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EVALUATION OF ULCERATION RISK ON THE FEET OF DIABETIC PATIENTS FROM THE PRIMARY CARE IN A BRAZILIAN COUNTY: A CROSS-SECTIONAL ANALYTICAL STUDY

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ABSTRACT

Objective: To evaluate the risk of developing diabetic foot ulcers in Primary Care patients in a Brazilian county. **Methods:** Cross-sectional analytical study developed in the city of Olinda (PE), Brazil. An analysis of risk factors for diabetic foot ulcerations was made using the criteria established by the International Working Group on the Diabetic Foot (2019). The data were analyzed statistically considering $P < 0.05$ and the confidence interval used of 95%. The chi-square association test and the Akaike Information Criterion (AIC) were used for multivariate analysis. **Results:** It was seen that 25.5% of people with diabetes were at level 2 risk for diabetic foot ulcers. The highest prevalence of risk was associated with the presence of mid foot collapse (P -value 0.001). As for clinical related causes, the highest risk of foot ulceration was identified in the presence of poor glycemic control (adjusted odds ratio, OR = 2.79 (95% confidence interval, CI 1.15-2.29); $P = 0.002$) and previous amputation (adjusted OR = 2.67 (95% CI 1.45-2.56); $P = 0.003$). **Conclusion:** In the analyzed sample, the intermediate risk (level 2) for diabetic foot ulcers was the most frequent, especially in patients with midfoot collapse, poor glycemic control and previous amputation.

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INTRODUCTION

Among the various chronic diseases that plague thousands of people around the world, Diabetes Mellitus (DM) stands out as an important public health problem. This occurs because each year its incidence increases, leading to high expenses with treatment and care, as well as decreasing the quality of life for many people (RIDDLE, 2020). In 2014, the International Diabetes Federation (IDF) and the World Health Organization (WHO) estimated 422 million people with this disease worldwide, equivalent to 8.8% of the entire world population. The data also indicates that the prevalence of this disease is expected to increase to about 629 million people by 2045 (WHO, 2016; IDF, 2019).

Regards to Brazil, it has an estimated population of 12.5 million diabetics, being classified as one of the countries with the highest number of diabetics in the world and a financial burden of US \$ 15.7 billion in 2017 with prevention and treatment for diabetes mellitus (IDF, 2019). One of the main complications of DM refers to diabetic foot ulcers (DFU), considered a clinical condition characterized by ulceration and/or destruction of the soft tissues of the feet on individuals with diabetes, associated with peripheral neurological changes and vascular conditions such as peripheral arterial disease (PAD), being the cause of 20% of all hospitalizations of people with DM (Brasil, 2016; Schaper et al., 2019). It is estimated that a person with DM has an approximately 25% risk of developing DFU during their lifetime, corroborating with high health cost, such as what happened in 2014, that Brazil spent US \$ 180 million on the treatment

of these ulcers (Toscano *et al.*, 2018). The main complication of this clinical condition is the amputation of lower limbs, severely affecting the quality of life of these patients. A foot ulcer precedes and it is responsible for 85% of these amputations and 15%-27% result in surgical bone removal (Young *et al.*, 2003). The prevention of those complications is based on the identification of high-risk patients and the prevention of triggering events. Several studies suggest that amputations can be reduced to 40%-85% when high-risk patients are identified and receive a multi-professional treatment approach on preventive strategies (Apelqvist *et al.*, 2000; Peters; Lavery, 2005). The meticulous evaluation of the feet is a fundamental step in the risk screening of these ulcerations, through severe inspection and palpation, and observation of possible dermatological, musculoskeletal, vascular and neurological changes (Al-Rubeaan *et al.*, 2015; Van Netten; Woodburn; BUS, 2020). Thereby, classifying the risk for diabetic foot ulceration allows health professionals to implement better prevention programs that will result on the improvement of patients' quality of life and will reduce the economic burden for the patients and the health system (VAN Netten; Woodburn; BUS, 2020). Despite the increasing coverage of the Primary Care Network in Brazil, the high frequency of patients with foot ulcers persists, which infers that the practices of prevention of this complication are still in second place in the assistance offered by the professionals of the Family Health teams. In view of the aspects presented, the aim of this study was to assess the risk of developing diabetic foot ulcers in Primary Care patients in a Brazilian county.

MATERIALS AND METHODS

A cross-sectional analytical study was conducted in the Primary Health Care network in the municipality of Olinda, located in the state of Pernambuco, in the Northeast region of Brazil. Data were collected in three Family Health Units from January 2018 to January 2020. The amount of individuals with diabetes registered in the units participating in this study is approximately 180, and to reach them, a non-probabilistic approach method (by convenience) was used during the collection period, consisting of a sample of 106 people with diabetes (58.9% of the study population).

