

# The diabetic foot

## *In the Arab world*

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### ABSTRACT

The literature is replete with diabetic foot problems throughout the world, but few has been written about the problem in the Middle East and even in the Arab world. After reviewing these discussions, we realized that the magnitude of the problem is not yet appreciated for many reasons. In this paper, we explained why it is more prevalent, less managed and has been associated with worse health outcomes in diabetic patients in the Arab world. We believe that the leading problems are preventable, and this cancer can be controlled in a simple cost-effective way.

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**D**iabetic foot complications remain a major problem among patients with diabetes and the health care system. The interest to manage diabetic foot problems is sub-optimal for many factors shared by patients themselves, the community, health care professionals and policy makers. More than 120 million people in the world suffer from diabetes mellitus and mostly have diabetic foot ulcers, which may ultimately lead to amputation. By the year 2025 it is estimated that this number will rise to 250 million.<sup>1</sup> In the Arab world, the prevalence of diabetes had doubled and in some countries had dramatically tripled in the last decade only. Some countries are ranked as having the highest in diabetes prevalence worldwide reaching in certain population to approximately 20%.<sup>2-13</sup> Diabetic foot problems follow as it occurs in 10-15% of patients with diabetes. Perhaps it is worth mentioning that the most difficult task in writing this chapter was finding references, as there are almost none.

**Pathophysiology.** Causes of the diabetic foot has been studied and documented in the literature such

as neuropathy and angiopathy. There are no available studies in the Arab world to confirm these pathological and histological changes and if they are different from the west, however the clinical radiological and gross pathology changes are similar.

**Neuropathy.** All nerve fibers (sensory, motor, and autonomic) are affected in diabetic peripheral neuropathy. Studies in the Arab world showed a prevalence range of neuropathy from 38-94% in diabetic foot cases<sup>14-17</sup> Few patients are aware or even believe that they are afflicted with diabetic foot since they are unable to feel pain or pressure in their feet, and by the time they realize this fact they had already sustained catastrophic wounds or ulcers. We are aware of a number of tragic situations where patients only became aware of the extent of injury to their neuropathic feet when they smelled the seared tissue from their feet being too close to an open fire. Motor neuropathy with its deformity effect on the feet has a significant role in the high number of diabetic ulcers. Development of foot deformities with lack of foot care awareness and almost absent footwear

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centers led to the high prevalence of diabetic foot ulcers in the Arab world compared to the west. Autonomic neuropathy which leads to dry cracked skin with fissures is a common factor. With dry hot weather it is almost mission impossible to convince old diabetic patients to keep their feet moist and wear socks. Callus, a common foot formation even for the non-diabetics, is unfortunately frequently perceived as a normal lesion, with it commonly being one the common preceding lesion to a foot ulcer.

**Angiopathy.** Avicenna (980-1037 AD) described the association between diabetes and the diabetic foot. Heidenhain in 1891 published a thorough review of diabetes and arteriosclerosis of the legs. Bell's autopsy studies of 2130 diabetic persons who died from 1911 through 1955, gangrene was found among 21% of the cadavers and was 53-71 times more common than among non-diabetic individuals.<sup>19</sup> As diagnostic studies have improved, prevalence studies have indicated that approximately 15-30% of heterogeneous group of non-insulin dependent diabetes mellitus type 2 patients may have evidence of peripheral vascular disease when studied by noninvasive techniques. In the Arab world, peripheral arterial disease is commonly found in diabetics with a prevalence range of 50-78.7%.<sup>14,15,20</sup> It has been proven by many studies that age, duration of diabetes, hypertension and smoking are the risk factors for the development of peripheral vascular disease in diabetics. It is not clear yet if hyperglycemia, hyperinsulinemia and some types of lipids are risk factors for atherosclerosis in diabetes.<sup>19</sup> There are various informations from epidemiological studies of peripheral vascular disease in diabetes. This could be due to: 1) insensitive endpoints such as claudication and amputation. 2) The possibility that the pathogenesis between types of diabetes is different. 3) The probability that multiple risk factors such as hyperglycemia, lipid disturbances, hypertension and cigarette smoking interact and 4) the frequent association of diabetic neuropathy and vascular insufficiency in many patients with diabetes.<sup>19</sup> There are no peripheral arterial lesions specific to diabetes; however, the pattern of arteriosclerosis is somewhat different. It has been noted in the west and in our clinical experience that the most commonly affected area of the diseases is the infra popliteal part of the vascular tree with almost sparing of the proximal vessels. Atherosclerosis occurs at a younger age among diabetics, and has been observed to progress faster with no gender difference. Atherosclerosis is the most important factor related to the outcome of the diabetic foot ulcer. Microangiopathy now is not accepted as the primary cause of the diabetic foot ulcer or a reason not to improve the blood supply by means of revascularization.

