



Diabetic Foot Risk Factors and Effectiveness of Education in Saudi Arabia

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Diabetes mellitus (DM) is a chronic disease with a remarkable global burden on the affected patients and healthcare systems. Among the reported complications, the diabetic foot has been reported to be a common one, which might be disabling, resulting in related amputations.

Furthermore, we will provide evidence regarding the effect of education on the awareness and knowledge of diabetic Saudis about diabetic foot risk factors and management practices. Different risk factors were reported for developing diabetic foot among patients with DM. These will be studied in the current literature review, focusing on evidence that was conducted in Saudi Arabia. Age, gender, type of diabetes, education, duration of the disease, peripheral neuropathy, erythrocyte sedimentation rate, peripheral vascular disease, ischemic heart disease, renal artery disease, having a previous history of diabetic foot, and hypertension were all reported to be significant factors that were associated with the risk of developing diabetic foot across the Kingdom. The level of knowledge was variable across the different investigations. However, there is a poor attitude in general about the appropriate care practices of diabetic foot. Although it has been demonstrated that educational campaigns are effective, further efforts are still needed to increase awareness and attitude levels among diabetic patients in Saudi Arabia.

Keywords: Diabetes mellitus; complications; epidemiology; risk factors; education; knowledge; awareness; diabetic foot.

1. INTRODUCTION

Diabetes mellitus (DM) is a chronic disease with a remarkable global burden on the affected patients and healthcare systems. The disease is high prevalence with millions of cases that have been estimated globally that vary based on the affected populations and exposure to the different risk factors [1]. Estimates from Saudi Arabia show that the condition is highly prevalent, and projections indicate the rates are increasing within recent years [2,3]. Many complications can develop secondary to DM, either type 1 (T1DM) and type 2 (T2DM). These complications include various serious conditions that can end up in death [4-7]. Therefore, providing optimal management of DM is essential to enhance the prognosis [8].

Among the reported complications, the diabetic foot has been reported to be a common one, which might be disabling, resulting in related amputations [9]. Different risk factors were reported for developing diabetic foot among patients with DM [10-12]. These will be studied in the current literature review, focusing on evidence that was conducted in Saudi Arabia. The impact of education is also important in reducing the incidence and decreasing exposure to the relevant risk factors [13,14]. Accordingly, we will provide evidence regarding the effect of education on the awareness and knowledge of diabetic Saudis about diabetic foot risk factors and management practices.

2. LITERATURE REVIEW

2.1 Overview and Prevalence

The incidence of developing diabetic foot is high across the different countries in the world and

Saudi Arabia. Evidence shows that the condition is a serious one and can significantly impact the quality of life of the affected patients. This is because it can lead to amputation and disability of the affected patient. In the United States, a previous investigation by Ramsey et al. [15] estimated that the prevalence of diabetic foot in their settings was 5.8%. A similar rate was also reported in another investigation in the United Kingdom, which found that the prevalence of diabetic foot in their community-based survey was 5.3% among patients with T2DM, and these patients had a history of having a previous or active diabetic foot ulcer. It has been furtherly demonstrated that the prevalence of the condition among T1DM was 7.4% [16]. In the Netherlands, an epidemiological investigation estimated an annual rate of 2.1% for patients with T2DM to develop foot ulceration [17]. Similar investigations were also conducted in the Middle East. For instance, a previous study from Iran reported that the prevalence of heel cracks, callus, and diabetic foot was found to be 50%, 12%, and 4%, respectively among patients with diabetes [18].

