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Risk Assessment of Diabetic Foot Disease at Family Health Centers in Alexandria, Egypt

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A B S T R A C T

Background: Diabetic foot is a costly complication of Diabetes Mellitus (DM). It significantly impacts public health, and society, necessitating empowering the crucial role of family physicians (FPs) in evaluating and managing diabetic foot. **Objective**: To estimate the rates of peripheral neuropathy (PN) and peripheral arterial disease (PAD) as well as assess the risk of diabetic foot disease (DFD) among diabetic patients at family health centers in Alexandria (Egypt) as well as assessing the practice of FPs regarding diabetic foot care. **Methods:** A cross-sectional study was conducted among 513 diabetic patients at eight family health centers/units (FHC/Us) in Alexandria. A clinical examination and pulse oximeter (PO) oxygen saturation measurement were performed to detect PN and PAD, respectively. DFD risk stratification was done based on the Egyptian diabetes practice guidelines. FPs' practices were assessed through reviewing patients' records using a predesigned checklist. **Results:** PN and distal symmetrical polyneuropathy (DSPN) were detected in 96.3% and 55.2% of patients, respectively. PAD was detected in 0.6% of patients. Approximately 27.3% of patients had high-risk diabetic foot. FPs considered 1.6% of patients as having high-risk foot. Approximately 79.5% of patients received no education about the care of diabetic foot. FPs performed partially regular foot checkups in 66.7% of patients at moderate and high-risk feet categories. **Conclusions:** Most diabetic patients had PN and subsequently were categorized as having moderate- to high-risk foot. FPs should regularly monitor DFD in accordance with the management plan for each foot risk category.

INTRODUCTION

Diabetes Mellitus (DM) refers to a category of metabolic diseases that are distinguished by the presence of elevated blood glucose in the absence of treatment. There are many etio-pathological causes, which include abnormalities in insulin action, secretion from pancreas or both, as well as problems in the metabolism of carbohydrate, lipid, and protein.[1] Diabetes' long-term micro-vascular complications include neuropathy, retinopathy, and nephropathy. Diabetic patients are also more likely to develop macro-vascular complications as cardiac disease, peripheral arterial disease (PAD), and cerebrovascular disease. Other consequences of DM include eye disorders, sexual dysfunction, and fatty liver disease.[1]

Diabetic foot disease (DFD) is one of the most significant and costly complications of DM. It is primarily caused due to peripheral neuropathy (PN), PAD, and/or infection. It can pose a considerable

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negative impact on public health, society, and economy, particularly in areas with low-income.[2]

Worldwide, DFD and lower-extremity complications impact 40 to 60 million individuals, with foot ulceration accounting for 6.3% of all cases. The increased life expectancy of patients with DM and the global prevalence of DM have led to an increase in the incidence of DFD.[3] In countries with low or middle incomes, foot ulcers and amputations are more common than in countries with high incomes.[4] Men have a higher prevalence of diabetic foot problems than women. It is also higher in patients with type 2 DM (T2DM) than in those with type 1 DM (T1DM).[3]

A large long-term prospective cohort study evaluated limb amputation and mortality following the initial neuropathic diabetic foot ulcer (DFU) found that 1-in-three patients with ulcers have amputation, and one in every six patients dies early.[5] A systematic review and meta-analysis found that an amputation is required in 0.03% to 1.5% of diabetic foot patients.[6] The DFD is responsible for the overburden of disability in diabetic patients.[2]

A systematic review of DFUs prevalence in 5 Arabian countries revealed that Saudi Arabia had the highest mean prevalence of 11.85%, followed by Bahrain and Jordan at 5.9% and 4.65% respectively. Egypt had a mean prevalence of 4.2%, while Iraq had a 2.7% prevalence.[7]

Preventive care, a crucial part of primary health care (PHC), has frequently been neglected. In several settings, PHC, which is the initial encounter of individuals that is provided in a comprehensive and coordinated way, has generally centered on disease treatment instead of initially preventing it.[8]

Primary Health Care is the best healthcare level to prevent DFD and PHC professionals have a crucial role in foot evaluations, risk categorization, and educating DM patients about foot care.[9] The diabetic foot risk assessment begins with a thorough history and examination, followed by allocating the diabetic foot to the appropriate risk group for subsequent management and follow-up.[10] Worldwide, the treatment of DFD must be prioritized according to the foot risk categories.[2]

The objective of the current study was to estimate the rates of PN and PAD as well as the risk of DFD among diabetic patients at family health centers/units. Additionally, to assess the practice of family physicians (FPs) regarding DFD risk categorization and care.

