteus, passes forward between the two heads of the tibialis posterior, and through the aperture above the upper border of the interosseous membrane, to the deep part of the front of the leg: it lies here close to the medial side of the neck of the fibula. It then descends on the anterior surface of the interosseous membrane, gradually approaching the tibia; at the lower part of the leg it lies on this bone, and then on the front of the ankle-joint, where it is more superficial, and becomes the dorsalis pedis ***(Williams et al., 2000).***

Relations:

In the upper two-thirds of its extent, the anterior tibial artery rests upon the interosseous membrane; in the lower third, upon the front of the tibia, and the anterior ligament of the ankle-joint. In the upper third of its course, it lies between the tibialis anterior and extensor digitorum longus; in the middle third between the tibialis anterior and extensor hallucis longus. At the ankle it is crossed from the lateral to the medial side by the tendon of the extensor hallucis longus, and lies between it and the first tendon of the extensor digitorum longus. It is covered in the upper two-thirds of its course, by the muscles which lie on either side of it, and by the deep fascia; in the lower third, by the integument and fascia, and the transverse and cruciate crural ligaments. The anterior tibial artery is accompanied by a pair of venæ comitantes which lie one on either side of the artery; the deep peroneal nerve, coursing around the lateral side of the neck of the fibula, comes into relation with the lateral side of the artery shortly after it has reached the front of the leg; about the middle of the leg the nerve is in front of the artery; at the lower part it is generally again on the lateral side ***(Williams et al., 2000).***

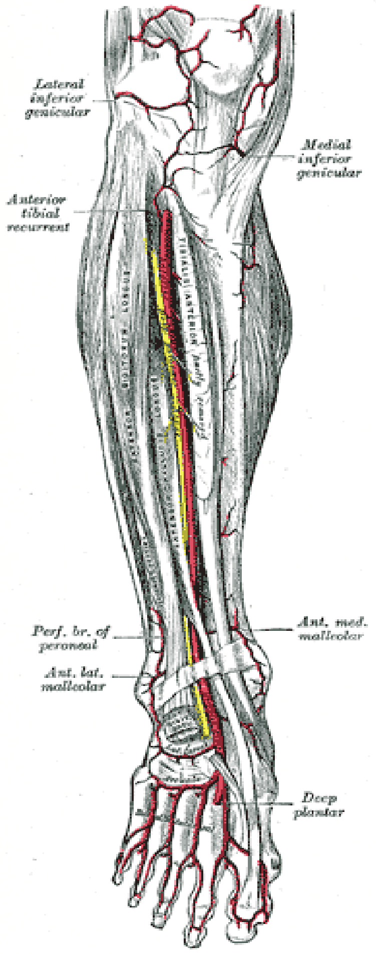


Figure (1-1): *Anterior tibial and dorsalis pedis arteries* ***(Quoted from Gray & Lewis 2000).***

Course:

The artery occasionally deviates toward the fibular side of the leg, regaining its usual position at the front of the ankle. In rare instances the vessel has been found to approach the surface in the middle of the leg, being covered merely by the integument and fascia below that point ***(Gray & Lewis, 2000).***

Branches:

The branches of the anterior tibial artery are:

