Evaluation of quality of life in patients with type 2 diabetes Mellitus with symptomatic distal symmetric polyneuropathy

Avaliação da qualidade de vida em doentes com diabetes Mellitus tipo 2 com polineuropatia simétrica distal sintomática

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ABSTRACT

INTRO/BACKGROUND The complications of Diabetes Mellitus (DM) are traditionally categorized as micro and macrovascular disorders. Among them, diabetic polyneuropathy (DPN) is one of the most common, presenting with or without associated neuropathic pain, and its morbidity exerts a significant impact on the quality of life (QOL) of these patients. About 50% of individuals with type 2 DM (T2DM) suffer from this condition and the distal symmetric polyneuropathy (DSPN) constitutes its most frequent clinical form. OBJECTIVE: To demonstrate the effect of symptomatic DSPN on the QOL of T2DM patients in a sample of the Brazilian population, correlating clinical and electrophysiological findings, besides comparing the results obtained by the Medical Outcomes Study Questionaire 36-Item Short Form Health Survey (SF-36) among patients with painful and non-painful diabetic DSPN. METHODS: This study comprised 25 outpatients with DSPN and T2DM submitted to a detailed anamnesis to identify clinical and demographic characteristics, besides comorbidities and complications of DM. Clinical evaluation was performed through neurological physical examination, in addition to specific scales for neuropathy as the Neuropathy Disability Score (NDS). In order to assess the health-related quality of life (HRQoL) of these patients, the SF-36 translated and adapted for the Brazilian population was applied. Nerve conduction study (NCS) was performed for the examined nerves (motor part of peroneal nerve and sensory part of the sural nerve). The following parameters were assessed: motor conduction velocity (MCV), amplitude of the compound muscle action potentials (CMAP) and amplitude of the sensory nerve action potentials (SNAP). RESULTS: Role Physical (RP) domain of SF-36 was significantly related to some of the clinical and electrophysiological factors measured. RP had an inverse and significant relationship with the NDS values (Rho: -0.44), showing the impact of neuropathy severity on these patients' QOL. The sural nerve SNAP and peroneal nerve MCV showed a significant and positive relationship with RP (Rho: 0,52 and 0,36, respectively). The Mental Health (MH) domain showed a statistically significant difference between those patients with pain and without pain (p =

0.002), and patients without pain had higher mean values, as well as a higher minimum and maximum value. The Role Emotional (RE) domain also showed a significant difference between patients with and without pain, and patients with pain had a lower mean value (p = 0.04). For all other domains, patients with pain showed lower mean values than those without pain, however without statistical difference in the test performed. Between DM complications, only nephropathy presented statistically different RP scores from those without nephropathy (p = 0.02). CONCLUSION: There was a significant inverse relationship between the severity of DSPN and the QOL of the evaluated patients, as evidenced by lower values in the SF-36 specific RP domain, as polyneuropathy becomes more severe. This domain also presented significantly lower values in patients with associated nephropathy. The presence of pain negatively affected the QOL of patients with painful DPN, who presented significantly lower mean values in the MH and RE domains when compared to patients without pain.

Keywords: Diabetes mellitus, Diabetic polyneuropathy, Distal symmetric polyneuropathy, Quality of Life, SF-36.