METHODS

A cross-sectional study was conducted in eight family health centers/units (FHC/Us) selected based on the largest catchment areas; distributed in four randomly selected health districts out of the eight health districts in Alexandria Governorate.

The study targeted diabetic patients for 5 years and more, who attended FHC/Us and willing to participate in the study, for detection of PN, PAD and their stratification to the proper foot risk category. To ensure accurate readings of the pulse oximeter, patients who had the following diseases were excluded after being observed and questioned by the researcher: severe hypotension (systolic Bp less than 80 mmHg), heart failure, arrhythmias, severe tricuspid regurge, methemoglobinemia, sulfhemoglobinemia, and excessive tremors. DM patients who met the selection criteria were included in the study until reaching the required sample size from each FHC/Us. Family files of the same diabetic patients to assess FPs practice regarding examination, risk categorization, management of DFD and current detection rate of PN and PAD.

Sample size was calculated using Epi info 7.2, 2018. Based on PN prevalence of 29.7% among diabetic patients[11], a 4% precision, the minimum required sample at 95% confidence level was 502 diabetic patients. A total of 513 diabetic patients were included. DM patients' sample was selected by proportional allocation according to the catchment area size of each FHC/Us. The 513 family files of the same DM patients were included in the study.

Data collection: A clinical examination sheet was designed based on International Diabetes Federation (IDF) practice recommendations on diabetic foot, American Diabetes Association (ADA), International Working Group on Diabetic Foot (IWGDF), and Egypt diabetes clinical practice guidelines to detect PN, distal symmetrical polyneuropathy (DSPN), PAD and to assess the risk of diabetic foot among diabetic patients.[2,10, 12, 13] The examination sheet included the followings: (1) General characteristics of the diabetic patient, including age, gender, education, occupation, years of being diabetic. (2) Patient's history and examination, including risk factors for developing foot ulcer, neuropathy symptoms, vascular history and neurological, vascular, dermatological, and musculoskeletal examination. [2, 10, 12-14] (3) Assessing the

Table 1: General characteristics of the study patients attending family health centers/units (N=513)

	Number*	%
Gender		
Male	88	17.2
Female	425	82.8
Age (years)		
Mean ± SD	56.9 ±10.2	
≤40	36	7.0
41-50	90	17.5
51-60	201	39.2
61-70	147	28.7
>70	39	7.6
Education		
Illiterate	216	42.1
Read and write	48	9.4
Primary education	35	6.8
Preparatory education	43	8.4
Secondary education	128	24.9
University education	43	8.4
Occupation		
Professional	18	3.5
Business	6	1.2
Housewife	388	75.6
Worker	37	7.3
Retired	33	6.4
Unemployed	31	6.0
Duration of diabetes in years		
Mean ± SD	13.3±7.611	
5-10	243	47.4
11-20	189	36.8
21-30	66	12.9
>30	15	2.9

**Unless mentioned otherwise*

practice of FPs regarding DFD care against the following checklist; comprehensive foot examination, Foot patient education, requested laboratory investigations including HbA1c and complete lipid profile, Blood pressure measurement, and detection of PN and PAD

A pilot study was carried out to pretest the examination sheet on a purposive sample of 5 patients, then some modifications were made. Those patients who were enrolled in the pilot study were not included in the study.