Diabetic Foot (Iwgd) – 2019 (Schaper *et al.*, 2019). The data were tabulated and subsequently the descriptive and inferential statistical analysis was performed using the Statistical Package for the Social Sciences - SPSS software, version 21 (IBM, Armonk, NY, United States), through distributions of absolute and relative frequencies. The chi-square association test was used for univariate analysis of the categorized variables and the Akaike Information Criterion (AIC) for multivariate analysis. The statistically significant variables were those with a P-value < 0.05. The risk estimates were calculated using odds ratios (OR) and the confidence interval used was 95% (95% IC). The development of the study complied with national and international standards of ethics in research involving human.

RESULTS

The final sample of this study was composed of 106 diabetic patients. Regarding to individual characteristics, there is a predominance of females (81.1%), with an age average of 63.6 ± 11.2 years and a median of 64.3 years (minimum age: 30 years; maximum age: 87). In matters of the time of diagnosis for DM, the average years of the disease among the participants was 11 ± 9.5 years, while the median, 14.3 years. Concerning the risk rating for foot ulcers (Table 1), it is notorious to verify the presence of factors predisposing diabetic foot ulcers in a considered number of individuals, so that 47 of them had some risk of ulceration (excluding risk 0). All values were statistically significant. Skin, musculoskeletal, neurological and vascular alterations are shown in Table 2. It appears that in users classified as level 3, the main alterations found were dry feet (8.49%), low dorsalis pedis pulse (8.49%) and protective sensitivity loss (PSL) (8.49%). In the risk of foot ulceration analysis, the highest prevalence was associated with the presence of midfoot collapse (p-value 0.001) and protective sensitivity loss (P-value 0.002). According to Table 3, the increased risk of developing diabetic foot ulcers had statistically significant associations with the following variables: poor glycemic control (adjusted OR = 2.79 (95% CI 1.15-2.29); P = 0.002); previous amputation (adjusted OR = 2.67 (95% CI 1.45-2.56); p = 0.003); diabetes mellitus present for over 10 years (adjusted OR = 1.19 (95% CI 1.11-1.75); p = 0.003).

Table 1. Foot ulcers risk rating in Northeast, Brazil, 2020.

Risk rating	n	%	P-value*
0	59	55.6	0.001
1	27	25.5	0.002
2	11	10.4	0.001
3	9	8.5	0.001
Total	106	100	

*Conclusions at the 5% level of significance, according to the chi-square association test.

Table 2. Percentage distribution of skin, musculoskeletal, neurological and vascular alterations according to the risk rating for foot ulceration in people with diabetes mellitus, Northeast, Brazil, 2020

Alterations	n	Level 0 (%)	Level 1 (%)	Level 2 (%)	Level 3 (%)	Total (%)
Dry feet	72	19.81	29.24	10.37	8.49	67.91
Thick nails	67	20.75	27.35	7.54	7.54	63.18
Erythema	58	10.37	27.35	9.43	7.54	54.69
Low dorsalis pedis pulse	55	0.0	33.01	10.37	8.49	51.87
Low posterior tibial pulse	51	0.0	33.01	10.37	4.71	48.09
Edema	45	30.18	6.60	1.88	3.77	42.43
PSL	43	0.0	21.69	10.37	8.49	40.55
Midfoot collapse	15	0.0	0.0	8.49	5.66	14.15
Hammer toes	09	0.0	0.0	2.83	5.66	8.49

PSL = protective sensitivity loss

The proposed inclusion criteria were: having a confirmed diagnosis of diabetes mellitus and being 18 years of age or older. Patients with active ulcers in the lower limbs and those who did not have preserved cognitive ability were excluded from the study. The data collected in this study were performed using an instrument developed by the researchers, based on the guidelines of the International Working Group on the Diabetic Foot (2019) and the Diabetic Foot Manual of the Health Ministry of Brazil (Brasil, 2016; Schaper *et al.*, 2019). The ulceration risk rating for the patients was fulfilled according to parameters established by the International Working Group on

DISCUSSION

In this study, the publications on this matter corroborate the predominance of female patients, which can be justified by the fact that women seek primary health care more often than men, since these units are still seen as places feminized by a large part of the population (Grillo; Gorini, 2007; Nunes *et al.*, 2020). Regarding to age, prevalence studies sustain those age ≥ 45 years among diabetics

Table 3. Prevalence of ulceration risk in the feet of people with diabetes mellitus according to the variables of clinical conditions, Northeast, Brazil, 2020

