

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 (Fig 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

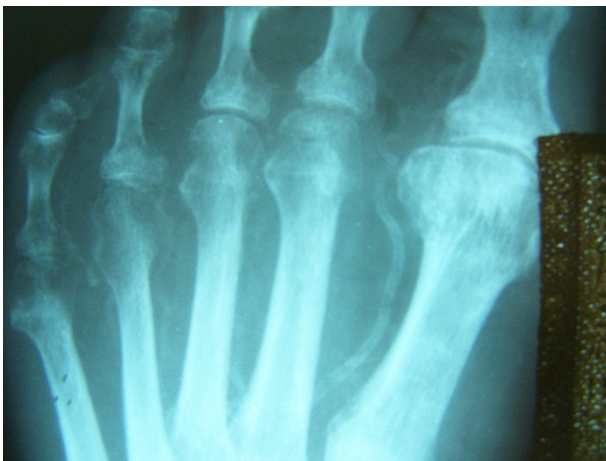


Fig 3-7 Hardening of the artery of the foot

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

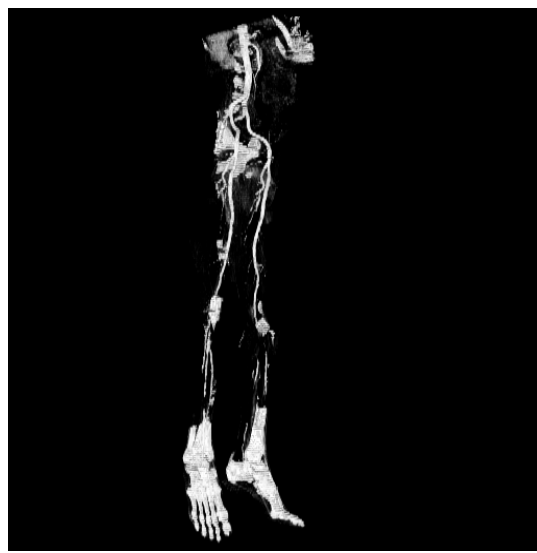


Fig 3-9 3-D CT angiogram

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)

The Small Cut That Can Take Your Leg: Infections in the Diabetic Foot

A small cut in the skin of a diabetic foot can lead to a serious infection. Although the end result of foot infection may be loss of the leg or life, or both, the initial event can be so trivial and insignificant, even in a non-diabetic person. Initially it may be an incident such as stepping on a piece of glass careless cut of corns and calluses, or a blister from walking with a new pair of shoes. Most diabetics have altered sensation of the feet and no minor cut or trauma does not produce any painful symptoms until the infection becomes noticeable (Fig 8-1).



Fig 8

Many diabetics neglect corns and calluses because they do not appreciate the damage that can be produced by these seemingly trivial ailments.

The human body is populated by many different kinds of bacteria and fungi that vary with location, environment, and skin condition. For example, the area between the toes has a larger number and types of bacteria than anywhere on the body because of the moisture between the toes. Moisture favors the growth of bacteria and fungi. The feet have the lowest temperatures compared to other parts of the body that stimulate the

faster growth of bacteria and fungi. It is a known fact that diabetic feet are more prone to infection. Diabetics do not have problems with the immune system of antibodies, nor does it cause their antibodies to react differently than non-diabetics, when they are invaded by bacteria. High blood sugar by itself does not generally increase the growth rate of bacteria either. The exact mechanisms of the increased severity and frequency of infection among diabetics is not yet very clear. However, pre-existing circulation problems in the foot and diabetic infections and neuropathies become more dangerous than infection in non-diabetic people. Progress to a major infection with tissue death can be much faster while the diabetic patient is ignoring of the contagious process that he suffers without painful symptoms in neuropathic feet. The small capillary vessels around the infection site clot causing further tissue death. In addition to capillary blood vessels clotting in the area of infection, some bacteria produce toxic substances that also cause even more tissue death. When tissue death becomes so extensive, then the area becomes gangrenous. Sometimes the infection process progresses to any tendon in the foot, and then the infection will follow the course of the tendons that are deeper in the leg. This rapid spread of infection is a serious threat to life and limbs.

