



DIABETIC FOOT

Thesis

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Submitted for partial fulfilment
of the master degree in

GENERAL SURGERY

by

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1982

ACKNOWLEDGMENT

I would like to express my deep gratitude and appreciation to Prof. Dr. Mahmoud Naguib, whose continuous instructive education, guidance and step to step follow up of my scientific efforts, in addition to his constant encouragement were essential for this work to be finalized in its current presentation.

Appreciative thanks to my Senior Staff and to my colleagues in Mahmoud Naguib Surgical Unit for their helpful remarks and providing me with every possible reference about this subject.

Finally, I wish to express my sincere gratitude to all those who have participated in one way or another in the planning, execution and presentation of this study in its final form.



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INTRODUCTION

INTRODUCTION

Patients affected with diabetes mellitus have acquired an increased life span, so they no longer die from infection, coma or starvation. These added years have brought into sharp focus the diabetic complications of retinopathy, nephropathy, neuropathy, and vascular disease.

The foot of the diabetic is especially susceptible to the diabetic complications of vascular disease and neuropathy. The interaction of these complications and perhaps the hyperglycemia and infection produce a wide panorama of clinical findings, ranging from disorders of the nails, callus formation, and skin lesions up to involvement of muscles and bones. In such a vulnerable foot, trivial trauma may quickly lead to ulceration, infection, gangrene, and the final event "amputation".

Today it is possible to prevent diabetic foot lesions and to salvage and maintain a functioning foot in those patients who have developed diabetic foot problems.

**ANATOMY AND ARTERIAL SUPPLY
OF THE FOOT**

EMBRYOLOGY

Toward the end of the fourth week, the limbs appear as small elevations or buds, forming a slight lateral ridge on either side of the trunk. Each bud consists of a core of mesenchyme covered by ectoderm. The mesenchyme of the limb bud is invaded by ventral rami from 12th thoracic up to the 4th sacral root. The axial part of the limb bud mesenchyme condenses and is converted into its cartilaginous skeleton, then ossification takes place, and limb bones are formed.

Each limb bud has two borders, the preaxial border cranially and the postaxial border caudally. The limb bud undergoes a process of adduction, flexion and rotation. The lower limb buds rotate medially as a result, the big toe becomes medially and the preaxial digit and the flexor surface become posterior. The mesenchymal core of peripheral part of the plate condenses to outline the digits, and the thinner intervening part breaks down forming the circumference towards the centre. This process may be carried out completely or arrested leading to varying degrees of webbing of the fingers or toes (Davies, 1964).

Ossification of the Foot :

All the foot bones ossify in cartilage. Three bones of the tarsus are ossified at birth. The calcaneus begins to ossify at the 6th month, and the talus at the 7th month. The cuboid ossifies at the 9th month. The navicular ossifies in the 4th year. The metatarsals and phalanges ossify by shaft centres in utero. (Last, 1978).

The Arterial Supply of the Foot

The arterial supply of the foot is all derived from the femoral artery. The femoral artery is the continuation of the external iliac artery. It begins behind the inguinal ligament midway between the anterior superior iliac spine and symphysis pubis and ends at the junction of the middle and lower thirds of the femur. It passes through an opening in the adductor magnus to become the popliteal artery. The upper part is located in the femoral triangle and the lower part in the adductor canal. In the first 3 to 4 cm the artery and the vein are enclosed in the femoral sheath. The branches of the femoral artery are : The superficial epigastric artery, the superficial circumflex iliac artery, the superficial external pudendal artery, the deep external pudendal artery, muscular branches, and the profunda femoris

artery which is considered as the largest branch, arising from the posterolateral side of the femoral artery about 3.5 cm below the inguinal ligament. It gives the lateral femoral circumflex artery, muscular branches, the medial femoral circumflex artery, and the perforating arteries which are usually three in number and anastomosing with each others. The last branch of the femoral artery is the descending genicular artery.

The Collateral Circulation : After ligation of the femoral artery above the origin of the profunda, the main channels for carrying the circulation are the following anastomotic branches : -

1. The superior and inferior branches of the internal iliac with the medial and lateral femoral circumflex and the first perforating branch of the profunda femoris artery.
2. The obturator branch of the internal iliac with the medial femoral circumflex artery.
3. The internal pudendal of the internal iliac artery with the superficial and the deep external pudendal arteries of the femoral artery.
4. The deep circumflex iliac artery of the external iliac with the lateral circumflex femoral branch of the profunda femoris artery.

5. The inferior gluteal branch of the internal iliac artery with the perforating branch of the profunda femoris artery.

The Popliteal Artery : It is the continuation of the femoral artery at the opening in the adductor magnus and extends laterally and downwards through the popliteal fossa to the lower border of the popliteus muscle where it divides into an anterior and posterior tibial arteries (Davies, 1962).