ABSTRACT

INTRO/BACKGROUNDO As complicações da Diabetes Mellitus (DM) são tradicionalmente categorizadas como doenças micro e macrovasculares. Entre elas, a polineuropatia diabética (DPN) é uma das mais comuns, apresentando ou não dor neuropática associada, e a sua morbilidade exerce um impacto significativo na qualidade de vida (QOL) destes pacientes. Cerca de 50% dos indivíduos com DM tipo 2 (T2DM) sofrem desta condição e a polineuropatia simétrica distal (DSPN) constitui a sua forma clínica mais frequente. OBJECTIVO: Demonstrar o efeito da DSPN sintomática na QOL de pacientes T2DM numa amostra da população brasileira, correlacionando os resultados clínicos e electrofisiológicos, além de comparar os resultados obtidos pelo Medical Outcomes Study Questionaire 36-Item Short Form Health Survey (SF-36) entre pacientes com DSPN diabético doloroso e não doloroso. MÉTODOS: Este estudo incluiu 25 pacientes ambulatórios com DSPN e T2DM submetidos a uma anamnese detalhada para identificar características clínicas e demográficas, além de comorbilidades e complicações da DM. A avaliação clínica foi realizada através de exame físico neurológico, para além de escalas específicas para neuropatia como o NDS (Neuropathy Disability Score). Para avaliar a qualidade de vida relacionada com a saúde (HRQoL) destes pacientes, foi aplicado o SF-36 traduzido e adaptado para a população brasileira. Foi realizado um estudo de condução nervosa (NCS) para os nervos examinados (parte motora do nervo peroneal e parte sensorial do nervo sural). Foram avaliados os seguintes parâmetros: velocidade de condução motora (MCV), amplitude do potencial de acção do músculo composto (CMAP) e amplitude do potencial de acção do nervo sensorial (SNAP). RESULTADOS: O domínio físico (RP) do SF-36 foi significativamente relacionado com alguns dos factores clínicos e electrofisiológicos medidos. A RP tinha uma relação inversa e significativa com os valores da SDN (Rho: -0,44), mostrando o impacto da gravidade da neuropatia na QOL destes pacientes. O SNAP do nervo sural e o MCV do nervo peroneal mostraram uma relação significativa e positiva com a RP (Rho: 0,52 e 0,36, respectivamente). O domínio da Saúde Mental (MH) mostrou uma diferença estatisticamente significativa entre os pacientes com e sem dor (p = 0,002), e os pacientes sem dor tinham valores médios mais elevados, bem como um valor mínimo e máximo mais elevado. O domínio Role Emotional (RE) também mostrou uma diferença significativa entre os pacientes com e sem dor, e os pacientes com dor tinham um valor médio mais baixo (p = 0,04). Para todos os outros domínios, os pacientes com dor

apresentaram valores médios inferiores aos dos pacientes sem dor, contudo sem diferença estatística no teste realizado. Entre complicações de DM, apenas a nefropatia apresentou valores de RP estatisticamente diferentes daqueles sem nefropatia (p = 0,02). CONCLUSÃO: Houve uma relação inversa significativa entre a gravidade da DSPN e a QOL dos pacientes avaliados, como evidenciado por valores mais baixos no domínio específico de RP SF-36, à medida que a polineuropatia se torna mais grave. Este domínio também apresentou valores significativamente mais baixos em doentes com nefropatia associada. A presença de dor afectou negativamente a QOL dos pacientes com DPN doloroso, que apresentaram valores médios significativamente mais baixos nos domínios MH e RE, quando comparados com os pacientes sem dor.

Palavras-chave: Diabetes mellitus, Polineuropatia diabética, Polineuropatia simétrica distal, Qualidade de vida, SF-36.

1 INTRODUCTION

Diabetes Mellitus (DM) consists of a metabolic disorder characterized by persistent hyperglycemia due to deficiency in insulin synthesis, in its action or in both mechanisms, causing several long-term complications. The most common form, type 2 diabetes mellitus (T2DM), corresponds to 90-95% of all cases of the disease, which reaches epidemic proportions, with an estimated prevalence of 425 million carriers worldwide in 2017, which corresponds to 8.8% of the total of adults between 20-79 years. Brazil occupies the fourth position among the countries with the largest number of diabetics in the world (14.3 million in 2015, being designed 23.3 million of Brazilian diabetics in 2040. [1]

The complications of DM are commonly categorized as micro and macrovascular disorders, which result in neuropathy, nephropathy, retinopathy, cerebrovascular disease, coronary disease and peripheral arterial disease. Among them, diabetic polyneuropathy (DPN) is one of the most frequent and may present with or without associated neuropathic pain, with increasing incidence with DM duration. [2],[3]

About 50% of patients with DM2 suffer from this condition, compared to approximately 30% of those with type I (T1DM). DPN affects 11-21% of diabetic patients[4] and its morbidity exerts a significant impact on the quality of life of these patients[5]. Venkataraman et al. (2013) showed that among DM complications, DPN would be associated with a greater reduction in the perception of Quality of Life (QOL).

