Revista Brasileira de Enfermagem
REBEn

THEMATIC ISSUE:
HEALTH OF THE ELDERLY

RESEARCH

Assessment of ulceration risk in diabetic individuals

Avaliação do risco de ulceração em indivíduos diabéticos

Evaluación del riesgo de ulceración en los individuos diabéticos

Luz Marina Alfonso Dutra[I], Maria Rita Carvalho Garbi Novaes[I], Manuela Costa Melo[II], Danyelle Lorrane Carneiro Veloso[I], Dayane Leticia Faustino[II], Leila Maria Sales Sousa[II]

[I] Universidade de Brasília, College of Health Sciences. Brasília, Distrito Federal, Brazil.
[II] Escola Superior de Ciências da Saúde. Brasília, Distrito Federal, Brazil.

How to cite this article:
Dutra LMA, Novaes MRCG, Melo MC, Veloso DLC, Faustino DL, Sousa LMS. Assessment of ulceration risk in diabetic individuals. Rev Bras Enferm [Internet]. 2018;71(suppl 2):733-9. [Thematic Issue: Health of the Elderly] DOI: http://dx.doi.org/10.1590/0034-7167-2017-0337

Submission: 05-09-2017 **Approval:** 10-01-2017

ABSTRACT

Objective: To identify the risk factors for foot ulceration through the tracing of diabetic peripheral neuropathy and peripheral arterial disease in individuals with type I and II diabetes, who were assisted in reference centers of the Federal District, Brazil. **Method:** a cross-sectional and analytical study, with the assessment of 117 individuals in outpatient clinics of the Federal District. Continuous variables were compared through *Mann-Whitney* test, and categorized variables, through Chi-square test for univariate analysis and Logistics regression test for multivariate analysis. **Results:** painful diabetic peripheral neuropathy was present in 37 (75.5%) of the individuals with neuropathy. Deformities and loss of protective plant sensibility were related to neuropathy (p=0.014 and p=0.001, respectively). Of the 40 (34.2%) individuals in the sample who presented peripheral arterial disease, 26 (65%) presented calcification risk. **Conclusion:** signs of painful peripheral polyneuropathy, peripheral arterial disease, deformities, loss of protective plantar sensibility, and dry skin were identified as risk factors for ulceration.

Descriptors: Diabetes mellitus; Diabetic neuropathies; Peripheral arterial disease; Nursing care; Secondary attention to health.

RESUMO

Objetivo: Identificar os fatores de risco para ulceração do pé mediante o rastreamento de neuropatia diabética periférica e doença arterial periférica em indivíduos diabéticos tipo I e II assistidos em centros de referência do Distrito Federal, Brasil. **Método:** estudo transversal e analítico, com avaliação de 117 indivíduos em ambulatórios do Distrito Federal. As variáveis contínuas foram comparadas por meio do teste de *Mann-Whitney*, e as variáveis categorizadas, dos testes de qui-quadrado para análises univariadas e regressão logística para análises multivariadas. **Resultados:** a neuropatia diabética periférica dolorosa esteve presente em 37 (75,5%) dos indivíduos com neuropatia. Deformidades e perda de sensibilidade protetora plantar tiveram relação com neuropatia (p=0,014 e p=0,001, respectivamente). Dos 40 (34,2%) indivíduos da amostra com doença arterial periférica, 26 (65%) apresentaram risco de calcificação. **Conclusão:** identificados sinais de polineuropatia dolorosa periférica, doença arterial periférica, deformidades, perda de sensibilidade protetora plantar e pele seca como fatores de risco para ulceração.

Descritores: Diabetes Mellitus; Neuropatias Diabéticas; Doença Arterial Periférica; Cuidados de Enfermagem; Atenção Secundária à Saúde.

