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Tibial Angioplasty as An Alternative in The Management of Critical Lower Limb ischemia

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AHMED MOHSEN ALMAHROUKY

To My Family

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List of abbreviations

AKA	ABOVE KNEE AMPUTATION
ACC	AMERICAN COLLEGE OF SURGEONS
AHA	AMERICAN HEART ASSOCIATION
AII	ANGIOTENSIN 2
ABI	ANKLE BRACHIAL INDEX
ATA	ANTERIOR TIBIAL ARTERY
AP	ANTEROPOSTERIOR
BKA	BELOW KNEE AMPUTATION
BTK	BELOW THE KNEE
CVD	CEREBROVASCULAR DISEASE
CTO	CHRONIC TOTAL OCCLUSION
CFA	COMMON FEMORAL ARTERY
CTA	COMPUTERIZED TOMOGRAPHY ANGIOGRAPHY
CLI	CRITICAL LIMB ISCHEMIA
DES	DRUG ELUTING STENT
DA	DUPLEX ARTERIOGRAPHY
DPA	DORSALIS PEDIS ARTERY
Fig	Figure
Fr	FRENCH
HDL	HIGH DENSITY LIPOPROTIEN
LDL	LOW DENSITY LIPOPROTIEN
MRA	MAGNETIC RESONANCE ANGIOGRAPHY
OTW	OVER THE WIRE
PSV	PEAK SYSTOLIV VELOCITY
PTA	PERCUTANEOUS TRANSLUMINAL ANGIOPLASTY
PAD	PERIPHERAL ARTERIAL DISEASE

PAES	POPLITEAL ARTERY ENTRAPMENT SYNDROME
RBP	RATED BURST PRESSURE
SA	SUBINTIMAL
SFA	SUPERFICIAL FEMORAL ARTERY
TP	TIBIOPERONEAL
TASC	TRANS ATLANTIC SOCIETY CONSENSUS
TCPO2	TRANSCUTANEOUS O2 TENSION

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Abstract

PAD may be one of the most frequently undetected, chronic, debilitating disorders, and it is certainly the most frequently unrecognized atherosclerotic cardiovascular disease.

This retrospective study included 40 patients presented to the vascular surgery department in Kasr Al Aini and New Kasr Al Aini teaching hospitals with critical chronic lower limb ischemia for whom percutaneous transluminal angioplasty was done, between January 2008 and January 2010.

The aim of the study is to evaluate the effectivness of infrapopliteal angioplasty in limb salvage in critical limb ischemia.

The plan was that in all patients with gangrene or severe infection we try to revascularize as much tibial vessels as possible. For every patient, the following data were recorded:

Indications of the procedure, Risk factors i.e. diabetic, cardiac, hypertensive and renal failure, Access method, Type of the guide wire, size of balloon (diameter and length), Indication for stenting if needed, Size of the stent.

Our results showed 38 cases immediate success and after 3 months only 31 remained patent and after 6 months 25 remained patent.

Of the 25 patients who presented with nonhaling ulcers:

- (24) had successful angioplasty and healed within 8-10 weeks after the successful angioplasty. At the time of complete healing only(19) had the angioplastied tibial vessel still patent.
- One case of unsuccessful angioplasty who did not heal but remained stable ulcer.

The (15) patients who presented with gangrene:

- (13) cases had successful angioplasty and underwent minor amputations after successful angioplasty and the amputation stumps healed in (3) months average. At the time of complete healing only (9) cases had the angioplastied tibial vessel still patent.

- One case of unsuccessful angioplasty who did below the knee amputation.

Endovascular therapy is increasingly becoming a first-line treatment option for patients suffering from critical limb ischemia from infrapopliteal arterial occlusive disease by easily revascularizing inflow and outflow lesions with minimal morbidity and mortality. It has the ability to significantly improve distal extremity perfusion pressure with high technical success rates.