The distal symmetric polyneuropathy (DSPN) constitutes its most frequent clinical form, usually presenting in an asymptomatic way [6]. Less than half of the patients present some type of neuropathic symptom, being most often sensitive[7]. Among DPN

patients, approximately 20% have neuropathic pain, implying a significant decrease in QOL and functional capacity.[8]

The present study aims to demonstrate the effect of symptomatic DSPN on the QOL of T2DM patients in a sample of the Brazilian population, correlating clinical and electrophysiological findings, besides comparing the results obtained by Health-related Quality of Life Assessment Questionnaire (SF-36) among patients with painful and non-painful diabetic DSPN.

2 MATERIALS AND METHODS

This is an observational, transversal and descriptive study, carried out with a sample consisting of 25 patients screened from the neurology and endocrinology outpatient clinics of the Antônio Pedro University Hospital (HUAP), linked to Fluminense Federal University (UFF), Rio de Janeiro, Brazil, between November 2011 and March 2013. This study was approved by the Research Ethics Committee of the Faculty of Medicine/UFF, being carried out in the Clinical Research Unit of HUAP.

All patients were submitted to a detailed anamnesis, where information was obtained such as: demographic characteristics (e.g. gender, age, duration of DM), comorbidities (e.g., systemic arterial hypertension, metabolic syndrome), complications of DM (e.g.: nephropathy, retinopathy, diabetic foot) and other variables of interest of the study (e.g., level of glycosylated hemoglobin (HbA1c), use of insulin and presence of pain).

Clinical evaluation was performed through neurological physical examination, in addition to specific scales for neuropathy (Neuropathy Disability Score - NDS) [9.10], neuropathic pain (Leeds Assessment of Neuropathic Symptoms and Signs – LANSS)[11] and disability (Modified *Rankin Score* – mRS) 12, all validated for the Portuguese language.

In order to assess the health-related quality of life (HRQoL) of these patients, the Medical Outcomes Study Questionaire 36-Item Short Form Health Survey (SF-36)[13,14], translated and adapted for the Brazilian population was applied[15]. This instrument consists of a questionnaire composed of 36 items, distributed among eight dimensions or "domains" of QOL: Physical Funcioning (PF), Role Physical (RP), Bodily Pain (BP), General Health (GH), Vitality (VIT), Social Functioning (SF), Role Emotional (RE) and Mental Health (MH). The score ranges from 0 (worst result) to 100 (best result).

The neurophysiological evaluation was performed through the nerve conduction study (NCS) based on a basic evaluation routine recommended for DSPN[16], being arbitrarily opted for the evaluation of the right lower limb, aiming to simplify the correlation of data and consequently the statistical analysis.

NCS was performed for the examined nerves (motor part of peroneal nerve and sensory part of the sural nerve). The following parameters were assessed: motor conduction velocity (MCV), amplitude of the compound muscle action potentials (CMAP) and amplitude of the sensory nerve action potentials (SNAP).

3 INCLUSION AND EXCLUSION CRITERIA

Patients fulfilled the following inclusion criteria: age between 21 and 70 years old; meet current ADA criteria for the diagnosis of T2DM; have neuropathic symptoms such as: paresthesias, pain, imbalance or weakness and present DSPN defined by clinical scale NDS > 3.

As exclusion criteria, we ruled out patients with history of conditions that may compromise the peripheral nervous system; have recently used (less than six months) potentially neurotoxic drugs and present cognitive and/or sensory deficits which impair the scoring of scales or the neurological and neurophysiological examination.

4 STATISTICAL ANALYSIS

The study variables were analyzed as numerical or categorical ones (yes or no). NDS was initially used in numerical format and later categorized into three disability levels: 3-5: mild; 6-8: moderate; 9-10: severe. Numerical variables were tested for normality adequacy using the Shapiro test.

The relationship between the QOL measured by the SF-36 and the clinical variables was assessed by the Spearman correlation test. The difference in neuropathic impairment between the three groups in relation to the various clinical variables analyzed was verified by the nonparametric Kruskal test. The difference among the three groups of neuropathy for the categorical variables of the study was evaluated by Fisher's test.

5 RESULTS

5.1 POPULATION DESCRIPTION

The study included a sample of 25 patients: 80% female and 20% male (Table 1). The mean age of the participants was 57 years and the mean time of T2DM was 9 years.

