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Original Article

Prevalence and related risk factors of diabetic foot ulcer in Ahvaz, south west of Iran

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ABSTRACT

Aims: The aim of this study was to evaluate the prevalence of diabetic foot ulcer and its related risk factors.

Materials and methods: In this descriptive cross-sectional study, 605 patients with diabetes were evaluated in July 2014. A checklist was used to obtain demographic data, diabetes related data, past medical history, and physical examination data.

Results: The prevalence of diabetic foot ulcer was 6.4% (95% CI: 4.64–8.73). Seventeen cases of them were female (4.9%). In univariate analysis, the following variables had statistically significant relationship with DFU prevalence: diabetes duration, educational level, 10 g monofilament sensation, Ankle Brachial Index (ABI) and Body Mass Index (BMI). Patients' age, glycemic control and smoking did not show any significant relationship with DFU. After logistic regression analysis, the patients with decreased 10 g monofilament sensation had DFU more than patients with normal sensation (OR = 8.84, 95% CI: 3.5–22.3). Abnormal ABI increased the odds of DFU (OR = 5.6, 95% CI: 1.3–24.18). The DFU prevalence in patients with diabetes duration of 11–20 years, was more than patients with ≤5 years (OR = 3.8, 95% CI: 1.33–10.8). The odds of DFU development in educated patients compared with illiterate patients was 0.27 (95% CI: 0.12–0.57). BMI had a significant relationship with DFU prevalence. The odds in overweight patients was 0.259 (95% CI: 0.108–0.623) and in obese patients was 0.263 (95% CI: 0.1–0.687).

Conclusion: The prevalence of DFU was 6.4% in this study. Final associated risk factors of DFU were decreased 10 g monofilament sensation, abnormal ABI, diabetes duration, educational level and BMI.

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1. Introduction

Diabetes is one of the main problems in health systems worldwide [1]. Diabetes prevalence has been increasing dramatically in the past two decades [1–3]. It is expected that by 2035, from every ten adults, one is diagnosed with diabetes [4]. The effect of diabetes on health systems renders it as an important challenge for policy makers [5].

Diabetes has several micro and macro vascular complications. The most frequent reason of hospitalization in patients with diabetes is diabetic foot ulcer (DFU) [2,6]. One of every 20 inpatients suffered from foot disease according to a systematic review of patients with diabetes [7]. A lower limb is lost because of diabetes every 20 s [4].

The main risk factors of DFU are diabetic neuropathy, vascular disease, foot deformity and decreased resistance to infection [6–9]. A disabling end-point of diabetic foot ulcer is amputation that has many effects on the diabetic patients' quality of life. The survival rate for patients undergoing amputation is about 50% after three years [10]. The risk of amputation in patients with diabetes is 15 times more than that in patients without diabetes [2].

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Global prevalence of DFU is about 6% [11,12]. According to a literature review, North America had the highest prevalence of diabetic foot ulceration. Its prevalence in Asia was reported to be about 5.5% [11]. Few studies have reported the prevalence of DFU. In a study conducted on the Arab world, in 17 out of the 22 Arab countries, there were no studies about DFU prevalence [13]. Given the paucity of research on such an important health issue, such studies are of great value to the clinical management of patients with diabetic foot ulcer.

Diabetes prevalence in Iran in 2000 and 2025 is estimated to be 5.7% and 6.8% respectively. Similarly, the prevalence of associated complications is increasing too [14]. The prevalence of DFU is reported to be about 3% in 2010, and about 18% of the diabetes burden in 2001 was related to DFU [5]. However, studies about DFU prevalence in Iran are rare [15–17]. In fact, studies conducted on diabetes have dealt with the prevalence as a byproduct of the research and not as the main aim in the study design, and to the best of our knowledge, no study has yet been conducted on DFU prevalence in Ahvaz. This is one reason why the present study was conducted. In addition, due to the fact that Ahvaz is one of the few cities in Iran with a specialized diabetic foot clinic in a university hospital and that epidemiologic evaluation of DFU is the backbone of clinical practice, identification of risk factors can help us to put more effort to improve our health status, provide valuable background information for policy makers and reduce disabling outcomes of disease in the community. All these factors warrant the need for designing a study to assess the prevalence of diabetic foot ulcer and related risk factors in Ahvaz, southwest of Iran.

2. Materials and methods

This descriptive cross-sectional study was performed in Golestan Hospital Diabetes Clinic, a university hospital in Ahvaz (the capital of Khuzestan province in southwest of Iran) in July 2014. Golestan Hospital is a referral center for patients with diabetes in the province.

Eligible participants were patients who had either type 1 or type 2 diabetes, were aged over 18 years, and attended diabetes clinic with or without diabetic foot ulcer. Individuals with disabling diseases or psychological disorders were excluded from the study.

