Review Article:
Diabetic Foot in the Arab World: An Update

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Abstract
While diabetic foot problem was discussed in many papers throughout the world, unfortunately it has not discussed well in the Arab World. The global epidemic of diabetes has not spared the Arabic-speaking countries; this has not been fully appreciated in the world’s literature. In this paper, we clarify why it is more prevalent, less managed and has been associated with worse health outcomes in diabetic patients in the Arab world.

Key Words: Diabetic foot – Arab world – Diabetes.

Introduction
DIABETES mellitus, long considered a disease of minor significance to world health [1], is now considered a global epidemic of the 21st century. The International Diabetes Federation (IDF) estimates show that for the year 2012, 371 million people are living with diabetes, representing a prevalence rate of 8.3%. Estimates also show that 50% of diabetics do not know that they have the condition, as it has not been diagnosed yet [2]. By 2030, the global burden of diabetes is projected to reach 552 million people [1], with a 69% increase in the number of adults with diabetes in developing countries and a 20% increase in developed countries [3].

The Arab world refers to Arabic speaking countries expanded from the Atlantic Ocean in the west to the Arabian Gulf in the east and from the Mediterranean Sea in the north to the horn of Africa and Indian Ocean in the southeast, the prevalence of type II diabetes has increased dramatically in the Arabic-speaking countries over the last three decades, a trend that parallels increased industrial development. The wealth generated by oil-rich resources in countries of the Arabian Gulf have led to improved living standards, while there have also been accelerated urbanization, drastic changes in nutrition, reduced physical activity, and a greater reliance on mechanization and migrant workers. As many as six Arabic-speaking countries are among the world’s leaders in terms of type II diabetes prevalence: These countries are SA is ranked with the 6th highest prevalence of diabetes worldwide, and is expected to hold this position for the next 20 years, with a prevalence rate of 20.0% among 20-79 year-old adults [5]. Other countries ranked in the top 10 include Kuwait (21.1%), Lebanon (20.2%), Bahrain (19.9%) and the United Arab Emirates (19.2%) [4].

Table (1): Arab countries located in the East have among the top ten highest diabetes prevalences in the list published by the IDF (Table 2).

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Data accumulated over the last 30 years have confirmed that the epidemic of type 2 diabetes is mainly affecting Saudi Arabia SA and adjacent Gulf Council Countries GCC. Indeed, in Sudan knowledge of diabetes epidemic in Sudan is limited the most recent data come from small scales study that was carried out in 1996 the result of the study indicate prevalence of 3-4% but recent estimates place the diabetes population at around one million 95% of whom have type 2 diabetes [8].

**Diabetic foot syndrome:** Foot disorders are among the most feared chronic complications of DM. Diabetic foot disease comprise a group of disorders that often present with at least one of the following clinical manifestations: Foot ulceration, infection, neuropathy, deformity, gangrene and ischemia. Some or all of these problems may develop in the same patient, often on both feet. If not treated in a timely and appropriate, amputation will become necessary [9]. In turn, amputation is often associated with significant morbidity and mortality [10] in addition to immense social, psychological and financial consequences [11-13].

A person with diabetes has a 15% to 25% lifetime chance of developing a foot ulcer and a 50% to 70% recurrence rate over the ensuing 5 years. A foot ulcer precedes lower-limb amputation in 85% of cases [14]. The 1-year amputation rate of a person with diabetes and a foot ulcer is 15% [15]. The presence of diabetes increases the risk of a nontraumatic lower-limb amputation 20-fold, and worldwide 25% to 90% of amputations, especially nontraumatic lower-limb loss, are associated with diabetes [16].

Moreover, according to some conservative estimates, the treatment costs of these complications account for approximately 25% of total hospital costs of diabetes care, the true costs of which might be an order of magnitude higher [17].

In Saudi Arabia, Alwahabi, 2006 stated that 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 some discussions, we realized that the magnitude of the problem is not yet appreciated for many reasons [7]. Jaffar and Jane were conducted a study to evaluate associated risk factors, clinical presentation, and outcome of diabetic foot ulcers (DFUs) in a Saudi Arabian hospital and they found that DFUs continue to be an important cause of morbidity and resulted in an amputation rate of 19% [18].

In Sudan, Similar to other African countries, diabetes is no longer rare in Sudan. The country's resource strained health care system is far from ready to deal with the rising burden of diabetes. Superficial heel ulcers in diabetic patients with a short history of diabetes and with good limb circulation are more likely to heal within an average duration of 25 weeks. At 3 years of follow-up, 75% showed a favorable outcome for ulcer healing, and 22 patients underwent lower extremity amputation (25%), of whom 14 were dead within 3 years [8].