RESUMEN

Objetivo: Identificar los factores de riesgo para la ulceración del pie de acuerdo con el rastreo de neuropatía diabética periférica y la enfermedad arterial periférica en los individuos diabéticos tipo I y II asistidos en los centros de referencia del Distrito Federal, Brasil. **Método:** Estudio transversal y analítico, con la evaluación de 117 individuos en ambulatorios del Distrito Federal. Las variables continuas fueron comparadas por medio de la prueba de *Mann-Whitney*, y las variables categorizadas, de las pruebas de chi cuadrado para los análisis univariados y la regresión logística para los análisis multivariados. **Resultados:** La neuropatía diabética periférica dolorosa estuvo presente en 37 (el 75,5%) de los individuos con neuropatía. Las deformidades y la pérdida de sensibilidad protectora plantar tuvieron relación con la neuropatía (p=0,014 y p=0,001, respectivamente). De

los 40 (el 34,2%) individuos de la muestra con enfermedad arterial periférica, 26 (el 65%) presentaron riesgo de calcificación. **Conclusión:** Identificadas las señales de polineuropatía dolorosa periférica, la enfermedad arterial periférica, las deformidades, la pérdida de sensibilidad protectora plantar y la piel seca como los factores de riesgo para ulceración.
Descriptores: Diabetes Mellitus; Neuropatías Diabéticas; Enfermedad Arterial Periférica; Cuidados de Enfermería; Atención Secundaria a la Salud.

CORRESPONDING AUTHOR **Luz Marina Alfonso Dutra** E-mail: marinayyu95@gmail.com

INTRODUCTION

An individual with a diabetic foot is under risk of ulceration, infections and/or destruction of deep tissues that are associated with neurological changes, several degrees of peripheral vascular disease and/or metabolic complications of diabetes in the lower limbs[1]. Because of this elevated risk of complications, health promotion and harm prevention actions become necessary. The incidence of feet complications in individuals with *diabetes mellitus* (DM) over a lifetime is estimated to be between 15% and 25% and, every minute, three amputations occur in people with DM worldwide[2]. Foot ulcerations are the most prevalent problem, with an annual incidence from 2% to 4% in developed countries, and higher incidence in countries under development. According to multicentered studies, the most crucial factors underlying the development of feet ulcers are sensory neuropathy, peripheral feet deformities related to motor neuropathy, foot trauma, and peripheral arterial disease (PAD)[3-4].

The tracing test for diabetic peripheral neuropathy (DPN) and PAD has a high degree of national and international recommendation, for presenting evidence on prevention of lacerations, ulcers, and amputations in diabetic individuals[5]. DPN has, as symptoms, numbness or burning sensations in the lower limbs, tingling, pricking, shocks, pains that can develop into deep pain, allodynia, and hyperalgesia; moreover, and more frequently, the decrease or loss of tactile, thermal, or painful sensibility. It can also be asymptomatic[3].

Another chronic complication with high prevalence is the PAD, which affects 50% of the DM patients, being five to ten times more frequent in this population than in people with no DM. From the individuals affected by it, 25% to 50% may be asymptomatic or show atypical symptoms, 30% have intermittent claudication, and only 20% present the severe form of the disease, which may evolve to critical ischemia[6-7].

In Brazil, the National Program of Diabetes is responsible for actions of health promotion and protection, harm prevention, diagnosis, treatment, rehabilitation, and maintenance of health. The diabetic individual should be assisted by a multiprofessional team and, in such assistance, the nurse develops health education activities in primary and secondary healthcare, establishes strategies for preventing harms, identifying risk factor and complications, and encouraging the adherence to treatment[8].

Considering the high rates of neuropathic complications and PAD in Brazil and worldwide, combined with the scarcity of research on the topic, this study aimed to identify the risk factors to foot ulceration, through the tracing of diabetic peripheral neuropathy and peripheral arterial disease in individuals with type I and II diabetes who were assisted in reference centers of the Federal District, Brazil.