The Posterior Tibial Artery : It begins at the lower border of the popliteus muscle and passes downwards and medially on the back of the leg. In the lower part of the leg it is situated midway between the medial malleolus and the medial tubercle of the calcaneus. It divides under cover of the abductor hallucis into a medial and a lateral plantar arteries. Before its termination it gives the medial malleolar branches which wind round the tibial malleolus and end in the medial malleolar network. Also it gives calcaneal branches, which pierce the flexor retinaculum, and that are distributed to the fat and the skin behind tendocalcaneus and about the heel, and anastomose with the medial malleolar arteries and calcaneal branches of the peroneal arteries.

The Medial Plantar Artery : It is the smaller of the two terminal branches of the posterior tibial artery.

It passes distally along the medial side of the foot accompanied with the medial plantar nerve which lies to its lateral side. Firstly, it lies deep to the abductor hallucis muscle then, it runs distally between it and the flexor digitorum brevis. At the base of the first metatarsal bone it passes along the medial border of the first toe. It supplies three small superficial digital branches which accompany the digital branches of the medial plantar nerve and join the first, second and third plantar metatarsal arteries.

The Lateral Plantar Artery : It is the larger of the two terminal branches of the posterior tibial artery. It passes at first obliquely, laterally and distally to the base of the fifth metatarsal bone, in company with the lateral plantar nerve which lies on its medial side. It then turns medially with the deep branch of the nerve to the interval between the bases of the first and the second metatarsal bones where it unites with the dorsalis pedis artery, thus completing the plantar arch (Davies, 1964).

The Plantar Arch : It is deeply notched and arises from the base of the fifth metatarsal bone to the proximal part of the first interosseous space. It lies plantar to the bases of the second, third, and fourth metatarsal bones and the corresponding intermetatarsal. The plantar arch gives three perforating and four plantar metatarsal branches. The perforators ascend through the proximal parts of the second, third, and fourth interosseous spaces between the heads of the dorsal interossei muscles, and anastomose with the dorsal metatarsal arteries. The four plantar metatarsal arteries run distally between the metatarsal bones in contact with the intermetatarsal, each divides into a pair of plantar digital arteries which supply the adjacent sides of the toes near their points of division. Each plantar metatarsal artery sends laterally a distal perforating branch to join the corresponding dorsal metatarsal artery. The first plantar metatarsal artery springs from the junction between the lateral plantar and the dorsalis pedis arteries and sends a digital branch to the medial side of the first toe. The digital branch for the lateral side of the fifth toe arises from the lateral plantar artery near the base of the fifth metatarsal bone.

The Anterior Tibial Artery : It is one of the two terminal branches of the popliteal artery at the lower border of the popliteus muscle. It passes forwards between the two heads of tibialis posterior and through the upper part of the interosseous membrane to the front of the leg, lying medial to the neck of fibula. At the lower part of the leg it lies on the tibia, and then on the front of the ankle joint, midway between the two malleoli, and is continued on the dorsum of the foot under the name of the dorsalis pedis artery.

The Dorsalis Pedis Artery : It is the continuation of the anterior tibial artery. It passes distally from the ankle joint along the tibial side of the dorsum of the foot to the proximal part of the first intermetatarsal space where it descends into the sole of the foot between the two heads of the first dorsal interosseous muscle and complete the plantar arch. At its junction with this artery it gives off the first plantar metatarsal artery.

Surface anatomy :

The vessel can be felt pulsating along a line from a mid point between the two malleoli to the proximal end of the first intermetatarsal space.

Branches of the dorsalis pedis artery are : Tarsal, arcuate and first dorsal metatarsal branches.

- . The lateral tarsal branches anastomose with branches from the arcuate, anterior, lateral malleolar and lateral plantar arteries and with the perforating branch of the peroneal artery. The medial tarsal branches join the medial malleolar network.
- . The arcuate artery arise from dorsalis pedis artery opposite the medial cuneiform bone. It passes laterally over the bases of metatarsal bones deep to tendons of extensor digitorum brevis. It supplies this muscle and anastomose with the lateral tarsal and lateral plantar arteries. It gives off also the second, third, and fourth dorsal metatarsal arteries which run distally upon the corresponding dorsal interosseous muscles. In the cleft between the toes, each divides into two dorsal digital branches for the sides of the adjoining toes.
- . The first dorsal metatarsal artery arises from the dorsalis pedis just before it passes into the sole at the cleft between the first and second toes and divides into two branches (Davies, 1964).