**Pathogenesis:**

Diabetes can lead to serious complications if it is not properly managed: Most of these complications are related to complications arising from microvascular (e.g., nephropathy, neuropathy, and retinopathy) and macrovascular (e.g., coronary artery disease (CAD), peripheral artery disease (PAD), and cerebrovascular disease [19]. Studies have shown that people with peripheral neuropathy (PNP), and peripheral vascular diseases (PVD) are known to be at high risk of foot complications [20].

**Diabetic neuropathy:**

DPN is thought to result from multiple factors. Putative mechanisms for the development of DPN include glycosylation of neural proteins, microangiopathy, the development of neural autoantibodies, and ischemia from basement membrane thickening of the nerve capillaries (vaso nervorum). Abnormalities of the polyol pathway and defects in metabolism of myoinositol and protein kinase C3 leading to neuronal demyelination have also been described in DPN [21].

Peripheral neuropathy may cause loss of sensation in the feet, resulting in a patient's failure to perceive foot problems, and may cause development of foot deformities that increase pressure points susceptible to ulceration. Osteomyelitis and gangrene may develop from inadequate blood supply and infection [22]. 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 [23].

Data from the Western part of Saudi Arabia indicates that the prevalence of neuropathy in diabetic patients is about 82% (which is considered one of the highest in the world) with another 57% being asymptomatic [24].

In a cross-sectional study from Egypt, 22% had peripheral neuropathy and 0.8% had foot ulcers.
In Jordan, 5% had amputations (88). At a diabetic clinic in Libya 45% had neuropathy (26). In the UAE the overall prevalence of PN was 39%, which was higher than the equivalent rates reported in other populations (27).

Peripheral vascular disease was defined as the presence of ischemic symptoms such as, or a combination of, intermittent claudication, absence of pedal pulse, arterial occlusion, or decreased blood circulation to the foot on Doppler study (28).

Patients have a 2-4 fold greater risk of developing CAD and PAD than non diabetic individuals (29).

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 (30). In the Arab world, peripheral arterial disease is commonly found in diabetics with a prevalence range of 50-78.7% (23).

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 proceeded by callus formation. Due to hot climate, the common footwear’s 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 (7).

Charcot neuroarthropathy: Charcot deformity is a neuroarthropathy of the foot and ankle. The most common area of manifestation is in the mid-foot, followed by the forefoot and ankle region. This presents as hot, red, swollen foot, ankle or lower leg that is most often confused with cellulitis, DVT or gout in the early phase. The average time of delay to proper diagnosis is 29 weeks. Prompt treatment with offloading of the foot with a removable walking boot or short leg cast and crutches, wheelchair or rollabout prevents progressive collapse of the foot. It is this collapse of the foot that can lead to callus formation, ulceration, infection and amputation (31).

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 (Fig. 1) (23).

Fig. (1): Diabetes mellitus is responsible for a variety of foot pathologies contributing to the complications of ulceration and amputation. Multiple pathologies may be implicated, from vascular disease to neuropathy to mechanical trauma.
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 [7].

Diabetic foot in the Arab world:

In the Arab world, several factors make diabetic foot prevalence higher as compared to the West (Table 2):

I- Weather and footwear: In most Arab countries the weather is hot and dry most of the year. This makes the habit of wearing closed shoes and socks rejected by many patients and instead they prefer to wear sandals. Sandals do not offer the protection afforded by closed foot wear since they expose feet to heat, dryness and injuries [32].

II- Habits: Walking bare-footed especially inside the home is still a common habit in many regions of the Arab world [32].

III- Religion: Ninety percent (90%) of Arab populations are Muslims. They pray five times per day where the feet have to be washed before praying. These maneuvers help patients to inspect their feet as well as clean them. Washing feet before praying and the praying itself offer some sort of physical massage to the feet.Trimming the nails is a habit encouraged by Islam, but it should be done properly so as not to harm the toes. Also, every year millions of Muslims engage in the holy practice of Hajj. Among them are many persons with diabetes who may sustain unnoticed physical harm to their feet. Diabetes education and foot care is therefore an important issue before going to do Hajj [32].

IV- Education: The percentage of illiterate people is higher in the Arab world than in western countries. Lack of education leads to unawareness of diabetic foot problems and their prevention. Interestingly, one study showed that 90% of screened diabetic patients had poor knowledge about their disease and 96.3% had poor awareness about its control [33].

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 [7].

Table (2): Risk factors for diabetic foot complications, Arab world versus Western world [7].