OBJECTIVE

This study aimed to identify the risk factors to foot ulceration, through the tracing of diabetic peripheral neuropathy and peripheral arterial disease in individuals with type I and II diabetes who were assisted in reference centers of the Federal District, Brazil.

METHOD

Ethical aspects

The study followed the recommendations of Resolution No. 466/2012 of the National Health Council. It was approved by the Research Ethics Committee of the Foundation for Education and Research in Health Sciences from the Federal District and conducted in accordance with the ethical standards required.

Study design, place and period

A cross-sectional and analytical study, performed at the reference outpatient clinic of three public hospitals of the Federal District, from March to December 2015. The instrument used was the tracking sheet of DPN and PAD in people with type 1 and 2 diabetes (DM1 and DM2), validated by the Brazilian Society of Diabetes[9] and standardized by the Secretary of State for Health of the DF (SES/DF).

Sample and inclusion and exclusion criteria

The selected population comprised 134 diabetics who conducted examinations, of which 117 composed the sample: 27 individuals with DM1, and 90 with DM2. Inclusion criteria were: patients with DM1 or DM2 referred to DPN and PAD tracking and assisted at the secondary level. The exclusion criteria were patients with peripheral or central neurological disease, whose information was incomplete in the electronic medical records.

Study protocol

The tracking assessment was performed by nurses with experience in this type of care and trained for this purpose. Training of this professionals was conducted by the Brazilian Society of Diabetes with SES/DF. Such training aimed to reduce the risk of bias in the instrument application and to guide the interviewers' procedures in order to homogenize the nursing behavior, as well as to avoid misinterpretations that could compromise the results.

In the electronic medical record, information regarding time and type of DM, associated diseases such as systemic arterial hypertension, and glycated hemoglobin (HbA1c) values were collected. The evaluated clinical findings were: dilated vessels, dry skin, cracks, interdigital and nail mycosis, callosity, and edema, followed by evaluation of loss of plant sensitivity. Regarding the evaluation method, the individuals were questioned about discomfort or pain in the legs or feet.

Neuropathic symptoms and signs were extracted from the tracing sheet, in which are also described the information of clinical findings that identify deformities and the assessment of protective plant sensitivity loss. Thus, questions were asked, accompanied by the following answer possibilities: 1) What is the feeling on your feet or legs? (A) Burning, numbness, and tingling (2 points); (B) Fatigue, cramps, or pain (1 point); (C) Asymptomatic (0 points); (2) Which is the most frequent location? (A) Feet (2 points); (B) Leg (1 point); (C) Other location (0 points). (3) When do the symptoms occur? (A) During the night (2 points); (B) During the day and night (1 point); (C) Only during the day (0 points); (4) Ever woke up at night because of the symptoms? (If the person wakes up at night with symptoms, 1 additional point); (5) What relieves the symptoms? (A) Walking (2 points); (B) Standing up (1 point); (C) Sitting or lying down (0 points). The sum of points leads to the following symptoms classification: from 0 to 2 points, normal; 3 to 4 points, mild; 5 to 6 points, moderate; and from 7 to 9 points, severe.

In the assessment of neuropathic symptoms, the Achilles reflex exam and the test of vibratory, thermal, and painful sensitivity were performed. Achilles reflex was classified as absent (2 points for each foot); present at reinforcement (1 point for each foot); and present (0 points). Vibration was classified in: decreased or absent (1 point for each foot) or present (0 points). Pain was assessed considering the scores 1-2 (normal) and from 3 to 9 (ranges from mild to severe pain). Temperature was assessed and classified as diminished or absent (1 point for each foot) or present (0 points). The sum of the points allowed ranking the signs in the scale: from 0 to 2 points, normal; 3 to 5, mild; 6 to 8, moderate; and from 9 to 10, severe.