Outcome assessment: PN was considered if the tuning fork and/or Ipswich touch test (IpTT) were positive.[13] Distal symmetrical polyneuropathy was considered if the patient had typical symptomatology (numbness, tingling, burning, electric shocks, stabbing pain) and any bilateral abnormal small (pinprick) or large (tuning fork) nerve fiber test, or if the patient had no symptoms and the two previously mentioned tests were positive bilaterally.[15] PAD was considered if PO oxygen saturation reading (SpO2) of the feet was > 2% below the finger reading of the same side.[16,17]A Hand-held pulse oximeter (Justec Shenzhen Co., Ltd. OxiEasy200 V: 1.3.6) was used to measure oxygen saturation in both feet, with PO readings of range and accuracy of (70-100% ± 2%). DFD risk categorization was classified according to the Egyptian diabetes clinical practice guidelines into high, moderate, and low risk foot categories.[12] FP practice: A checklist was designed for reviewing family files to evaluate FPs' practices regarding diabetic foot care, detection rate of PN, PAD and DFD risk categorization based on Egypt diabetes practice guidelines.[12] The practice assessment checklist also included the patient's foot risk categorization according to physician's recorded findings and the management done (follow-up and referral) for each risk category and the matching of the researcher's and FPs' findings regarding PN, PAD and foot risk categorization. All practice items in the checklist were reviewed for at least 1 year duration. Items that should be practiced monthly were reviewed for 1 year e.g foot checking for moderate and high-risk foot and blood pressure examination. Items that should be practiced every 6 months were reviewed for 2 years e.g HbA1c. Items that should be practiced every year were reviewed for 3 years e.g comprehensive foot examination, foot patient education, complete lipid profile.

Statistical analysis: Data was reviewed, coded, verified and statistically analyzed using the computer package SPSS version 25. Quantitative variables were described by means and standard deviation, while categorical variables were summarized by frequencies and percentages.

RESULTS

Regarding general characteristics of the diabetic patients (Table 1), the majority were females (82.8%). The mean age of them was almost 57 years old.

Table 2: Medical history and examination the study patients attending family health centers/units (N=513)

	Number	%
History		
Current or ex-smoker	64	12.4
Previous foot ulcer	17	3.3
Previous lower limb amputation	10	1.9
Lower limb arterial surgery	3	0.6
Retinal problem	94	18.3
Hypertension	338	65.9
Hyperlipidemia	208	40.5
Neuropathic symptoms	357	69.6
Neurological examination		
Peripheral neuropathy	494	96.3
Loss of protective sensation	494	96.3
Distal symmetrical polyneuropathy	283	55.2
Vascular examination		
Posterior tibial artery pulse cannot be detected	423	82.5
Dorsalis pedis pulse cannot be detected	99	19.3
Low right foot oxygen saturation	1	0.2
Low left foot oxygen saturation	3	0.6
Peripheral arterial disease	3	0.6
Musculoskeletal and dermatological examination		
Foot deformities	408	79.5
Physical disability	200	39.0
Inter-digital space infection	211	41.1
Current foot ulcer	6	1.2
Callus	126	24.6

Illiteracy was found among in 42.1% of the sample and more than three- quarters of patients were housewives (75.6%). Less than half of the sample (47.4%) reported being diabetic for 5 to 10 years. The mean years of being diabetic were 13.3 years.

Concerning the distribution of the diabetic patients according to their diabetic foot-related history and examination (Table 2), current smokers represented

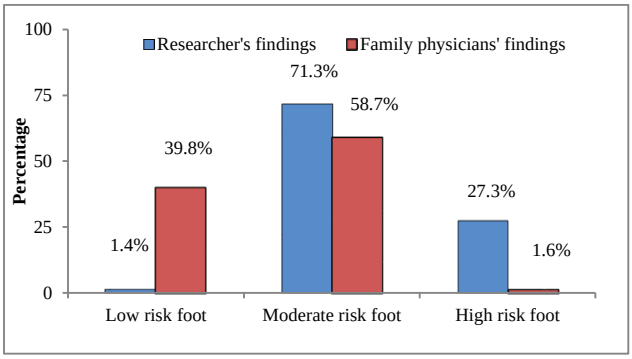

Figure (1): Classification of the diabetic foot risk categories by the researcher and family physicians among study patients attending family health centers/units (N=513)