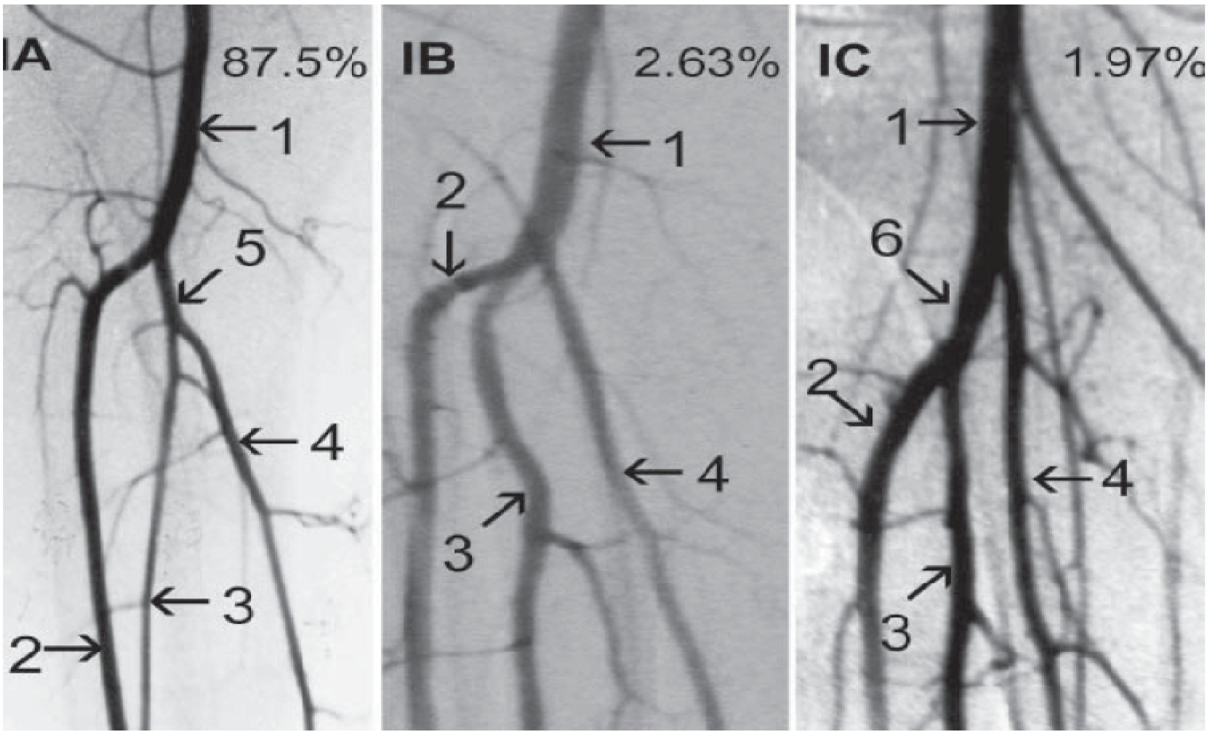
- Posterior Tibial Recurrent.
- Fibular.
- Anterior Tibial Recurrent.
- Muscular.
- Anterior Medial Malleolar.
- Anterior Lateral Malleolar.

The fibular artery is sometimes derived from the anterior tibial, sometimes from the posterior tibial. It passes lateralward, around the neck of the fibula, through the soleus, which it supplies, and ends in the substance of the peroneus longus ***(Gray & Lewis, 2000).***

The arteries around the ankle-joint anastomose freely with one another and form net-works below the corresponding malleoli. The medial malleolar net-work is formed by the anterior medial malleolar branch of the anterior tibial, the medial tarsal branches of the dorsalis pedis, the posterior medial malleolar and medial calcaneal branches of the posterior tibial and branches from the medial plantar artery. The lateral malleolar net-work is formed by the anterior lateral malleolar branch of the anterior tibial, the lateral tarsal branch of the dorsalis pedis, the perforating and the lateral calcaneal branches of the peroneal, and twigs from the lateral plantar artery ***(Chung and Chung, 2008).***