In addition to this classification, the evaluation of Visual Analogue Scale (VAS) was used to measure the intensity of the neuropathic symptoms, being 0 the value for when the person reported no pain and 100 mm the worst pain possible. After obtaining information from VAS and from symptoms and sign scores, the DPN was classified as: 1) painful diabetic polyneuropathy when the scores of symptoms were equal or greater than 5 and the neuropathic scores of signs were equal or greater than 3; 2) diabetic polyneuropathy with ulceration risk when the scores of signs were equal or greater than 6, with or without symptoms; and 3) asymptomatic diabetic polyneuropathy when the patient presented only the scores of signs. Neuropathic pain was considered only when the scores of symptoms were equal or greater than 5 and the VAS was equal or greater than 40 mm.

The evaluation instruments were: for vibration perceptions, a tuning fork 128 Hz; *Semmes-Weinstein* monofilament (10 g) for Plantar Protective Sensibility (PPS); a pick for painful stimulus; cold metal for thermal sensitivity evaluation; and hammer for Achilles reflex. For assessment of PAD, we resort to Arm-Ankle Index (AAI), using a manual 8 MHz Doppler of continuous waves. Interval of AAI between 0.90 and 1.30 was considered normal. The AAI under 0.9 determined the presence of PAD, and values over 1.30 were considered suggestive of arterial calcification[9].

Analysis of results and statistics

Data were presented through relative frequencies for qualitative variables, and through measures of central tendency for quantitative variables. Continuous variables were compared through *Mann-Whitney* nonparametric test. For categorized variables, Chi-square association tests were conducted for univariate analysis and generalized linear models. Multivariate analysis was assessed with binomial distribution and logit binding functions (logistic regression), using the *Akaike Information Criterion* (AIC) as a criterion for model selection. Initially, the complete model (all covariates) was considered and, through *stepwise* algorithm, the model with lowest AIC was reached, indicating the variables which contributed significantly to the likelihood, and, consequently those that possessed an explanation factor with response variable (PAD, DPN). In the final model, the variables that presented a p-value of $p < 0.05$ (alpha) were considered significant, estimating their chance ratio. The analyses were performed in the R environment of statistical computing, version 3.1.2.

RESULTS

Prevalence and classification of DPN are exposed in Table 1. Of the 117 individuals in the sample, 68 (58.1%) showed no DPN; from those, 43 (63.2%) presented no neuropathic pain. In other words, they presented symptoms but no clinical signs. Painful DPN was present in 37 individuals (75.5%) of the sample.

Table 1 – Classification of diabetic peripheral polyneuropathy, Health Secretariat Hospitals of the Federal District, Brasília, Brazil, 2015

Variable	n (%)
DPN*	
Yes	49 (41.9)
No	68 (58.1)
Present DPN*	
Asymptomatic (signs only)	10 (20.4)
Ulcer risk †	2 (4.1)
Painful ‡	37 (75.5)
Absent DPN*	
Neuropathic pain§	43 (63.2)
Without neuropathic pain	25 (36.7)

*Note: *Diabetic peripheral polyneuropathy; † score of signs ≥6, with or without symptoms; ‡ score of symptoms ≥5 and score of neuropathic symptoms ≥3; § score of symptoms ≥5, VAS ≥40.*

The assessed deformities (Table 2) were clawed fingers, cavus foot, Charcot foot and valgus. Individuals with no deformities had a higher tendency not to present DPN (p=0.1065) than those with deformity (p=0.0148), because the frequencies distribution was not homogeneous. Loss of protective plantar sensibility proved to be an influential factor for DPN (p<0.001). Prayer sign was not a common trait among the individuals. Regarding scores of symptoms, 43 (36.8%) had mild symptoms and 51 (43.65%) presented no signs. The VAS, which assesses the intensity of the symptoms, showed that 83.8% felt an intensity which was equal or greater to 40 mm. However, this isolated variable showed no relation to pain and DPN. PAD had no relation to DPN and neuropathic pain. In addition, from the 34.2% with PAD, 65% had an AAI greater or equal to 1.30, with calcification risk.