Different studies were also conducted in Saudi Arabia. A previous study by Qari and Akbar found that the prevalence of foot ulcers among their population was 59%, and debridement was required in 65% of these cases [19]. Another study by Nielsen et al. [20] reported that the prevalence of diabetic foot was 4.7% in their Saudi population with T2DM. The authors also compared this rate with the rate in an included Swedish population to find that the rate in Saudi Arabia was significantly lower than in the Swedish population. This has been explained by the different exposure to the different risk factors of developing the condition and the different

behavior related to the quality of care of the diabetic foot. Another retrospective investigation by Sulmani et al. [21] also reported that the prevalence of diabetic foot among their Saudi patients with DM was 10.4%. The prevalence of diabetic foot was also investigated among diabetic patients that were referred for having diabetic nephropathy in Riyadh. It has been demonstrated that the prevalence rate of the condition was 13.5%. Furthermore, the authors investigated the potential risk factors for developing the condition and found that long duration of DM, old age, high systolic blood pressure, proteinuria, and baseline creatinine clearance were the most significant factors related to developing the condition in these settings [22]. Another case series was also conducted in Jeddah and included seven diabetic patients to find that the prevalence of gangrenous foot was 7.7%. The authors reported that inadequate screening for microalbuminuria, high smoking rate, inadequate control of hypertension, and poor glycemic control were the most apparent factors that were potentially associated with developing this condition [23].

3. RISK FACTORS

Many risk factors were reported for developing diabetes foot. Nevertheless, evidence indicates these risk factors in addition to the routine physical examination for assessment and early detection of the condition are poorly conducted in the different clinical settings. Therefore, raising awareness in these settings is essential to enhance the quality of care for these patients and reduce the incidence of diabetic foot among them [24]. Among the different risk factors that have been reported in the literature, different studies have stressed the importance of poor glycemic control in this context. Besides, some reports also showed that the prevalence of diabetic foot was significantly correlated with the presence of peripheral arterial diseases and peripheral diabetic neuropathy. This is logical because these factors lead to reduced immunity and reduced foot sensation, leading to the development of ulcers in the affected regions, which are also at high risk of catching infections and reduced blood supply. In a previous investigation by Qari and Akbar, the authors demonstrated that the prevalence of uncontrolled DM was 79% in their Saudi population, which is considered an evidenced risk factor for developing diabetic foot features [19]. Another investigation that was also conducted in Saudi Arabia by Al-Nuaim et al. [25] aimed to study the epidemiology of glycemic control across the

Kingdom. The authors of this study reported that the prevalence of uncontrolled DM among patients with T2DM was found to be 50%. It has also been reported that the prevalence of poor glycemic control was significantly higher among older patients than younger ones. It has been furtherly reported that underutilization of insulin therapy was noticed in the included Saudi population. This has been concluded secondary to the presence of high rates of diabetic complications, and the increased frequency of poor glycemic control in their included population. Another study that was also conducted in Saudi Arabia by Qari et al. [26] assessed the prevalence and patterns of poor glycemic control in their diabetic population as compared between two different diabetic groups at different settings. It has been reported that the prevalence of poor glycemic control was high among the included populations, which were 54% and 58% in both of the included diabetic groups. It is worth mentioning that the authors also demonstrated that great efforts at the different care settings, where the patients were recruited, were exerted to enhance glycemic control among these patients. A previous investigation by Azab et al. [27] also reported that the rate of glycemic control was not acceptable among patients within the primary care settings. It has been reported that poor glycemic control among their population was prevalent in 49% and 44% of the included population (which was defined by two readings of the fasting blood glucose levels >10 mmol/L). Abolfotouh et al. [28] also identified different risk factors for developing diabetic foot, including age, gender, type of diabetes, education, duration of the disease, peripheral neuropathy, erythrocyte sedimentation rate, peripheral vascular disease, ischemic heart disease, renal artery disease, having a previous history of diabetic foot, and hypertension. After adjusting the different variables of baseline demographics of the included diabetic population, it has been reported that erythrocyte sedimentation rate, neuropathy, and the duration of diabetes were the most significantly correlated factors with the development of the diabetic foot. Therefore, healthcare authorities should exert efforts to raise awareness about these factors and enhance care practices to improve the prognosis and associated outcomes.

