Chapter 3

Poor Circulation, Big Consequences: What Every Diabetic Must Know

Obliterative Arteriosclerosis (ASO) is a term used to describe a slow chronic disease of occlusion (obstruction) of the arteries by arteriosclerosis plaques (abnormal hardening and thickening of the artery wall).
ASO involves the large and medium arteries such as the common iliac artery in the pelvic area, the femoral artery above the knee, the popliteal artery, and the tibial artery behind the knee. As people with Diabetes Mellitus, along with ASO patients, the small arteries of the skin and the capillaries of the foot are involved in microangiopathy which is characterized by thickening of the wall of the blood vessel. Therefore, blood circulation problems in diabetic feet are more severe and common. There are several theories that describe how the forms of arteriosclerotic injury affect the arteries, but the risk factors for this disease are well known. Cigarette smoking, high blood pressure, high blood cholesterol, and diabetes are the main factors that contribute to a high risk of disease. Occlusion of the arteries above the level of the pelvis (common iliac arteries) can result in sexual impotence and therefore thigh and leg cramps while walking. Occlusions of the popliteal artery (behind the knee) and the tibial artery (in the calf) are more common in the diabetic patient. The occlusion process can be fast, moderate, or slow. When the process is slow, the collateral arteries may form a communication at the site of the occlusion. In this case, the symptoms may be mild or totally absent.

When there is a rapid occlusion, it is generally due to an arterial embolism (small blood clot that floats in the artery) which means, it is the result of advanced arteriosclerosis. A sudden development of gangrene can be the result of an arterial embolism. If you have a heart problem, the more you suffer from Diabetes Mellitus, the amount of blood that your heart pumps to the body will decrease and therefore the blood circulation to the foot is also reduced.

There are many signs and symptoms that characterize circulation problems in diabetic foot. When the foot is raised above the level of the heart, the toes turn pale(Fig 3-1)


Fig 3-1


Fig 3-2


Fig 3-3

but as soon as you stand up, the toes may turn dark and bluish (Fg 3-2).
This sign is characteristic of arterial problems. The skin of the foot and leg can be smooth, shiny, and paper-thin and toenails become brittle and yellowish because of lack of blood circulation in the toes (Fig 3-3). The foot is cold and wet to touch and the pulses in the foot are absent. Occasionally, you can feel the pulses when the foot is resting, but they disappear during or after exercise. If one foot is colder than the other, it is more significant that both feet are cold. Hair loss on the toes, top of the foot, and lower leg may be present. The thigh and leg muscles can become smaller due to insufficient blood supply.
In some cases, you may have a condition called Intermittent Claudication which is described as pain and cramping of the thigh and / or leg muscles after walking a certain distance (Fig 3-4).


Fig 3-4

Pain and cramps are gradually relieved by discontinuing walking and massaging the leg. As the disease progresses, the distance you can walk without cramping and pain becomes less and less. When the disease reaches its most severe form, you may have pain at night in the buttock, thigh, or calf. This pain is relieved by getting out of

bed and walking around. This means that your leg is congested with blood, and this increases the gravity when standing. In this case, you are at the highest risk for gangrene even from minimal trauma to the foot.

In this advanced stage of the disease, you may develop a foot ulcer and no signs of bleeding can be seen from the ulcer (Fig. 3-5).

Fig 3-5

Fig 3-6

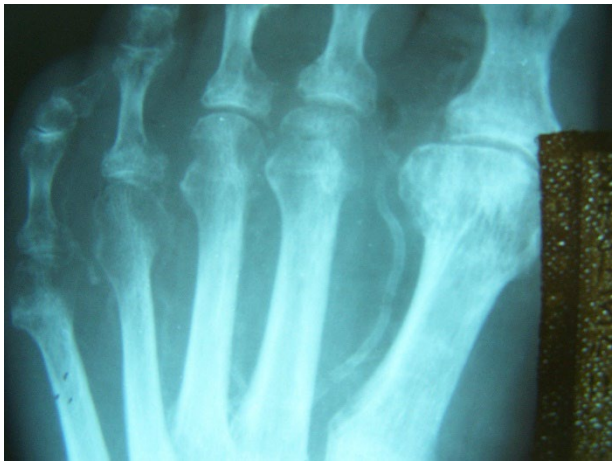

Fig 3-7 Hardening of the artery of the foot

This is called an ischemic ulcer and it can be very painful. However, in diabetics the ulcer can be painless due to the presence of neuropathy.