According to Table 3, the mean age of the sample (50.8 years) was a relevant factor for PAD (the null hypothesis at the level of 5% was rejected, concluding that age and PAD held association). Time of DM presented a statistically significant relation with PAD. Although most individuals have HbA1c superior to 7% or 53 mmol/mol, and meantime of 12 years of DM, 59.1% presented no statistical significance correlation to DPN and neuropathic pain. Many individuals exhibited risk 1 and 2 of ulceration, being recommended monitoring from three to six months with a specialized team.

To assess the relation of stratified clinical signs with DPN and neuropathic pain, generalized linear models were adjusted with logistic regression, as it can be seen in Table 4. The adjustment diagnosis of the model was done through simulated envelopes for the residuals. Considering an initial model with all the variables, AIC was used. In both cases, the model with the lowest AIC was composed only by the variable of dry skin, the only one to possess significant explanation (at 5% level) on DPN and neuropathic pain. Concerning PAD, no variable was significant, leading to the conclusion that they exert no influence on it, which resulted in a null model.

Table 2 – Clinical evaluation and classification of scores of neuropathic symptoms and signs, and peripheral arterial disease, Health Secretariat Hospitals of the Federal District, Brasília, Brazil, 2015

Variables	n (N=117)	%	DPN ‡ *p* value	Neuropathic pain *p* value
Deformity			0.0148	0.1065
Yes	48	(41)		
No	69	(59)		
PPS*			< 0.001	–
Present	56	(47.8)		
Absent	61	(52.2)		
Prayer sign			0.8450	0.999
Yes	43	(36.7)		
No	74	(63.3)		
Score of symptom			–	
Normal (0–2)	15	(12.8)		
Mild (3–4)	21	(17.9)		
Moderate (5–6)	43	(36.8)		
Severe (7–9)	38	(32.5)		
Score of signs			–	–
Normal (0–2)	51	(43.6)		
Mild (3–5)	42	(35.9)		
Moderate (6–8)	23	(19.6)		
Severe (9–10)	1	(0.9)		
VAS†			0.9999	0.9800
Lower than 40	19	(16.2)		
Equal or greater than 40	98	(83.8)		
Arterial disease			0.9207	0.1957
Yes	40	(34.2)		
No (0.90–1.30)	77	(65.8)		
Arterial disease			–	–
Yes (AAI ≤ 0.90) &	14	(35)		
Yes (AAI ≤ 1.30)	26	(65)		

*Note: ‡ Diabetic peripheral polyneuropathy * Loss of Protective Plant Sensitivity – conclusions at the significance level of 5%, according to Chi-square test; † Visual Analogue Scale; &Ankle-Arm Index.*

Table 3 – Association estimates of demographic and clinical data, Health Secretariat Hospitals of the Federal District, Brasília, Brazil, 2015

Variable	n (%)	Mean + deviation	DPN‡ *p* value	Neuropathic pain *p* value	PAD* *p* value
Age, years	5.8 ± 13.8		0.767	0.4861	0.0344
Adult (18 to 59)	58 (49.6)				
Older adult (≥ 60)	59 (50.4)				
†DM type 1	27 (23.08)				
DM type 2	90 (76.92)				
Arterial Hypertension					
Yes	87 (74.00)				
No	30 (26.00)				
Diabetes Mellitus		12.46±8.5	0.2907	0.903	0.0306
Time/year†					
0 to 5	30 (25.65)				
6 to 10	30 (24.65)				
Over 10	57 (48.70)				
HbA1c		8.25±1.8	0.3281	0.9899	0.1172
<7	28 (24.00)				
≥7	89 (76.00)				

To be continued

Table 3 (concluded)

Variable	n (%)	Mean + deviation	DPN‡ *p* value	Neuropathic pain *p* value	PAD* *p* value
Ulceration risk&					
0	15 (12.80)				
1	48 (41.00)				
2	41 (35.00)				
3	12 (10.60)				