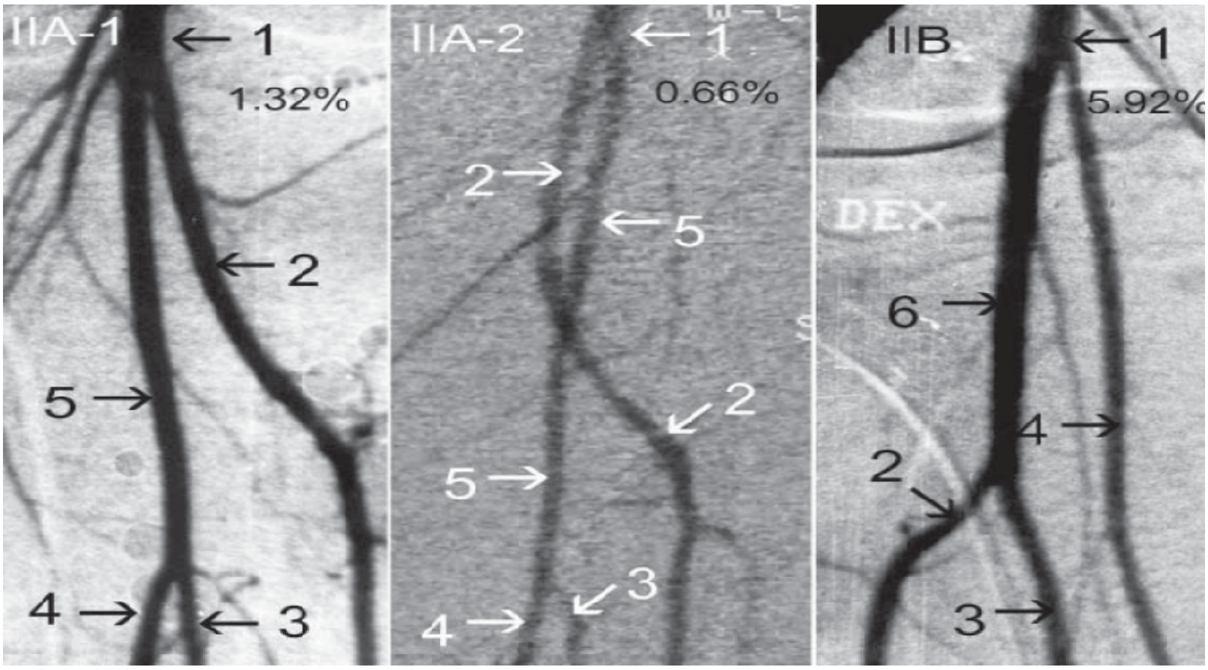
Anatomical variations of the anterior tibial artery

Two general types of popliteal artery division, normal (I) and high (II), have been distinguished. The high type of popliteal artery is seen 12 times less frequently than the normal one. The normal type of popliteal artery comprises the following three subtypes: IA, IB and IC (Fig. 1-2).



(Fig. 1-2) Normal *subtypes (*IA, IB and IC*) of popliteal artery division: 1 — popliteal artery, 2 — anterior tibial artery, 3 — peroneal artery, 4 — posterior tibial artery, 5 — posterior tibioperoneal trunk, 6 — anterior tibioperonal trunk.* **(Quoted from szpinda, 2006)**

In subtype IA the anterior tibial artery and the short type of posterior tibioperoneal trunk are found. In subtype IB an arterial trifurcation is observed. The anterior tibial artery, peroneal artery and posterior tibial artery arises in close proximity. A trifurcation is described only if the common trunk following the origin of the first branch is less or equal to 5 mm in length.



(Fig.1-3) High subtypes (IIA 1, IIA 2, IIB) of popliteal artery division: 1 — popliteal artery, 2 — anterior tibial artery, 3 — peroneal artery, 4 — posterior tibial artery, 5 — posterior tibioperoneal trunk, 6 — anterior tibioperonal trunk. **(Quoted from szpinda, 2006)**

The high division comprises the following three subtypes: IIA 1, IIA 2 and IIB (Fig. 1-3). In two subtypes, IIA 1 and IIA 2 , the anterior tibial artery and the long type of posterior tibioperoneal trunk are found. In the first (IIA 1) the anterior tibial artery has a straight course, whereas in the second (IIA 2) it courses with a medial swing. In subtype II B the long type of anterior tibioperoneal trunk and the posterior tibial artery were observed. In this pattern an anomalous origin of the posterior tibial artery proximal to the anterior tibial artery is noted. Subtype IIB is the correlative of subtype IC, differing in that the posterior tibial artery arises high. The anterior tibial artery occurrs most frequently as a terminal branch of the popliteal artery in its normal and high division . In the remainder the anterior tibial artery arose from both anterior tibioperoneal trunks . **(Spzinda , 2006)**