SOFT TISSUE INFECTION

Diabetic foot infections can occur in an insulin-dependent as well as a non-insulin-dependent patient. This generally occurs in diabetics with neuropathy of the feet where diabetics tend to neglect the initial signs of infection due to the absence of pain symptoms. Gangrene that precedes infection occurs from toxic material that is produced by bacteria. The tissue becomes inflamed and the enzymes in the small arteries fill with clots that surround the infection site, destroying the tissue.

Oftentimes, the infected foot of the diabetic patient contains gas within the soft tissue. Generally, the gas formed by bacteria produces an odor and does not require oxygen to survive. When there is reduced blood flow to the infection site due to pre-existing circulation problems, the proliferation of bacteria that do not require oxygen to survive can be extensive and very destructive to the tissue. Generally, most diabetic foot infections are caused by a mixture of many different kinds of bacteria.

The best way to treat diabetic foot infection is prevention. Knowledge and understanding are the key. When you notice a small cut on the skin, even if it is calluses or a simple cut, the first thing you should do is wash the area thoroughly with running water. Do not wash the area with strong chemicals such as iodine, alcohol, or

hydrogen peroxide as these chemicals actually damage skin cells (cytotoxic) and become an additional source of infection. Immediately move your foot away and raise it above the level of your heart. If you notice swelling, redness, and a bad odor, you should call your doctor. Your doctor needs to cut the surgically infected area and drain the pus. This must be done early in the course of infection and is the most important part of therapy. Your doctor will take some fluid sample from the contagious site where the bacteria have grown and send it to the laboratory. This is an important step in treating the infection because it will tell us the type of bacteria causing the infection and will give us the choice of the type of antibiotics that will destroy the bacteria.

Initially without knowing the types of bacteria, your doctor will put you on an antibiotic based on the nature of the wound, the appearance of the wound, and your general health condition. The most effective way to administer the antibiotic is intravenously rather than orally. As we mentioned earlier, diabetic foot infection is generally caused by a combination of bacteria (Polymicrobial). Therefore, you need several types of intravenous antibiotics in the hospital. If your doctor sends you home on oral antibiotics, assuming the infection is caused by "staph," and it is the most common bacteria that causes skin infection, you are at a very great risk because most diabetic foot infections are caused by a combination of many different types of bacteria. Bacteria that do not require oxygen to grow will not be killed by common oral antibiotics and the infection can spread quickly to involve the entire leg. Failure to recognize the nature of these destructive bacteria in the initial stage of local infection can have disastrous consequences. For the diabetic patient with kidney damage, the doctor will be adjusting the dose frequently during the course of treatment.

BONE INFECTION IN THE DIABETIC FEET

Bone infection, also known as osteomyelitis, in diabetic feet is one of the most serious problems. In most cases, this osteomyelitis, along with a chronic ulcer on the sole of the foot, begins as a callus. If a diabetic has an ulcer on the sole of the foot, this usually takes months or years to heal, if they do heal. If the ulcer is neglected or poorly healed, the bacteria that enter the ulcer spread inside the foot, reaching the bone. Bone infection is common in diabetic feet with neuropathy and circulation problems. It may go unnoticed, however there may be little or no pain, redness may be absent, and swelling may not be noticeable. To treat the bone infection, you need surgical removal of the infected bone and about six weeks of intravenous antibiotics. If these conservative treatments fail, amputation is indicated. One condition that mimics bone

infection is Charcot's foot (Chapter 7). Charcot's foot is red, swollen, and hot. These signs and symptoms are similar to a bone infection. Careful examinations and diagnostic MRI will be important to determine if it is a Charcot bone or bone infection. I saw a diabetic patient who had an amputation that thought the patient had a bone infection when in fact, he had the initial stage of Charcot's diabetic foot.

TEST YOURSELF

(T F) True or false

1. T F Diabetics have problems with the body's immune system therefore they are more prone to infection than non-diabetics.
2. T F Swelling and redness in your foot and leg means there is a serious contagious process going on even if you are not experiencing any pain.
3. T F Diabetic foot infections are caused by many different types of bacteria.
4. T F Bone infection is common in diabetic feet with neuropathy and circulation problems.
5. T F Diabetic Charcot foot means foot bone infection.
6. T F as long as there is no pain, there is no bone infection.

1. (F) 2. (F) 3. (T) 4. (T) 5. (T) 6. (T)