*Note: ‡ Diabetic peripheral polyneuropathy; * Peripheral arterial disease; †Diabetes Mellitus; &0: without DPN and PAD; 1: polyneuropathy, but with no evidences of deformities or PAD; 2: neuropathy with PAD or presence/absence of DPN; 3: history of ulcer or amputation*

Table 4 – Logistic regression measures of the feet clinical inspection regarding diabetic peripheral neuropathy, neuropathic pain, and peripheral arterial disease. Health Secretariat Hospitals of the Federal District, Brasília, Brazil, 2015

Variable	χ^2	F.D&	Initial model *p* value	Final model *p* value
DPN*				
Vessels	0.50	1	0.4762	–
Ringworm	0.33	1	0.5600	–
Dry skin	3.37	1	0.0661	0.0233
Callosity	0.63	1	0.4255	–
Edema	0.77	1	0.3786	–
Neuropathic pain				
Vessels	1.39	1	0.2379	–
Ringworm	0.04	1	0.8308	–
Dry skin	4.16	1	0.0413	0.0209
Callosity	0.76	1	0.3827	–
Edema	0.09	1	0.7585	–
PAD#				
Vessels	1.14	1	0.2857	–
Mycosis	1.03	1	0.3098	–
Dry skin	0.02	1	0.9879	–
Callosity	0.03	1	0.9868	–
Edema	0.05	1	0.817	–

*Note: & Freedom degree * Diabetic peripheral polyneuropathy; #Peripheral Arterial Disease; Decision criteria via AIC, through stepwise selection*

DISCUSSION

The DPN and PAD were prevalent in the individuals investigated and, despite being frequent complications, they are often underreported; when present, they increase the risk of ulceration and amputation, as well morbidity and mortality[9-10]. The prevalence of DPN can range from 2% to 50%, being found in Brazil a prevalence of 50.9%[10-11]. Diabetic peripheral neuropathy is the most prevalent among the neuropathies, constituting a risk factor that precedes ulceration; its severity depends on disease evolution, time with diabetes, and glycemic disarray. Regarding DM type, the prevalence rates of DPN may vary from 8% to 54% in people with DM 1, and from 13% to 46% in those with DM 2[8].

In this study, the prevalence of DPN showed results that were similar to other studies. Many people who did not present neuropathy suffered from neuropathic pain, that is, they had symptoms but no signs, such as tactile, thermal, and painful sensibility alteration, as well as reflex alterations. From the individuals evaluated, 69.3% had a therapeutic indication of neuropathic pain, with VAS equal or superior to 40, and symptoms with scores equal or superior to 5, being 36.8% of mild degree and 32.3%, severe.

Concerning the severity of the neuropathic symptoms found in this study, the results were similar to those of an international study, carried out in Toronto, which applied a numerical scale of neuropathic pain, resulting in 15.7% to 36.4% of mild symptoms; 13.8% to 57.1% of moderate pain; and 10% to 35% of severe pain[11-12]. Peripheral neuropathic pain is normally considered moderate to severe and is more frequent at night, which may lead to sleep disorders. Moderate pain may evolve to cutaneous allodynia, adversely affecting the quality of life of the individuals, in particular in the productive phase. It can also be cause for disruption of social and recreational activities, being associated with depression[11-13].

Dry skin was an important sign in the feet clinical inspection, not only for individuals who showed neuropathy, but also for those suffering neuropathic pain. Anhidrosis and dry skin are related to sensory neuropathy, which is associated with the impairment of the neurovegetative nervous system[13-14]. If not prevented or treated, they can make the skin scaly and cracked, which favors ulceration and the entry of micro-organisms, in addition to subsequent infections[14-15].

Deformities were also factors in association with DPN, which is related to motor neuropathy. These deformities, in conjunction with dry skin, constitute a potentializing risk factor for the foot ulcer. The mean of HbA1c values was above the recommended goals, with 75.2% of the individuals with DM 2 presenting 64 mmol/mol in a meantime of 12.46 years.