6.6% of diabetic patients. Having a previous foot ulcer and lower limb amputation was reported by 3.3% and 1.9% of patients, respectively. Retinal affection was reported in 18.3% of patients. More than two-thirds of patients (69.6%) complained of neuropathic symptoms. More than half of the sample (65.9%) had hypertension. In addition, at least 40.5% had a history of hyperlipidemia. Regarding foot neurological examination, 33.5% of patients had an abnormal Ipswich test, 95.1% had abnormal tuning fork test, and pain sensation was absent in 10.1% of patients. Collectively, diabetic patients who had PN or LOPS accounted for 96.3% of the sample, while DSPN was present in more than half of the patients (55.2%). The Posterior tibial pulse was absent unilaterally in 0.6% of the cases. According to pulse oximeter readings, a total of 0.6% of the sample had PAD. More than three-quarters of diabetic patients (79.5%) had one or more-foot deformities. Physical disabilities like obesity or motor limitations that hinder foot self-care were present in 39.0% of patients. Regarding dermatological findings, a high percent of patients (41.1%) had inter-digital infection. Nearly a quarter of the sample (24.6%) had foot calluses.

The classification of the diabetic foot risk categories by the researcher and family physicians is shown in (Figure 1). According to the researcher's findings, 71.3% of patients had moderate-risk diabetic foot, and 27.3% of them had high-risk foot. On the other side, FPs considered 58.7% of patients having moderate-risk foot category, while high-risk foot was considered in only 1.6% of patients.

In relation to foot health care provided to the diabetic (Table 3), a yearly comprehensive foot examination was done completely in 71.2 % of patients.

Table 3: **Foot health care provided to study patients attending family health centers/units (N=513)**

		Number	%
General diabetic foot health care practices			
Comprehensive foot examination is done at least once a year (n=428)	Partially done	73	17.1
	Not done	50	11.7
Blood pressure is measured at every routine visit (n=419)	Partially done	343	81.9
	Not done	9	2.1
Patient education about foot care is done at least once a year (n=428)	Partially done	81	18.9
	Not done	340	79.5
Hemoglobin A1c test is done every 6 months (n=424)	Partially done	122	28.8
	Not done	292	68.8
Complete lipid profile is done at least once a year (n=428)	Partially done	160	37.4
	Not done	211	49.3
Health care of high-risk foot (n= 6) [a]			
Detection of all foot risks by the physician	Partially detected	6	100
Performance of a regular foot checkup every month	Partially performed	4	66.7
	Not performed	2	33.3
Referral for appropriate footwear or orthotic device if deformity present	No referral	6	100
Referral to diabetic foot clinic	No referral	6	100
Referral to vascular specialist if absent foot pulse was diagnosed	Not diagnosed	6	100
Health care of moderate-risk foot (n=261) [b]			
Detection of all foot risks by the physician	Partially detected	194	74.3
Performance of a regular foot checkup every 1-3 months (n=198) [c]	Partially performed	132	66.7
	Not performed	17	8.6
Referral to vascular specialist, if absent foot pulse was diagnosed	Not diagnosed	261	100
Regular nail care, if visual impairment or physical disability present	No nail care	155	59.4
Health care of low-risk foot (n=152) [d]			
Performance of a regular annual comprehensive foot examination	Partially performed	30	19.7
	Not performed	30	19.7

a: First visit and dropout patients were excluded from the results. b: Patients with family files of less than a year duration, first-visit and dropout patients were excluded from the results. c: Patients who were diagnosed as having moderate-risk foot for less than one year were excluded from the results. d: Patients with family files of less than a year duration, first-visit and dropout patients were excluded from the results.

Educating diabetic patients about foot care was not provided to 79.5% of patients. Regarding laboratory investigations, testing HbA1c every 6 months was not performed in 68.8% of patients. In addition, a complete lipid profile per year was not done in nearly half of the sample (49.3%). Regarding care of high-risk foot patients, a monthly regular foot checkup was partially performed in 66.7% of patients. No referral for appropriate footwear or orthotic devices was issued in all patients (100%) who had foot deformities, and a similar percent of patients were not referred to a diabetic foot clinic. Regarding care provided to moderate-risk foot patients, a regular foot checkup every 1-3 months was partially performed in 66.7% of patients. Nail care was not performed for 59.4% patients who had either a visual impairment or a physical disability. An annual comprehensive foot examination was not performed in 19.7% of patients with low-risk foot.