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<tr>
<th>Affecting factors</th>
<th>Arab world</th>
<th>Western world</th>
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<tr>
<td>Weather and foot wear</td>
<td>Hot, dry weather, sandals for shoes</td>
<td>Cold, wet, protective shoes</td>
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<tr>
<td>Habits</td>
<td>Walking bare foot still common</td>
<td>Rare</td>
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<tr>
<td>Religion</td>
<td>(Ablution) Washing for prayer five times a day leads to regular foot inspection</td>
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<tr>
<td>Education</td>
<td>Patients information about diabetes and its complication is still developing. High prevalence of illiterate old patients</td>
<td>Patients are more educated</td>
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<tr>
<td>Media</td>
<td>Poor in health education</td>
<td>Advanced</td>
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<tr>
<td>Traditional Medicine</td>
<td>Cautery, herbal medicine and blood letting, still understudied and commonly used</td>
<td>Doesn’t exist</td>
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<td>Surgery Phobia</td>
<td>Poor education is leading to surgery phobia</td>
<td>Patients are more educated and less anxious to seek medical advise early</td>
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<td>Health care system</td>
<td>Patients have to be referred by primary care physician to the specialist</td>
<td>Diabetic foot clinics are more available</td>
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<td>Health care providers</td>
<td>Low awareness of the magnitude of the problem and standard management</td>
<td>More knowledge about the problem</td>
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<td>Community factor</td>
<td>Strong believe in traditional medicine, delayed presentation</td>
<td>Only modern medicine is practiced, early presentation</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>Still sub optimal</td>
<td>Advanced</td>
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VI- Traditional medicine: This is one of the most important factors 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 [34]. 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. 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 cauteryization, 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 60-120ml of blood is let [34].

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 [7].

VIII- Health care system and health care providers: Health resources available for diabetes care and diabetic foot management differs considerably among Arab countries and still the management of the diabetic foot is not based on a multidisciplinary team approach. Due to the frequency and long hospital stays, diabetic foot cases usually consume a considerable part of the health care budgets. For this reason the hospitals’ administrative staff and health care providers are somewhat reluctant to admit patients with diabetic foot problems in their early presentation. This of course results in more complicated problems and subsequently, more amputations [32].

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! [7].

X- Rehabilitation: Physical and social rehabilitation is still an underdeveloped field in Arab countries. Patients with amputations may wait for a long time before they can be provided with an orthotic device. Frequently the cost inhibits the patient from seeking appropriate help. Unfortunately, patients isolate themselves after amputation and live a lonely, depressed life. In addition to this, a lack of employment for amputees has a very negative impact on their life and that of their families [32].

Management:

International studies and guidelines show that targeted foot care and proper screening of risk cases can result in a reduction in the incidence of foot ulcers in patients with diabetes [35].

National Diabetes Programme was established in June 2010 under the Clinical Strategy and Programmes Directorate. In 2011 funding was received to establish a national multidisciplinary foot care service for people with diabetes [36].

Foot care management in diabetes is based on three categories of risk:

1- Patients “at low risk of diabetic foot disease” will be managed preventatively through annual screening and regular foot inspections/examinations by primary care nurses.*
(Definition: A low risk foot patient has normal foot pulses, normal vibration and sensation to 10g monofilament, no history of foot ulceration, no significant foot deformity, or no visual impairment).

2- Patients “at risk of diabetic foot disease” may be stratified as either moderate risk or high risk. All patients will be under regular surveillance by primary care nurses/general practitioners#.

Moderate risk patients will be referred by the GP to the podiatrist, either in the community or in the hospital, for an annual review. These patients will remain under the clinical governance of the GP and podiatrist #.

(Definition: The moderate-risk patient has either impaired peripheral sensation or impaired circulation or significant visual impairment or a structural foot deformity).

High risk patients will be called to be seen at least annually by the diabetes foot protection team in one of the 16 designated centres, and will be under the governance of the foot protection team for their foot care.

(Definition: The high-risk patient has an abnormality that predisposes them to foot ulceration. This can be impaired sensation and impaired circulation, or a previous foot ulcer, previous lower limb amputation or previous Charcot foot).

3- Patients with “active diabetic foot disease”, defined as patients with an active foot ulcer (defined as a full thickness skin break) or a Charcot foot, will be actively managed by a multidisciplinary specialist foot care service, in conjunction with vascular surgery, orthopaedics and orthotics input as required.

Nonetheless, the future is looking promising as there are many efforts to improve the outcome of diabetes and its complications in many Arab countries.

References


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