Glycemic control is an important recommendation to avoid chronic complications such as neuropathy, besides micro and macrovascular compromises[5,15]. However, the intensive glycemic control is more effective in preventing the progression of neuropathy in patients with DM 1 and DM 2. For each percentage point of decrease in the level of glycated hemoglobin, studies showed a reduction of 35% in the risk of chronic complications [16]. According to this study, the mean HbA1c found was 8.25%, meaning that most individuals were off the target set by the Brazilian Society of Diabetes, which would be below 7%[6].

Time of DM and age were factors associated with PAD. People with DM are twice as likely to have PAD when compared with those nondiabetics, being PAD a risk factor for higher amputation incidence. In addition, the proportion of

individuals with ischemic component has been demonstrated to be a causal factor of ulcer development in up to 50% of those with this disease[16-17]. A difficulty is that 40% of this population is asymptomatic, which slows the clinical diagnosis and raises the risk of ulceration and amputation[17-18].

Although PAD was not diagnosed in most individuals, the calcification of arteries was a prevalent factor, with AAI greater than 1.30, leading to a risk of cardiovascular diseases. A study points out that the main etiologic factor is arteriosclerosis[18-19]. The presence of PAD, even if asymptomatic, represents a marker of systemic vascular disease, involving coronary, brain, and renal vessels, and leading to a greater risk of heart attack, vascular accident, and death[8]. A study conducted in Brazil reports that the prevalence of PAD in people with DM was 13.7% (10/73), of which 9.6% showed calcification[19-20]. The results of this study emphasize the importance of the early tracking of PAD as a prevalent complication in diabetic individuals, as it allows the nurse to identify the need for referral to a specialized professional for the diagnosis, monitoring, and treatment, thus reducing the ulceration risk.

Other comorbidities, such as systemic arterial hypertension, were present in 74% of the individuals. This is a medical condition that is usually associated with DM 2, which leads to a higher risk of cardiovascular diseases and mortality[6]. Such association leads to the development of nephropathy, retinopathy, and diabetic cardiomyopathy, since systemic arterial hypertension increases the risk of micro and macrovascular injuries, raising, in turn, the risk of PAD[19,21]. However, these complications were not object of this study. Despite national and international consensus reporting the importance of tracing foot complications, this recommendation was singled out as the most neglected among health professionals worldwide[5,16].

Limitations of study

The limitations of this study are: lack of early investigation of hemoglobinopathies, which can interfere with the value of HbA1c; the cross-sectional design that does not allow temporal relations among variables; and the fact of the diabetic individuals had been referred to tracing when they already presented a sign or symptom of neuropathy or PAD.

Contributions to the farea of nursing and public health

The found results represent a relevant contribution to the field of nursing, because they confirm the importance of nurse's planning in the prevention of permanent complications to the diabetic individual, through the implementation of a protocol of performance and education in health by a multidisciplinary team. The implementation of such protocol ensures the quality integral care of the individual, which should be strengthened with systematized actions involving conducts directed to the nursing process. Such conducts, in turn, must consider the cultural context of the individual in the development of a nursing care plan. This study is the first to be held in Brazil by the application of a recommended and validated instrument to identify ulceration risk in the consultations carried out by nurses to diabetic individuals.

CONCLUSION

The prevalence of DPN found in this study was similar to what is reported in the literature; however, PAD had higher prevalence. In addition to these ulceration risk factors identified in the tracing, other findings were assessed in the clinical evaluation, such as deformity, dry skin, and loss of protective plantar sensibility. Dry skin was associated not only with DPN, but also with individual with neuropathic pain and no neuropathy. The tracing of DPN and PAD should be carried out at the primary level of care because it promotes faster access to specialists and the performance of tests with greater accuracy for the treatment. Ulceration risk tracing, from the primary care, is relevant in improving diagnosis and reducing complications such as ulceration and amputation.

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