Ethical approval was obtained from Ahvaz Jundishapur University of Medical Sciences. All of the patients referring to the diabetes clinic were evaluated and if they were eligible, the procedure was described for them and written informed consent was completed and signed by all of those who were willing to participate in the study. A checklist was used to obtain demographic data, diabetes related data, past medical history and physical examination data. The evaluated variables were age, gender, type of diabetes, diabetes duration, marital status, educational status, smoking status, body mass index (BMI), HbA1c, history of previous foot ulcer, ulcer characteristics (type, cause, site, appearance, length), monofilament sensation, ankle brachial index (ABI), Wagner grading, ulcer self-treatment, ulcer dressing.

BMI was measured as kg/m^2 and categorized to normal: <24.99 , overweight: 25–29.99 and obese: ≥ 30 . Marital status was recorded as married and single. Divorced patients considered as married. Educational level was defined as illiterate and educated. Smoking status was recorded as smoker and non-smoker. Former smokers considered as smokers.

Then the patients were examined. Protective sensation was examined by 10 g monofilament (Owen Mumford, UK). The nylon monofilament placed on four sites in each foot (1st, 3rd and 5th metatarsal head and plantar side of great toe) perpendicular. Inability to sense the monofilament at even one site was considered as decreased monofilament sensation. The areas of

callus, ulcer or necrotic tissue were avoided to place monofilament during examination [18]. ABI was evaluated by a hand held Doppler device (Hunt-Ligh Diabetic Foot Kit, UK). It is an index equal to maximum systolic pressure of dorsalis pedis artery or tibialis posterior divided to maximum systolic pressure of brachial artery. It was described as follows: $\text{ABI} = 0.9\text{--}1.3$ as normal, $\text{ABI} = 0.4\text{--}0.89$ as vascular disease and $\text{ABI} < 0.4$ as severe vascular disease [9].

DFU was defined as full thickness or partial lesion of the foot skin in a patient with diabetes excluding car accidents [19]. If DFU was present, its characteristics were evaluated. Type of ulcer was defined as neuropathic, ischemic and neuro-ischemic. The cause of ulcer was considered as the main reason that starts the ulcer and was recorded as spontaneous, trauma and burn. Ulcer site was described as toe, plantar, leg and mid-foot. Ulcer appearance was categorized as redness, cellulitis, non-pus discharge, pus discharge, mix, and other. Ulcer length was recorded in centimeters (cm). We used Wagner grading of ulcer to describe DFU according to this category: Grade 0: without ulcer or pre-ulcer status; Grade 1: superficial ulcer; Grade 2: deep ulcer with tendon or capsule involvement without bone damage; Grade 3: bone involvement (osteomyelitis); Grade 4: forefoot gangrene; Grade 5: generalized gangrene [20].

Ulcer self-treatment was defined as any medication or herbal drug used by the patient without any health care professional prescription. Ulcer dressing was recorded as routine (washing with normal saline and dressing just with gauze and bandage) and biologic (using biologic dressing such as film, hydrogel, alginate, etc.).

To measure the patients' HbA1c, a blood sample was obtained from each. This test was done in the Diabetes Research Center laboratory of Ahvaz Jundishapur University of Medical Sciences, using Nycocard technique to assess the plasma glucose control. HbA1c less than 7% was considered as good glycemic control; 7–8% as relatively good control and more than 8% as poor glycemic control [21].

The statistical data was recorded on SPSS version 20. We used mean \pm SD to describe our continuous data, and frequency and percentage for categorical data while the variables were first evaluated by Chi square test (or Fischer's exact test). P value ≤ 0.05 was considered as significant. Then statistically significant variables identified by Chi Square test were tested in multiple logistic regression to determine the risk factors of DFU.

3. Results

In this cross-sectional study, 605 patients with type 1 and 2 diabetes were included. Of the total number of the participants involved in this study, 591 cases (97.7%) were type 2, 346 patients were female (57.2%) and 259 cases were male (42.8%). Their mean age was 53.82 ± 10.73 years and the majority of the patients were in 50–59 years age group (37.9%). The mean duration of diabetes was 9.18 ± 7.06 years. The most frequent duration of diabetes among the participants was ≤ 5 years (38.2%). The mean HbA1c of the participants was $8.7 \pm 1.7\%$ and 64.2% had poor glycemic control. Among all participants 97.7% were married and 26.8% were illiterate. The mean BMI of the patients was $28.57 \pm 4.44 \text{ kg/m}^2$ and the majority of them were overweight (48.3%). Five percent of the participants were current smokers and 7.8% were former smokers.

The prevalence of diabetic foot ulcer was 6.4% (39 cases) in this study (95% CI: 4.64–8.73) of whom 17 cases were female (4.9%) and 22 (8.5%) were male with no statistically significant difference between the two genders ($P = 0.07$). Table 1 demonstrates the prevalence of DFU according to demographic characteristics.

First, we analyzed the data by Chi Square test. Diabetes duration had a statistically significant relationship with DFU prevalence ($P = 0.002$). That is, the DFU prevalence was 2.6% in 5 years diabetes

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