Mean values of HbA1c and body mass index (BMI) were 7.94 and 30.76, respectively. Among the clinical variables, only one patient had diabetic foot, and most had no macrovascular complications (72%). Microvascular complications were observed in 48% of patients, nephropathy in 28% and 32% had retinopathy. In relation to pain, 40% of the patients presented this complaint.

Among the comorbidities, 88% of the patients had systemic arterial hypertension and 48% had dyslipidemia.

Since all patients had symptomatic DSPN (mild: 36%, moderate: 36%, severe: 24%), 40% presented pain and 28% had disability.

Table 1. Clinical and sociodemographic characteristics of the patients.

CHARACTERISTICS (N=25)	Values
Gender	
Male	5 (20,0%)
Female	20 (80,0%)
Age (mean years ± SD)	57,44 ± 11,34
T2DM duration (mean years ± SD)	9,16 ± 6,54
Symptoms duration (mean years ± SD)	3,2 ± 62,46
HbA1c (%)	7,94 ± 2,33
BMI (Kg/m2)	30,76 ± 5,79
Metabolic Syndrome	
No	8 (32.0%)
Yes	17 (68.0%)
Diabetic Foot	
No	23 (95,9%)
Yes	1 (4,1%)
Macrovascular complications	
No	18 (72,0%)
Yes	7 (28,0%)
Microvascular complications	
No	13 (52,0%)
Yes	12 (48,0%)
Nephropathy	
No	18 (72,0%)
Yes	7 (28,0%)
Retinopathy	
No	17 (68,0%)
Yes	8 (32,0%)
Pain	
No	15 (60,0%)
Yes	10 (40,0%)
Insulinotherapy	
No	13 (52,0%)
Yes	12 (48,0%)
Systemic Arterial Hypertension	3 (12,0%)

No	22 (88,0%)
Yes	
Dyslipidemia	
No	13 (52,0%)
Yes	12 (48,0%)
Disability	
No	18 (72,0%)
Yes	7 (28,0%)

Figure 1 shows the mean values obtained through the SF-36 for the variables that measure the patients' HRQoL.

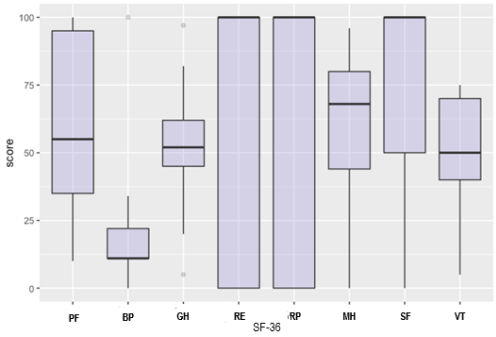


Figure 1. Boxplot of HRQoL variables measured from the SF-36 (n = 25).
Physical Funcioning (PF), Role Physical (RP), Bodily Pain (BP), General Health (GH), Vitality (VT), Social Functioning (SF), Role Emotional (RE) and Mental Health (MH).

6 RELATIONSHIP BETWEEN HRQOL MEASURED BY SF-36 AND THE CLINICAL AND ELECTROPHYSIOLOGICAL VARIABLES

The results show that the RP domain was significantly related to some of the clinical and electrophysiological factors measured. Spearman's correlation test between these factors and the SF-36 domains shows an inverse and significant relationship between the RP and the NDS values (Rho: -0.44).

The SNAP of the sural nerve also showed a significant and positive relationship with RP (Rho: 0.52). The MCV of the peroneal nerve showed little relation with SF-36, except for RP (Rho: 0.36). (Table 2)

Table 2. Spearman correlation test values (RHO) between clinical / electrophysiological factors and domains of SF-36 in patients with DSPN (n = 25).

SF-36	NDS	SURAL	VC F	AMP F
PF	-0,01	0,32	0,18	0,08
RP	**-0,44**	**0,52**	0,36*	0,05
BP	-0,01	0,29	-0,11	0,04
GH	0,23	0,02	-0,15	-0,01
VT	0,13	0,35*	0,18	0,09
SF	-0,23	**0,44**	-0,02	0,11
RE	-0,33*	**0,47**	0,14	0,20
MH	0,22	-0,09	-0,28	0,11

Values in bold are significant at p <0.05.
* Significant values at p <0.08

7 DETERMINATION OF THE CHANGES PATTERN IN THE DPN SEVERITY STAGES ACCORDING TO NDS

When comparing patients with neuropathy included in the mild and severe groups according to NDS, we observed that some clinical variables presented significant differences.