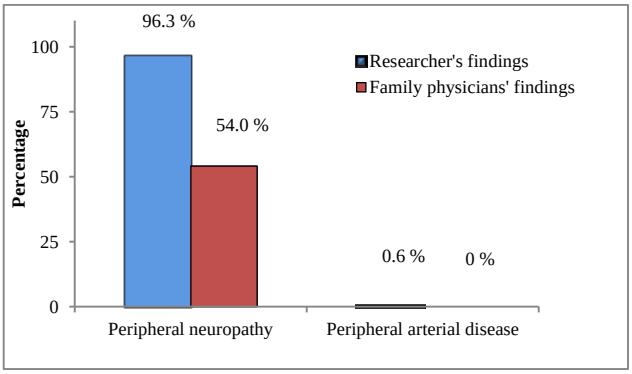

Figure (2): Detection rate of peripheral neuropathy and peripheral arterial disease by researcher and family physicians among study patients attending family health centers/units (N=513)

The detection rate of PN and PAD by family physicians is shown in Figure 2, where PN was detected in 54% of patients, while none of them was considered to have PAD. The detection rate of PN by FPs compared to the researcher finding was 56.1%.

As shown in Table 4, high/moderate diabetic foot risk was significantly associated with PN, history of amputation, and history of foot ulcer ($p<0.001$ for all)

DISCUSSION

Diabetic foot indicates a wide range of disorders that can affect diabetic patients' foot.[18] It is a debilitating and costly consequence of DM.[2] Therefore, preventive measures are needed to lower the frequency of foot problems in the diabetic population.[18]

In the present study, PN was detected in the majority (96.3%) of the examined diabetic patients. On the other hand, the prevalence of PN altered clearly among different studies that estimated the frequency of PN in hospital-based or clinic-based settings in different countries, such as Egypt, Saudi Arbia, Sudan, and Iran. The prevalence of PN in these studies varied from 22.5% to 87%.[11, 19-22]

To the best of the researcher's knowledge, no previous study assessed the prevalence of PN in the PHC population in Egypt. A cross-sectional study that was carried out to in inpatient and outpatient diabetics at Bani Swef University Hospital, found that PN was present in 73.7% of patients.[19] On the contrary, Kasim et al. conducted another cross-sectional study in DM clinics at Al-Azhar University Hospitals, and found that 29.7% of patients had PN.[11]

In Saudi Arabia, a cross-sectional study reported the prevalence of PN in 47.5% of T2DM patients attending a PHC center.[20] Another cross-sectional study in Sudan conducted at PHC center in Al-Khartom city found that PN was present in 22.5% of T2DM patients.[22]

According to a recent systematic review and meta-analysis in 2020 that included 29 studies, the prevalence of PN in DM patients varied widely from 7% to 75.1%. [23] Another systematic review and meta-analysis was performed in Iran and found that PN in different studies varied from 16% to 87%.[21] The differences in PN rates can be explained by the difference in the used detection methods. The current study adopted the IWGDF diagnostic criteria of PN.

The present study showed that PAD was present in 0.6% of the patients by using PO. This was partially consistent with a previous study by El-Nahas et al. that assessed diabetic patients at a DM clinic in Al-Mansoura University specialized hospital, and PAD was present in 3.1% of patients using ankle brachial index.[24] Also, the previously mentioned Bani Swef study diagnosed PAD with doppler ultrasonography in 1.6% of diabetic patients.[19] In addition, Aziz in Saudi Arabia assessed diabetic patients who were referred from PHC facilities to a DM center in a tertiary care hospital. He diagnosed PAD using doppler ultrasonography in 1.8% of patients.[25]

However, a higher figure (11%) was reported by Assaad et al. who assessed diabetic patients attending the diabetic foot (DF) clinic at Alexandria University Hospital for PAD using doppler ultrasonography. The larger percent is probably due to the specialized DF clinic setting, where the diabetic patients had more prevalent risk factors for PAD, as smoking status (29.5% vs. 12.4% in the present study).[26] Furthermore, the DF clinic received patients who already had PAD possible complications (6.1% with active foot ulcers, 8.7% with previous foot ulcers, and 4.4% with amputations vs. 1.2% with active foot ulcers, 3.3% with previous foot ulcers, and 1.9% with amputations in the present study).[26]