Symptoms of arterial disease can alert an experienced podiatrist to conduct appropriate diagnostic tests. Capillary filling time with the patient lying down is a simple but specific test to measure the extent of arterial perfusion of the toes. Your doctor may initially order an ultrasound test of your lower extremities as it is an important test for measuring blood flow. This measurement can be taken with the patient standing and after exercising. The experienced doctor can truly discern the different types of sounds that the passage of blood flow produces through ultrasound (Fig 3-6). The ultrasound examination also measures the blood pressure in the arm and foot, and the

radius it provides, is of the utmost importance for a foot wound to heal. Unfortunately, if there are calcified (hardened) arteries in the diabetic foot (Fig. 3-7), the ultrasound will measure the blood pressure and it cannot be used. In fact, the diabetic foot can fool even the most experienced doctor, because circulation problems in diabetic feet are so often mistaken. The foot may be warm, the toes may not turn pale with elevation of the feet, and they may still have pulses.

Nowadays, contrast angiography allows one to see the image of the lumen of the artery and more recently Magnetic Resonance Angiography (Fig 3 - 8) has gained significant popularity among vascular surgeons. The 3D CT (Fig 3 -9) scan is also useful as a diagnostic tool.

Fig 3-8 MR angiogram

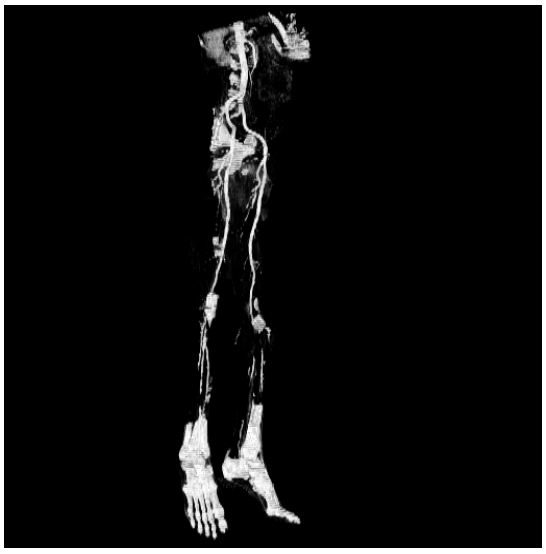

Fig 3-9 3-D CT angiogram

Once you have been diagnosed with arterial disease in your feet, you need to understand the consequences of presenting this significant problem. The foot amputation rate in diabetic people is "fifteen times higher" than in the non-diabetic population. The initial lesion of the skin, be it a blister or a callus, occurs in the painless neuropathic foot. However, there is an arterial circulatory problem that hinders these foot injuries, so that they may not heal. The impaired circulation stimulates necrosis of the tissue around the skin lesion. Bacteria thrive in a rich environment of diabetic foot necrotic tissue where the arterial supply is impaired. The decrease in blood flow to the foot prevents the arrival of antibiotics as well as the cells that fight infection which are called leukocytes. Also, the decrease in oxygen to the contagious site promotes the growth of bacteria that do not require oxygen, and which are very destructive to the foot. Neuropathy as well as damaged blood circulation and infection make diabetic people very susceptible to a crisis that will lead to foot amputation. You need to