The mean duration of T2DM and neuropathy symptoms for patients with mild neuropathy was 3.00 ± 2.87 and 1.55 ± 1.33 years, respectively, values significantly below the average of those presented by the severe group: 12.14 ± 6.38 years, p = 0.002 for the duration of T2DM and 3.85 ± 1.46 years, p = 0.004 for the duration of neuropathy symptoms.

HbA1c followed the neuropathy severity pattern, with the Severe group having its highest mean value (9.55 ± 3.37 years), contrasting with lower values presented by patients in the Mild group, with an average of 6.67 ± 1.47 years (p = 0.02).

Regarding the neurophysiological variables, all mean values measured showed statistical difference when compared the groups with mild versus severe neuropathy.

The mean SNAP of the sural nerve followed a decreasing pattern from the mild (11.18 ± 3.21 µV) to the severe group (0.65 ± 1.13 µV) with p = 0.0008, a behavior similar to that observed for the mean values of CMAP of the peroneal nerve - mild (5.04 ± 1.66 mV) and severe (2.74 ± 2.28), with p = 0.03 and for the mean MCV of the peroneal nerve - mild (47, 22 ± 4.52 m / s) and severe (33.28 ± 15.14 m / s) with p = 0.005.

The detailed analysis of each neurophysiological variable and its relationship with de NDS is shown in Table 3.

Table 3 - Mean and standard deviation of demographic, clinical and laboratory variables according to stages of neuropathy severity.

	NEUROPATHY		
	Mild (9)	Severe (7)	p-value*
Age (years)	53,33 ±14,44	58,71 ± 10,82	0,45
BMI (Kg/m^2)	32,91 ± 4,82	30,27 ± 7,32	0,83
T2DM duration (years)	3,00 ± 2,87	12,14 ± 6,38	**0,002**
Symptoms duration (years)	1,55 ± 1,33	3,85 ± 1,46	**0,004**
HbA1c (%)	6,67 ± 1,47	9,55 ± 3,37	**0,02**

SNAP sural nerve (µv, d^2/e^2)	11,18 ± 3,21	0,65 ± 1,13	**0,0008**
MCV peroneal nerve (m/s, d^2/e^2)	47,22 ± 4,52	33,28 ± 15,14	**0,005**
CMAP peroneal nerve (mV, d^2/e^1)	5,04 ± 1,66	2,74 ± 2,28	**0,03**

*Kruskal Wallis Test

Analyzing the binomial categorized clinical variables (yes or no), some relevant differences were found in relation to the level of neuropathic impairment – see table 4. The data show a significant difference (p = 0.04) between the two groups of neuropathy considering the proportion of patients with microvascular complications in each of them, with the Severe group showing the highest prevalence (85.7%), compared to only 22% of the Mild group.

Regarding the presence of retinopathy and need for insulin therapy, none of the patients in the Mild group had such conditions, which were observed in the same proportion among the members of the Severe group (71.4%, p = 0.004).

The other variables showed no statistical differences between groups, however the presence of diabetic foot was only observed in individuals with severe neuropathy (28.6%).

Table 4 - Distribution of demographic, clinical and laboratory variables according to neuropathy severity stages.

	NEUROPATHY		
	Mild (9)	Severe (7)	p-value*
Sex (% men)	1 (11.1%)	4 (57,1%)	0,10
Metabolic Syndrome (% Yes)	5 (55,6%)	6 (85,7%)	0,30
Diabetic Foot (% Yes)	0 (0,0%)	2 (28,6%)	0,17
Macrovascular Complications (% Yes)	1 (11,1%)	1 (14,3%)	0,99
Microvascular Complications (% Yes)	2 (0,22%)	6 (85,7%)	**0,04**
Nephropathy (% Yes)	1 (11,1%)	4 (57,1%)	0,10
Retinopathy (% Yes)	0 (0,0%)	5 (71,4%)	**0,004**
Pain (% Yes)	3 (33,3%)	2 (28,6%)	0,99
Insulin Therapy (% Yes)	0 (0,0%)	5 (71,4%)	**0,004**
SAH (% sim)	8 (88,9%)	6 (85,7%)	0,99