In Saudi Arabia, a cross-sectional study was conducted at PHC facilities in the El Joof region. PAD was diagnosed in 32.2% diabetic patients by doppler ultrasonography. This value is inconsistent with the current study figure, and this could be partially explained by the high frequency of smoking as a risk factor for PAD, which was present in 47% of participants. Also, past lower limb angioplasty was reported in 14.1% of the sample.[27]

Table 4: Association between diabetic foot risk and risk factors for foot ulceration among study patients attending family health centers/units (N=513)

	Diabetic foot risk category						P Value*
	High		Moderate		Low		
	No.	%	No.	No.	%	No.	
Peripheral neuropathy							
Yes	138	27.7	361	72.3	0	0	<0.001
No	2	14.3	5	35.7	7	50.0	
Peripheral arterial disease							
Yes	3	100	0	0	0	0	0.05
No	137	26.9	366	71.8	7	1.4	
Cigarette smoking							
Smoker	13	38.2	21	61.8	0	0	0.45
Ex-smoker	9	30.0	21	70.0	0	0	
Non-smoker	118	26.3	324	72.2	7	1.6	
History of amputation							
Yes	10	100	0	0	0	0	<0.001
No	130	25.8	366	72.8	7	1.4	
History of foot ulcer							
Yes	17	100	0	0	0	0	<0.001
No	123	24.8	366	73.8	7	1.4	
Retinal problem **							
Yes	28	29.8	66	70.2	0	0	0.47
No	18	25.4	52	73.2	1	1.4	

**P value for Monte Carlo for Chi Square test **patients who had fundus examination (n=165)*

It is essential to highlight that PO may be unable to post oxygen saturation value if there is inadequate toes perfusion resulting in weak pulse wave. Foot pulse weakness can be due to PAD, heart failure, dysrhythmia, shock, hypotension, use of vasoconstrictors, and hypothermia.[28] In the present study, PO was unable to post oxygen saturation values in 2.9% of cases. The possibility of PAD in these cases might exist. Because diabetic patients who had heart failure, arrhythmias, and severe hypotension were excluded at the beginning of this study, while patients experiencing shock, hypothermia, or those under the treatment of vasoconstrictors are mainly encountered in intensive care units not at PHC facilities.

Regarding DF risk categorization in the current study, only 1.4% of patients had a low-risk category. On the other side, 71.3% of diabetic patients had a moderate foot risk category. A high-risk category was found in 27.3% of diabetic patients. The current study results could not be compared directly with other studies due to different adopted foot risk categorization guidelines. To the best of the researcher knowledge, no published Egyptian study has evaluated DF risk categorization in PHC after the release of the latest 2019 Egyptian diabetes practice guidelines.

In 2018, a study in Zagazig assessed foot risk categories in diabetic patients at University Hospitals' diabetes and vascular surgery clinics using IDF foot risk categorization. It found that low-risk foot was present in 18.8% of patients, where the guidelines considered foot to be low-risk if patient had only normal sensation. High-risk foot was found in 13.2% of patients who had LOPS and either PAD, foot deformities, onychomycosis, or increased pressure on the foot (callus, repetitive trauma). A very high-risk foot was detected in 68% of patients who had either a previous ulcer, amputation, or neuropathic fracture.[29] The large percent of very high-risk foot in the mentioned study could be attributed to the vascular and DM clinics tertiary care settings, where they receive more complicated DF cases.

In the present study, the most prevalent risk factor for having a future foot ulcer was the presence of PN (96.3%), followed by foot deformities (79.5%). These were consistent with a recent systematic review and meta-analysis that assessed DF risk factors, as PN and

biomechanical deformities were considered the most frequent risk factors for ulceration (42.5% and 28.9%, respectively).[30]

Concerning practice of FPs regarding DF care, to the best of the researcher's knowledge, no study has assessed physicians' practice regarding the detection rate of PN or PAD and allocation of diabetic patients to different foot risk categories.

Annual comprehensive foot examination was done in 71.2% of patients; this was inconsistent with what was reported by Ugwu et al. in Nigeria who evaluated PHC physicians' practice about DM care using a self-administered questionnaire, as it was only done by 12.5% of physicians.[31] The high percent of annual comprehensive foot examination reported in this study may be due to the regular supervision on family files at FHC/Us, where supervisors urge the FPs to complete filling out the records, which pushes physicians to check some items that they might not have time to do.