understand that diabetic foot arterial disease will stay with you for the rest of your life. You have to change your lifestyle that includes quitting smoking, lowering cholesterol, lowering blood pressure, and intensive diabetes management. Regular exercise becomes important in your life, as collateral blood circulation will form. When you have sufficient collateral circulation, this may prevent surgical treatment or even amputation. Perform exercise daily, walk at a distance where you start to feel a cramp in the leg muscle or if you have pain, then stop, do this three to four times a day. Inspect the feet daily for possible infection or any cuts. Wash your feet daily with a mild soap in warm water. Let it be a doctor or your podiatrist who regularly has your toenails checked, as well as your calluses, and who is taking care of your feet, when you need it. Wear only appropriate shoes (Chapter 10). Orthotic insoles (Chapter 10) are essential for you to wear if you have neuropathy and circulation problems. Ulcers on the sole of the foot will not heal unless the weight of the foot is redistributed away from the ulcer, using this type of insole. These special insoles are important tools in the prevention of foot ulcers in the presence of neuropathy. The fungal infection can seriously affect your already damaged foot and can lead to a bacterial infection and thus gangrene. You have to remember that small infections; such as ingrown toenails (F 3-10), can develop into ulcers, become gangrenous and will require amputation (fig. 3-11).

Fig 3-10

Fig 3-11

There are surgical procedures that can be beneficial for people with severe arterial occlusive disease. If you have foot pain when you rest, foot ulcers that do not heal, frank gangrene, or impending gangrene, you can discuss the possibility of surgery with your doctor. There are surgeries that can prevent a major leg amputation. Vascular surgeons can effectively revascularize the foot or leg so that the level of the amputation site is more limited. You have to be realistic and that not everyone can be a candidate for vascular reconstructive surgery. A vascular surgeon can determine if you may be a candidate for surgery performed by an arteriogram. In case of occlusion of the small

arteries of the foot, amputation of one or several toes may be indicated. In the occlusion of large arteries as in ASO, it would be impossible to avoid surgery, if the amputation were done below the knee (Fig-12) it would be better, than if it were done above the knee (Fig-13), because the risk would be less and the rehabilitation would be easier.

Fig3-12

Fig 3-13

It is extremely important to recognize the early signs of circulation problems in your feet, your consent to seek medical attention and change your lifestyle would prevent you from being just another patient within the statistics.

TEST YOURSELF

(T F) True or false

1. T F Circulation problems to the foot are more common and severe in diabetics than non-diabetics.

2. T F People with diabetes who smoke cigarettes, have high blood pressure and high blood cholesterol level are more prone to foot complications and amputation.

3. T F Intermittent claudication should describe sudden blockage of blood vessels of the leg in diabetics.

4. T F Diabetic foot ulcer develops when there is a problem of blood circulation, but as long as there is no pain from foot ulcer, it is not a concern.

5. T F When you experience cramps or pain in the calf, thigh or buttock, but are relieved by walking, you should let your doctor know immediately.

6. T F If the foot is cold and wet and the toes are bluish / dark; you may be at risk of developing a spontaneous foot ulcer and infection.

7. T F If you have weak pulses in your feet and the hair on your toes which gradually disappear, you may have a blood circulation problem.

8. T F If you have a circulation problem in the feet and legs, you need protective shoes and proper orthotics in shoes to prevent skin irritation.

9. T F Leg blood bypass surgery should increase blood flow to the foot.

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1. (T) 2. (T) 3. (F) 4. (F) 5. (T) 6. (T) 7. (T) 8. (T) 9. (T)