4. EFFECT OF EDUCATION

Education is an important factor that should be considered in the management of patients with

diabetes. Educational campaigns should be directed to the patient and physicians in the primary care settings. This is important because aware physicians will direct their patients towards achieving proper glycemic control and enhance management plans. It has been reported that foot examination was poorly practiced across the different settings in Saudi Arabia, which might, therefore, increase the risk of developing diabetic foot in the corresponding diabetic population. The impact of education of physicians and patients was investigated in a previous randomized controlled trial, namely the Diabetes Education Study (DIABEDS) [29]. The results of this investigation demonstrated that the rate of glycemic control and glycosylated levels were significantly lower in the diabetic population that received educational courses, indicating the impact of conducting proper educational campaigns. Another investigation in Saudi Arabia also demonstrated that the rate of controlling blood glucose was significantly correlated with being adequately educated about the condition [30]. On the other hand, another investigation reported that not all educational programs can enhance the quality of self-care of diabetes and enhance the blood glucose levels, and therefore, it has been demonstrated that effective educational programs should be developed to enhance the quality of care and urge diabetic patients to adequately take care of their blood glucose levels and be keen on being adequately examined and routinely followed-up [31]. Another investigation that was conducted in the Asir region also aimed to assess the impact of conducting educational campaigns at the primary healthcare centers on controlling blood glucose levels, and the impact of the different factors on the effectiveness of these educational campaigns to the presenting diabetic population. It has been reported that poor compliance outcomes were reported among the included female population. However, it was also reported that educational sessions were more frequently introduced to the male diabetic population. It has also been reported that sex was the only factor that was significantly correlated with poor glycemic control in this population [31,32]. Another long-term investigation also reported that using follow-up sheets was significantly associated with enhanced quality of care of diabetic patients, and other patients with chronic disorders, by offering long-term routine structured care of their conditions [32]. Another study also investigated whether these approaches can significantly enhance the quality of care and foot examination by primary healthcare physicians [33,34]. It has

been reported that using reminders was significantly associated with a remarkable improvement in the quality of examination of foot among diabetic patients.

Many studies also assessed the level of knowledge among Saudi patients with DM about diabetic foot and required care. A previous study by Alhuqayl et al. [35] estimated that low knowledge about foot care was prevalent in 46.7% of the included patients with type 1 and 2 DM. The authors also demonstrated that diabetic retinopathy, type of DM, educational level of the patient, and gender were all significantly associated with the knowledge levels of these patients. Another investigation that was conducted in Riyadh also concluded that the levels of knowledge and awareness of diabetic foot and required care were good among the included population, Nonetheless, the levels of attitude towards practicing the proposed programs of foot care were not acceptable among this population [36]. Accordingly, the authors suggested that different educational campaigns should be directed to furtherly enhance the levels of knowledge and urge patients to presume the proposed care of foot as a good intervention against developing diabetic foot complications. A similar investigation was conducted in Saudi Arabia by Odhayani et al. [37] to assess the different practices of foot care among patients with diabetic feet. It has been demonstrated that the awareness of the different risk factors of DM and developing diabetic foot as a complication was low among the included diabetic population, in addition to the reduced awareness levels about the appropriate care that should be applied in these settings, indicating the urgent need to inaugurate effective and properly designed educational campaigns for these populations.

3. CONCLUSION

The present literature review discusses the different risk factors for developing diabetic foot among patients with DM in Saudi Arabia. Age, gender, type of diabetes, education, duration of the disease, peripheral neuropathy, erythrocyte sedimentation rate, peripheral vascular disease, ischemic heart disease, renal artery disease, having a previous history of diabetic foot, and hypertension were all reported to be significant factors that were associated with the risk of developing diabetic foot across the Kingdom. The level of knowledge was variable across the different investigations. Nevertheless, there is a

poor attitude in general about the appropriate care practices of diabetic foot. Although it has been demonstrated that educational campaigns are effective, further efforts are still needed to increase awareness and attitude levels among diabetic patients in Saudi Arabia.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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