Symptoms and sign of vascular insufficiency are less obvious in diabetic individuals due to masking of peripheral neuropathy, which cause shunting and falsely warm feet. In addition, medial sclerosis of the arteries lead to rigid walls which interfere with the noninvasive vascular tests such as ankle brachial index (ABI) and present inaccurate readings (normal or high). Nonetheless intermittent claudication, rest pain, ulcer or gangrene are a common occurrence. In this review, it is worth mentioning the peculiarities of our population that are rarely found in the west. In many Arab countries, the life style is sedentary as there is limited activity due to some factors such as the fact that the weather is hot most of the year so walking is difficult and people must depend on various modes of transportations. In the cities however the style is different from the west, the wide urban sprawl is such that people must use transportation to get to their work or shopping districts. The idea of walking in parks or streets just as a mean of exercise is still not a habit and sometimes even embarrassing. All the above factors will inevitably lead to a less active lifestyle where a significant arterial insufficiency is masked by absence of claudication. In fact, we observed patients with severe peripheral vascular occlusion and claudication at a distance of 50 meters and still they are refusing to undergo surgery. The effect of this behavior has resulted to serious gangrene on one or both feet. The coldness, paleness and dependent rubber all could be masked by peripheral neuropathy. Unfortunately, it is a common belief among health care professionals that the presence of distal Doppler signals will exclude vascular insufficiency as a cause or an aggravating factor for the ulcer and we commonly see late referrals to vascular surgeons of an ulcer treated for months with debridement and wound care with no improvement.

**Clinical presentation.** The diabetic foot have 2 categories: the neuropathic foot and the neuroischemic foot. Both categories could be accompanied by infection with different severities.

**The neuropathic foot (ulcer).** It occurs at sites of high mechanical pressure on the plantar surface of the foot, commonly at the head of metatarsal bones and usually preceded by callus formation. Due to hot climate, the common footwear used are slippers or sandals. These sandals or slippers has a ridge that fits between the first and the second toe. Neuropathic ulcers were commonly observed at the first web space and sometimes too advance that necessitates amputation. Neuropathic ulcers which are small and not infected are rarely seen due to its delayed presentation. Among those who present

early offloading and shoe modification, is usually unsuccessful. Orthotic services are minimum and patient's compliance is poor.

**Neuropathic (Charcot) arthropathy.** Swollen, erythematous, hot, usually painless foot is relatively uncommon. After radiological confirmation, the foot is immobilized and unloaded by total-contact plaster cast until the edema subsides then the foot is gradually mobilized using custom fitted shoes with a molded insole.<sup>21</sup>

**The neuroischemic foot (ulcer).** Ulcers often occur from localized pressure of tight shoes. One of the precipitating factors of ulcers and even infection and gangrene is wound caused by trimming of nails. The neuroischemic ulcers have a significantly poorer outcome compared to neuropathic ulcers because of the blood supply. Infection is multimicrobial. In local studies *Staphylococcus aureus*, *Pseudomonas Argenosa*, and *Proteus mirabilis*, were the most common bacteria.<sup>15,18,21,22</sup>

**Investigations.** Ankle brachial index which could be falsely high. Transcutaneous oxygen (Tco2) also could be falsely normal because of shunting due to peripheral neuropathy. Toe pressure is probably the most sensitive noninvasive test because of sparing of diabetic vascular changed to the digital arteries. It has been our policy that any diabetic foot ulcer with absent palpable distal pulses should be referred to vascular surgery for further work up. Selective angiography with minimal contrast still our standard investigation. Most of the time, we carried out distal revascularization with >90% limb salvage.