They Thought It Was Minor-
They Lost Their Leg. Learn From Their Stories

Patient A – If you are diabetic,
you should watch what shoe you wea

Patient A is a 47-year-old female with a history of insulin-dependent diabetes. She came to emergency room with infected blister of her left foot. She stated that she was wearing this shoe (Fig 13-1) for her friend's dancing party and when she came home, she noticed a blister on the side of her left foot. After a few days, she noticed the redness and pain have increased so she came to our emergency room. When I examined this patient in the emergency room, the skin abscess on her left foot was infected and the redness was extending toward the ankle. The blister had to be incised and pus had to be drained (Fig 13-2). She was admitted to the hospital for infection treatment. The infection was eventually resolved, but even with months of numerous wound care attempts to close this wound defect, the foot was left with a large non-healing hole in the foot. When I have a suspicion that the bone under the wound was also infected, I ordered MRI of the foot. the bone next to the ulceration was infected which showed on MRI images (Fig 13 - 3). At this point, infected bone had to be removed (Fig 13- 4) so that within a month the wound was finally resolved (Fig 13-5) and she was finally able to return to her normal activity.

Fig 13-1

Fig 13-2

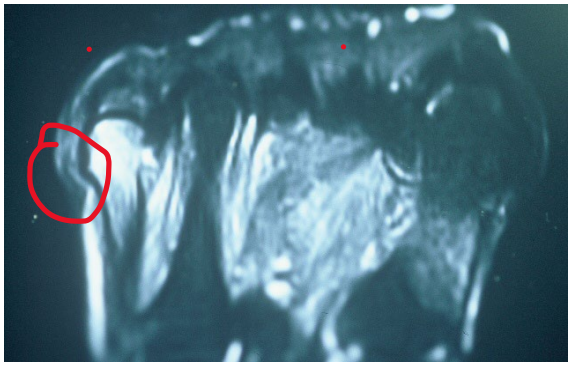

Fig 13-3

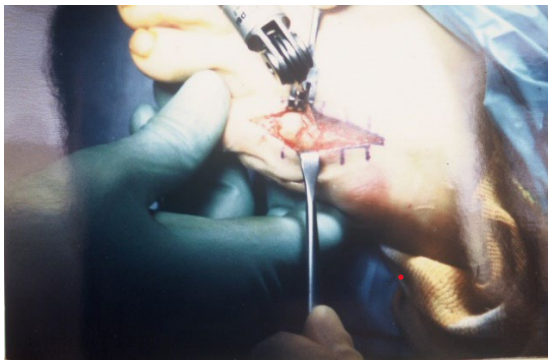

Fig 13-4

Fig 13-5

Patient B

Patient B is a 55-year-old male who has been diabetic for 10 years. He is taking oral medications for diabetes, high blood pressure and for high cholesterol. He came to emergency room because the bottom of his footwas swollen and red but he didn't have any pain. His wife said she noticed yellow and greenish fluid with a foul smell coming from between the toes (Fig 13-6). Physical examination of the right foot in the emergency room showed he had swelling and accumulation of pus at the bottom of the foot. While in the emergency room, the bottom of the foot was incised with a scalpel to drain all the pus (Fig 13-7). The infection and the pus were found to be coming from between the little toe and the next toe. That area had a fungal infection also known as athlete's foot and callus. The area between the toes got infected and the bacterial infection entered into the bottom of the foot causing the pus at bottom of the foot. The patient was admitted in the hospital for treatment of his foot infections. The patient was found to have a severe circulation problem so he was seen by a vascular surgeon. The vascular surgeon determined that the infection is difficult to heal because he has severe circulation problem. He received a revascularization procedure in an attempt to improve circulation to the right foot. After revascularization of the right foot, the wound was able to heal (Fig 13-8) but took several months to complete the healing.

As noted, this wound would not be able to heal without improving circulation, and he would have had a leg amputation.

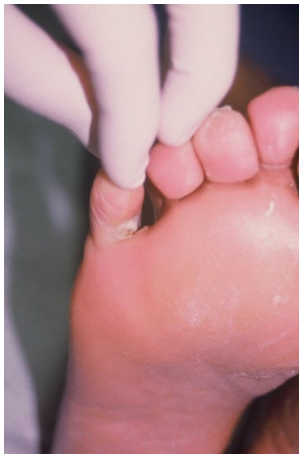

Fig 13-6

Fig 13-7

Fig 13-8

Patient C

Lost a leg because I had ingrown toenail???