In the present study, 79.5% of patients did not receive a minimum of a single annual health education message about foot care from their FPs. This was relatively in agreement with El-Nahas et al. study, as 93.8% of patients reported receiving no previous foot care education.[24] Also, Ugwu et al. stated that 71.9% of PHC physicians had not provided foot care education.[31]

High-risk DF patients should be referred to a diabetic foot clinic for in-depth evaluation and to be properly managed by a multidisciplinary team.[12] However, in the present study, none of the diabetic patients who were considered having a high-risk foot by FPs were referred to a DF clinic. Patients with serious foot problems were advised verbally to go to either the DF clinic at the governmental Abu-Keer hospital or at Alexandria Main university hospital. Abu-Keer general hospital is located at the easternmost region of Alexandria governorate with limited transportation accessibility, while there is no official referral pathway to Alexandria Main university hospital. This reflects the defects in the current PHC services that should be integrated and comprehensive services.

Most cases with moderate-risk foot had their foot risk factors partially detected by FPs (74.7%); also, 66.7% of them had a partial checkup of their feet. While none of the patients with visual impairment or physical disability received the nail care recommended by the Egyptian diabetic practice guidelines.

Overcrowding, time constraints, insufficient knowledge, lack of training, and limited referral pathways hinder FPs from proper history taking, examination, reviewing of patient's file disease information, and referring accordingly, which leads to missing those in need and the subsequent provision of deficient care.

The current FPs detection rate of PN and PAD (54.0% and 0%) is much lower than that of the researcher (96.3% and 0.6%). This could be attributed to time constraints, which force FPs to primarily rely only on patients' complaints to suspect PN or PAD. However, nearly half of diabetic patients may not have neuropathic symptoms, while others may not express their symptoms.[15] Therefore, screening through examination is important for early detection of neuropathy.

FPs considered 39.8%, 58.7%, and 1.6% of patients as having low, moderate, and high-risk foot, respectively. On the other side, the researcher considered 1.4%, 71.3%, and 27.3% of the sample as having low, moderate, and high-risk foot, respectively. Correct DF risk categorization depends mainly on the knowledge about the Egyptian guidelines risk categories as well as identifying all risk factors that determine each risk category. Lack of these two leads to wrong DF categorization.

In addition, performing the foot neurological tests and foot pulse palpation needs an appropriate clinic atmosphere for the patient to feel comfortable and for the FP to be able to conduct the examination properly. This may be difficult to achieve in most FHC/Us as two physicians are usually working in the same clinic due to patients overcrowding. Furthermore, the clinic door is open most of the time, which negatively affects patient's privacy and physician's concentration.

CONCLUSIONS

Most diabetic patients had PN, while DSPN was found in almost half of them. PAD was found in the minority of diabetic patients. High-risk foot was present in about quarter of patients, while nearly two-thirds of them had moderate-risk foot. Family physicians detected PN in about half of the sample and missed the majority of high-risk foot patients. Most diabetic patients did not receive annual diabetic foot education. It is recommended that FPs should educate diabetic patients on foot care, screen for DSPN in T2DM patients at time of diagnosis, manage risk factors for

neuropathy, PAD, and ulceration, and follow Egyptian guidelines for foot care of different risk categories.

Ethical Considerations

An informed consent was taken from study participants after an explanation of the purpose and benefits of the research. Education about foot care was given to every examined patient. Anonymity and confidentiality were assured and maintained. The researcher complied with the International Guidelines for Research Ethics. There was no conflict of interest. The study obtained all required approvals from the Institutional Review Board of Alexandria University and the Ministry of Health and Population Scientific and Research Ethics Committee (IRB number 0000687).

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Conflict of interest

All authors have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper

Author contributions

Nourhan RD Mostafa: Idea, literature search, data collection, analysis and writing; Amal E Khairy: Idea and critical review; Manal R Koura: Idea, critical review, analysis and writing; Shaymaa S Habib: data collection; Noha S Moustafa: Idea, critical review, analysis and writing

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