**Management.** The management of the diabetic foot ulcer with cellulites or gangrene by admission and broad spectrum IV antibiotics is relatively a standard procedure. This is followed by drainage of pus or debridement of necrotic tissues and deep cultures. However, further management differ due to lack of standard protocols. The following practices were carried out during management: all diabetic foot admissions will be seen by the following specialties: internal medicine, infectious disease, vascular surgery, dietitian and diabetic educators; patients with palpable foot pulses will be managed mainly by general surgery for debridement and wound care and if there were no palpable pulses, the vascular surgery team will evaluate the patient for further management and control the risk factors. Smoking is a very common habit in the Arab world; it could be more common as compared to the West because of the popularity of other forms of smoking such as shisha. Efforts to fight

smoking are very well established in many countries. Media in its various forms and campaigns are well developed. Unfortunately because of the low level of education the results are not encouraging.

**Revascularization.** Percutaneous angioplasty is rarely used in our practice for the reason that most of the disease is infrapopliteal where we do not recommend angioplasty. Distal revascularization using a vein or a composite bypass has been our practice with a good limb salvage rate. It is a common belief that the diabetic microangiopathy is a contraindication for any form of revascularization. In fact in many studies, the patency rate of distal revascularization between diabetic and non-diabetics did not differ and diabetes is not a reason to withhold this treatment. The aim of revascularization procedures for diabetic ulcers is different from ischemia or claudications. Long term patency of revascularization for the diabetic ulcer is not the goal. It is limb salvage which is needed by improving vascularity of the limb to heal the ulcer. Most of the time a patency rate of few months is enough to help the healing of a bad ulcer or a partial amputation. Plastic surgery team is also involved when the patient needs skin grafting or skin flap.

**Medications.** Until now only antiplatelet therapy has been shown to decrease the incidence of intravascular thrombosis. We commonly prescribe coated antiplatelets to every diabetic patient with symptoms or signs of peripheral vascular insufficiency. Pentoxifylline has been used extensively in some centers but with equivocal results. Non-infected small ulcers are usually managed as outpatients with regular wound care. Unfortunately until now the availability of orthotics is very limited in this part of the world.

**Diabetic foot in the Arab World.** The prevalence of diabetic foot problems differs between countries in the world. In the Arab world, several factors make this prevalence higher as compared to the West:

(i) **Weather and footwear.** Mostly hot and dry over the year which makes the habit of wearing sandals to avoid the heat is a very common habit. Sandals have many types but they have common effects (**Figure 1**). These footwears are not good protectors from injuries because the foot is exposed to heat, dryness and injuries and there is a ridge-like part that is commonly seen between the first and second toe. This ridge causes friction and injury that is not appreciated by the naturopathic senseless foot and is the nidus of the problem.

(ii) **Habits.** Walking barefooted, especially inside the house, is still a common habits in many regions in the Arab world. These habits were more prone to infection and complications.

(iii) **Religion.** Ninety percent of the Arab populations are Muslims. They pray 5 times a day where the feet has to be washed before praying. This helps in inspecting and keeping the feet clean and perhaps is a good way of decreasing the diabetic foot problems. Trimming the nails is one of the habits encouraged by Islam. This can work in 2 ways: making patients take care of their nails and inspect them regularly, which will decrease complications. Or will lead to frequent injury and lead to complications.

(iv) **Education.** The percentage of illiterate people is higher than in the west for many factors; poverty is one of them. Lack of education leads to unawareness of the problem and its prevention. Diabetes educators usually concentrate on teaching the patients on how to control their blood sugar with insulin or diet lectures, booklets, pamphlets and so forth which only concentrate on the same subject and rarely about the feet care. Sometimes, physicians are too busy to discuss to their patients the proper way of taking care of their feet. Proper knowledge is essential, as its failure can lead to disease and delayed wound healing. One study showed that 90% of screened diabetic patients had poor knowledge about their disease and 96.3% had poor awareness about its control.<sup>23</sup>

(v) **Media.** In some Arab countries, the media has an inadequate attention to the health problems in general and nothing about diabetic foot problems. Recently, few articles were published seeking medical attention promptly at the earliest onset of symptoms.