Patient C, a 67-year-old male, is a non-insulin-dependent diabetic. He has a history of kidney failure on dialysis and a severe circulation problem. He has years history of cigarette smoking. He presented to my office with a chronic ingrown toenail. He attempted to take care of the ingrown toenail by himself by trimming the ingrown portion of the nail, washing and cleaning with alcohol and peroxide. Eventually decided to come to my office. When he presented in my office, his toe was already became cyanotic and blueish (Fig 13- 9). In this case, attempts to save his leg by a podiatrist, vascular surgeon, infectious disease specialist, endocrinologist, the toe became gangrene, and he lost the big toe (Fig 13-10). When a patient with an advanced circulation problem, it is difficult to heal even a minor toe amputation. The toe

amputation did not heal (Fig 13 -10) so half of his foot had to be amputated (Fig-11) to stop the spread of infection up the leg (Fig 13-12). Again, our attempts to save the leg failed, and he eventually ended up with a below-the-knee amputation.

Fig 13-9

Fig 13-10

Fig 13-11

Fig 13-12

There are lessons to be learned here.

1. Even seemingly a minor problem such as an ingrown toenail, diabetic people can lose the leg
2. Do not attempt to treat the problem yourself.
3. Smoking cigarette causes damages to the circulation.

Patient D

Patient D, a 45-year-old construction worker and has a 15- year history of insulin-dependent diabetes. One day after he came home from work and took his shoe off, he noticed a blood soaked sock on his left foot. He noticed he had stepped on a rusty nail which had penetrated into his foot. He didn't have any pain and a few days passed

by without any pain. Several days passed and his wife noticed the redness was going up the leg from the bottom of the foot and the 2nd toe was turning black (Fig 13-13). When he came to the emergency room I immediately scheduled him for surgical treatment. His 2nd toe was becoming gangrene which had to be removed and pus that was traveling toward the leg had to be drained. His left foot was treated with the something called the Wound Vac (Fig 13-14) which is used for suctioning of pus within the deep tissues of the foot. He was able to heal the wound but took several months (Fig 13-15).

Fig 13-13

Fig 13-14

Fig 13-15

Patient E

lost a leg from hammer toe??

This patient E was a 65-year old male with a 26-year history of type II diabetes. He also had hammertoe problems on his 2nd and 3rd toes of the left foot. He was a long term heavy smoker with other medical problems. He had COPD, kidney insufficiency, heart problem. One day he noticed some pus coming from the thick corn he had on his 3rd toe. When he presented in my office, his second toe had already turned dark (Fig 16-and 13-17).

Fig 13-16

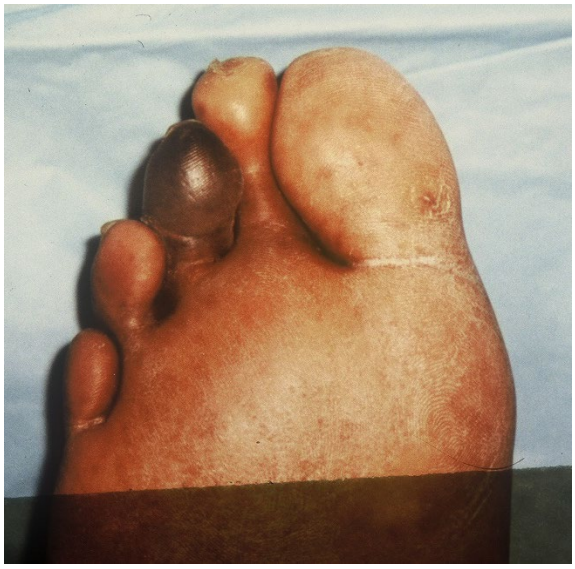

Fig 13-17

This is a case of severe circulation problems. He was immediately seen by a vascular surgeon for revascularization procedures and we were unable to save the foot. The patient eventually lost the leg.