Keywords : Infrapopliteal ; Tibial ; Angioplasty ;Stenosis ; Occlusion; Crural

Chapter one

Anatomy of the popliteal artery and infrapopliteal arteries

The popliteal artery extends from the inferior border of the adductor canal up to the take-off of the anterior tibial artery. Its course may be conveniently divided into three parts,

- Proximal (part I) between the distal end of the adductor channel and the inlet into the tunnel of the gastrocnemius,
- Middle (part II) up to the horizontal plane of the proximal border of the knee cleft,
- Distal (part III) up to the take-off of the anterior tibial artery, segments . ***(Diehm etal., 1999)***.

Variations in the patterns of division of the popliteal artery:

1- Type I, normal type;

2- Type II, high division;

3- Type III, trifurcation;

4- Type IV, peroneal artery arises from the anterior tibial artery; ***(Lusza 1963.)*** [see Fig .1]

The anterior tibial artery perforates the interosseus membrane between the tibia and fibula and courses distally between the extensor muscles of the lower leg to become the dorsalis pedis artery at the dorsum of the foot; In about 3.5% of limbs, the anterior tibial artery either fails to reach the foot, or is reduced to a very slender vessel.Dorsalis pedis aretry gives off the arcuate artery, which runs forming an arch to the level of the tarsometarsal line.

The five dorsal metatarsal arteries arising from the arcuate artery continue as the dorsal digital arteries to the toes.

The other terminal branch of the popliteal artery, the posterior tibial artery, descends straight toward the medial malleolus, while the peroneal (fibular) artery descends toward the lateral malleolus.

The larger of the two terminal branches of the posterior tibial artery, the lateral plantar artery, forms the plantar arch at the base of the metatarsal bones; this in turn forms the plantar metatarsal arteries for the second, third, and fourth toes, becoming the common and proper plantar digital arteries.

The lateral side of the fifth toe is usually supplied by an artery directly arising from the lateral plantar artery, whereas the first toe is largely supplied by the usually smaller medial plantar artery.

Thus, the arterial blood supply to the feet is mainly provided by the arcuate artery of the anterior tibial (dorsal supply) and plantar arch of the posterior tibial (plantar supply). However, the peroneal artery might become an important supplier of collaterals to the feet in the presence of tibial artery obstructions.***(Peter etal ., 2007)***