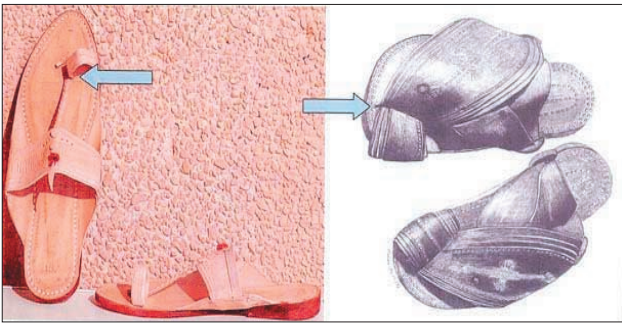
(vi) **Traditional medicine.** This is one of the most important factor in my opinion that led to high prevalence of diabetic foot problems in the Arab world. a) Herbal medicine - herbal medications are still commonly used and most of the time they complicate or obstruct the treatment of modern medicine. Local healers use different kind of local herbs of a broad spectrum to cure many illnesses.<sup>24</sup> (Figure 2). With all the explanation and education spent on trying to convince the public to avoid this kind of traditional medicine; still it is a very common practice. Complete evaluation of these remedies and control of local healers will decrease complications not only on diabetic foot problems but also to other common medical and surgical diseases treated. (b) Cautery - since ancient times it is a common belief that cautery is the treatment of choice or the last resort to many diseases. Local healers use heated iron rods of various sizes and shapes with either sharp or pointed ends while they are glowing red. The heated end of the instrument is used by either employing the fine touch or firm pressure. The site of the application varies with different disease. In the diabetic foot, it is commonly seen in the dorsum of the foot or the lateral aspect of the lower leg. We observed some cases complicated with wound infection due to delayed presentation, often leading to amputation.

(c) Blood-letting - there is a believe that in certain diseases the blood is bad and the body must get rid of this evil blood. Like in cauterization, there are different sites of blood-letting according to the disease. In the diabetic foot, it is carried out at the ankle. The skin is cut into small multiple cuts then an inverted cup is applied with a match burning inside, immediately before it is applied the match is put off. This will create suction on the skin. An average of 60-120 ml of blood is let.<sup>24</sup> The procedure is commonly performed by barbers. The septic technique used is suboptimal. The commonly used razors will be shared between patients. Many cases of hepatitis B and even C are reported to be transmitted by blood letting.

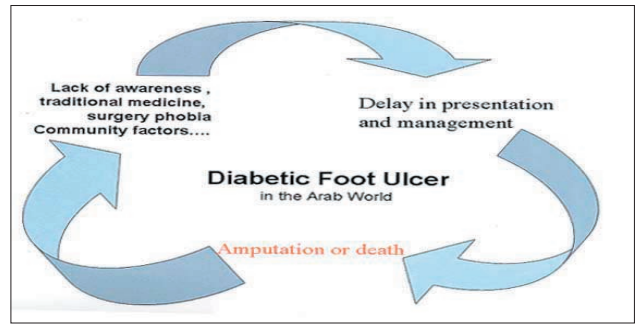
(vii) **Surgery phobia.** A very common reason for the delayed presentation of the diabetic foot even in educated patients, is the fear of surgery or amputation. People believe in our part of the world that they should not loose any part of their body even if this leads to death.

(viii) **Health care system and health care providers.** Worldwide, the interest to manage diabetic foot problems is low for the healthcare professional. This is for the following reasons: (a) it is usually more interesting and famous to do a cardiac or liver surgery but certainly not debriding a diabetic foot wound. (b) Diabetic foot patients usually need long and frequent admission; this is not appreciated by the physicians who prefer short and single admissions, or by the hospital administration that look at the cost-effective use of hospital resources. (c) Due to lack of awareness and education of patients there will be a delayed presentation of the diabetic foot problems at late stage where chronic wound care, partial or complete amputation will be the end result. This is not the outcome the physicians would like to have for his patients. Lack of awareness of the magnitude of the problem and the standard management is definitely not encouraging to physicians to care of the diabetic foot problems. The management of the diabetic foot is still not a multidisciplinary team approach, not only in the Arab world but world wide too, which makes it a burden among physicians with its negative effect on the care of their patients.

1) **Policy makers.** To hospital administration and policy makers managing diabetic foot with its long frequent admission, and prolonged bed utilization is quite unpopular and unrewarding than doing a cardiac or a liver transplant. Usually, when patients reach the stage of amputation they are convinced of its inevitability such that complaining to hospital administration about lack of care or mismanagement is not in their agenda. Without patients' complaints for improved diabetic foot care; this will never become a priority to hospital administration. Again, low health