Variables	Total		With ulceration risk		P-value*	Adjusted OR	CI 95%
	n	%	n	%			
Diagnosis time							
0-10 years	39	36.79	13	12.26	-	1	-
10 years or more	67	63.20	47	44.33	0.003	1.19	1.11-1.75
Poor glycemic control							
No	21	19.81	05	4.71	-	1	-
Yes	85	80.18	39	36.79	0.002	2.79	1.15-2.29
Insulin use							
No	80	75.47	27	25.47	-	1	-
Yes	26	24.52	20	18.86	0.032	0.32	1.07-1.73
Antidiabetic use							
No	09	8.49	0	0,0	-	1	-
Yes	71	66.98	27	25.47	0.064	0.28	1.09-1.75
Nephropathy							
No	95	89.62	36	33.96	-	1	-
Yes	11	10.37	11	10.37	0.003	1.92	1.38-2.45
Previous amputation							
No	102	96.22	12	11.32	-	1	-
Yes	04	3.77	04	3.77	0.003	2.67	1.45-2.56

*Akaike Information Criterion (AIC) test - significance level $P < 0.05$ (alpha). OR = odds ratios; CI 95% = confidence interval 95%.

is a major risk factor when associated with an unhealthy lifestyle (Al-Rubeaan *et al.*, 2015), corroborating with the results on this study, which was seen that the median of the participants was 64.3 years. Patients diagnosed with diabetes mellitus should be evaluated periodically, not only with the inclusion of laboratory tests, drug prescriptions and metabolic evaluation; it is necessary to evaluate the risk rating for foot ulceration, which allows not only the identification of risk factors, but also allows the planning of care in order to prevent complications such as diabetic foot and limb amputations (Morey-Vargas; Smith, 2015; Silva *et al.*, 2017). In matters of the risk level, it was observed that 44.4% of the research participants were classified in categories of risk above 0 (1-3); different results were found in a recent study carried out in the Federal District (Brazil), which 86% of those evaluated presented some level of ulceration risk (1-3) (Dutra *et al.*, 2018). These findings reinforce the need for specialized care by a multidisciplinary team, in order to prevent the appearance of complications related to the foot (Boell; Ribeiro; Silva, 2014).

Regarding the evaluation of the feet, the presence of midfoot collapse and protective sensitivity loss were related to a higher risk of ulceration. The loss of protective sensitivity leads to an insensitive and sometimes deformed foot, usually causing abnormal foot loading. In patients with neuropathy, minor trauma (for example, ill-fitting shoes or an acute mechanical or thermal injury) can precede foot ulceration (Brasil, 2016; Grennan, 2019). The loss of protective sensitivity, the presence of deformities in the feet and limited mobility of the joints can result in an abnormal biomechanical load on the foot, producing high mechanical stress in some areas, which commonly leads to thick skin (callus). The callus increases the functional load of the foot, usually with subcutaneous hemorrhage and eventually skin ulceration (Grennan, 2019; Kossioris *et al.*, 2019). In a study performed with 430 diabetic patients, a prevalence of 81 patients with foot deformities and 35 with PSL was identified, with a high risk for foot ulceration (Shahbazian; Yazdanpanah; Latifi, 2013). As for the clinical criteria, the greatest risk for foot ulceration was identified in the presence of poor glycemic control ($P: 0.002$). While some recent studies have observed an association between these two variables, others have reported the opposite (SUN *et al.*, 2012; Tabur *et al.*, 2015; Sadiwala; Gedam; Akhtar, 2018). This reinforces the need for primary care health professionals to assess individuals with diabetes using all possible resources, requiring a multiprofessional follow-up, so that they are properly instrumentalized regarding self-care and management of their lives (TESTON *et al.*, 2017). In this perspective, Primary Health Care nurses and physicians need to implement articulation and prevention actions, asserting the role of health detection and promotion, permeating actions that allow the identification of the main risk factors for ulceration and drawing up objective strategies inside the Primary Health Care system (MOLL *et al.*, 2019).

The content documented in this study can be significant for both healthcare professionals and health managers, as it shows the rate of involvement of multiple risk factors for foot ulcers in patients with diabetes, thus emphasizing the importance of effectively tracking these individuals in order to aware them about the prevention of those complications. A limitation of this study is the fact that it evaluated only people with DM2 and focused on only three health care units, so the results presented here reveal a local reality and, therefore, the data cannot be generalized. Besides these limitations, the fact that the study had a cross-sectional design does not allow establishing temporal relationships between the variables.

CONCLUSION

The risk rating level for foot ulceration in the diabetic patients investigated had a higher expression in risk level 2, excluding level 0. The risk of ulceration was more elevated in patients with midfoot collapse, poor glycemic control and previous amputation. Therefore, the periodically evaluation of the feet of people with diabetes mellitus is a necessary part of the nursing and medical consultation.

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