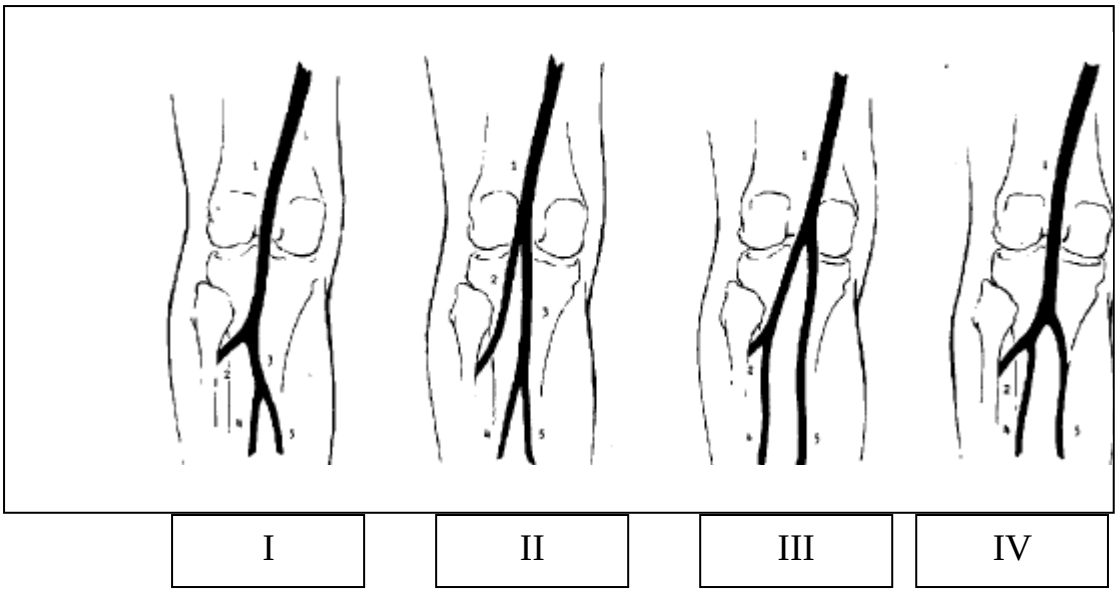

Fig 1. Patterns of popliteal division into its branches

Angiosomes Of The Foot And Ankle

Taylor expanded on the work of previous anatomists to further our understanding of muscle and skin vascular anatomy in his landmark paper on angiosomes. ***(Taylor et al., 1988)***

He defined an angiosome as an anatomic unit of tissue (which has skin, subcutaneous tissue, fascia, muscle, and bone) fed by a source artery. He defined at least 40 angiosomes in the body, including five in the foot and ankle. Adjacent angiosomes are bordered by choke vessels which link neighboring angiosomes to one another and demark the border of each angiosome. In addition, these choke vessels are important safety irrigation conduits that allow a given angiosome to provide blood flow to an adjacent angiosome if a source artery is damaged. ***(Taylor et al., 1992)***

The five angiosomes of the foot and ankle originate from the three main arteries in the lower extremity.

posterior tibial artery supplies the sole of the foot, the anterior tibial artery feeds the dorsum of the foot, and the peroneal artery supplies the lateral supramalleolar area and the heel. More specifically, the

calcaneal branch, the medial plantar branch, and the lateral plantar branch, all branches of the posterior tibial artery, supply the sole of the foot. ***(Attinger et al., 2001)***

The peroneal artery has the anterior perforating branch (which supplies the lateral anterior upper ankle) and a calcaneal branch (which supplies the plantar heel).

The anterior tibial artery supplies the anterior ankle and then becomes the dorsalis pedis artery that supplies the dorsum of the foot.

Angiosomes from the Posterior Tibial Artery: The Calcaneal Artery, the Medial Plantar Artery, and the Lateral Plantar Artery

In the foot, the posterior tibial artery gives off the posterior medial malleolar branch at the medial malleolus. The posterior medial malleolar branch joins the anterior medial malleolar branch from the dorsalis pedis artery, giving rise to an important interconnection between the posterior tibial artery and the anterior tibial artery. This system supplies the medial malleolar area. At the same level, the medial calcaneal artery branches off of the posterior Ttibial artery and arborizes into multiple branches that travel in a coronal direction to supply the heel. The medial calcaneal artery's angiosome boundary includes the entire plantar heel and extends from the posteromedial heel to the glabrous junction of the lateral posterior and plantar heel [area 1 in fig 1] ***(Attinger et al., 2001).***

Fig 2. Angiosomes of the foot (**Marek Krzanowski et al., 2008)** : (1) is the angiosome of the PTA (2) is the angiosome of medial plantar artery (3) is the angiosome of the lateral plantar artery (4) is the angiosomeof the DPA (5) is the angiosome of the peroneal artery

The posterior tibial artery then enters the calcaneal canal underneath the flexor retinaculum and bifurcates into the medial and lateral plantar arteries at the level of the transverse septum between the abductor hallucis longus and the flexor digitorum brevis (FOB) muscles. ***(Taylor et al.,1992.)***

boundaries of the Angiosome of the medial planter artery is area 2 in fig 1 . The distal border can vary depending on anatomic variation and can extend to include the hallux .

The lateral plantar artery's angiosome includes the lateral plantar surface as well as the plantar forefoot (area 3 in fig 1) . Note that while the hallux is usually part of the lateral plantar angiosome, it can also be part of the medial plantar artery angiosome or the dorsalis pedis angiosome. ***(Attinger et al.,2001)***

Angiosomes from the Dorsalis Pedis Artery: The Tarsal Arteries, the Arcuate Artery, and the First Dorsal Metatarsal Artery