**Figure 1** - Standard sandals (note the ridge-arrows).



**Figure 3** - Vicious circle.



**Figure 2** - Examples of herbal medicine on foot ulcers.



**Figure 4** - Dry gangrene of the left leg (delayed presentation to the hospital after trying traditional medicine).

**Table 1** - Risk factors for diabetic foot complications, Arab world versus western world.

Affecting factors	Arab world	Western world
Weather and foot wear	Hot, dry weather, sandals for shoes	Cold, wet, protective shoes
Habits	Walking bare foot still common	Rare
Religion	Washing for prayer five times a day leads to regular foot inspection	
Education	Patient's information about diabetes and its complication is still developing. High prevalence of illiterate old patients	Patients are more educated
Media	Poor in health education	Advanced
Traditional Medicine	Cautery, herbal medicine and blood letting, still understudied and commonly used	Doesn't exist
Surgery Phobia	Poor education is leading to surgery phobia	Patients are more educated and less anxious to seek medical advise early
Health care system	Patients have to be referred by primary care physician to the specialist	Diabetic foot clinics are more available
Health care providers	Low awareness of the magnitude of the problem and standard management	More knowledge about the problem
Community factor	Strong believe in traditional medicine, delayed presentation	Only modern medicine is practiced, early presentation
Rehabilitation	Still sub optimal	Advanced

care professional interest to proper and adequate management of diabetic foot problems will not bring this alarming health problem into the forefront of the priorities of the hospital administration.

2) *Health care system.* All patients have to be seen by a general practitioner first for any complaint before they could be referred to the hospital to be seen by a specialist. Unfortunately, the standard management of the diabetic foot and how to diagnose the high-risk foot is inadequate. As a result to that a diabetic foot ulcer will be managed lightly and given local treatment and a long series of follow-ups. By the time the patient is seen again the infection is already in its advance stage. He will be then referred to a hospital where amputation will be a life saving procedure.

(ix) *Community factor.* Due to a single story for example about a patient who went to the hospital to treat his diabetic foot and ended up by a major amputation or death and in the other hand another patient tried traditional medicine first and got cured, the repercussion would be that most of the patients will try traditional medicine first and will take recourse to the hospitals at a late stage of the disease and end up with an amputation, such as the vicious cycle!

(x) *Rehabilitation.* Physical or social rehabilitation of the amputees is an underdeveloped field. A patient with an amputation will isolate himself from the community and live a lonely depressing life which most of the time will lead to further complication and even death. If the 5 year survival after amputation due to diabetes complication is 50% in the west, in our observation it is much lower in our part of the world. Another reason is lack of job opportunity for amputees with its physiological and social consequences. Physical rehabilitation and prosthesis centers are few and most of patients cannot afford them. Overall, people are not blamed if they refuse amputation and try all kind of traditional medicine before they end up with sepsis in the hospital where amputation will be a life saving procedure.

**A vicious circle.** All the factors mentioned above, (Table 1) leads the delayed presentation of diabetic foot patients to the specialists and when they have gathered enough courage to show their foot, the disease will be so advanced that amputation or death is the only conceivable outcome. When this happens patients will believe that presenting to hospital will lead to either one of the most feared outcome and they will try any traditional method available to avoid presenting to the hospital hence delaying the presentation and so on (Figures 3 & 4).

**Current management.** To the best of our knowledge there are no multidisciplinary organized teamwork for the management of diabetic foot problems. There had been an attempt a few years ago to do something about it, but it seems that this is still a very difficult task among Arab medical practitioners mainly due to cultural, traditional and the lack of awareness among our policy makers. It will be close to the fact to say that there is no podiatry specialty in the Arab world. Rehabilitation is limited to providing prosthesis to an amputee. Orthotics is mainly confined to providing orthopedics with need prostheses for different kind of orthopedic prosthesis. Rarely orthotics are used to prevent foot deformities - due to diabetic foot - from causing an ulcer or amputation. The full physical social and psychological rehabilitation program is still underdeveloped. Cases are managed mainly by general surgery with individual efforts. In few institutions there are some efforts to establish practice guidelines and clinical pathways to try to standardize the method of treatment of the diabetic foot problems and hence decrease the rate of amputation. Also, there are more concentration on the rule of diabetes educators to prevent diabetic foot problems by adding and stressing in their agenda teaching the patients how to care for their feet. In many countries in the Arab world, the level of education and health care development has improved dramatically in the last decade, which led to increase in multidisciplinary programs for treatment of common diseases such as heart and liver disease. With the establishment of these programs, the concept will be more familiar to health care policy makers to a similar multidisciplinary management program for the diabetic foot.

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