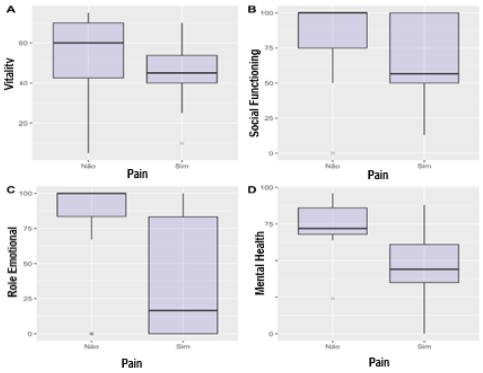
Dyslipidemia (% Yes)	3 (33,3%)	6 (42,9%)	0,99
Disability (% Yes)	1 (11,1%)	3 (42,9%)	0,26

Fisher's test. Bold values are significant at p <0.05.

8 RELATIONSHIP BETWEEN THE PRESENCE OF PAIN AND THE PHYSICAL AND MENTAL DOMAINS.

The relationship between physical and mental domains for patients with and without pain was assessed by the Mann-Whitney test. The MH domain showed a statistically significant difference between those patients with pain and without pain (p = 0.002), and patients without pain had higher mean values, as well as a higher minimum and maximum value (Fig. 2). The RE domain also showed a significant difference between patients with and without pain, and patients with pain had a lower mean value (p = 0.04). For all other domains, patients with pain showed lower mean values than those without pain, however without statistical difference in the test performed.

Figure 2. Relationship between the presence of pain and scores for mental domains



9 RELATIONSHIP BETWEEN DM COMPLICATIONS AND SF-36 DOMAINS

Patients with comorbidities and DM complications did not show statistically significant difference from those without comorbidities or complications in relation to the mean scores of the physical and mental domains (Table 5). The only exception was observed for patients with nephropathy, who presented statistically different RP domain scores from those without nephropathy (p = 0.02).

Table 5. Relationship between the scores obtained for the physical and mental domains and the patients' comorbidities and DM complications. (p-value)

	NEP	RET	MS	DF	Macro	Micro
PF	0,48	0,48	0,72	0,44	0,16	0,82

RP	**0,02**	0,30	0,47	0,26	**0,06**	0,10
BP	0,35	0,19	0,17	0,46	0,48	0,13
GH	0,64	0,83	0,72	0,20	0,58	0,86
VT	0,09	0,99	0,46	0,99	0,97	0,25
SF	0,20	0,20	0,14	0,78	0,48	0,10
RE	0,18	0,21	0,39	0,23	0,41	0,22
MH	0,90	0,76	0,63	0,11	0,73	0,56

Mann-Whitney test.
* NEP = Nephropathy; RET = Retinopathy; MS = Metabolic Syndrome; DF = Diabetic Foot; Macro = Macrovascular complications; Micro = Microvascular complications

10 DISCUSSION

Comparing the patients' NDS values with their SF-36 scores, we found an inverse and statistically significant relationship between the RP domain and the degree of neuropathic impairment. The other domains showed no significant difference. These findings suggest that DSPN progression would impact the QOL mainly in the physical domain, a hypothesis corroborated by Wegeberg et al. (2019), who despite having evaluated T1DM patients, concluded that physical rather than mental domains would be negatively affected in DPN patients, potentially limiting their daily physical and social activities[17].

Previous studies had already shown an association between DPN and a significant reduction in HRQoL scores, affecting physical and mental domains[18,19,20]. According to Venkataraman et al. (2013), the presence of DPN would be associated with major reductions in the physical domains of SF-36, even in the less severe cases, being the complication of DM associated with more significant reductions in this HRQoL scale[21].

Our study evaluated separately the impact of these complications on the QOL of these patients and with the exception of DSPN and nephropathy, which negatively affected the RP domain, the other comorbidities and complications evaluated did not present statistically significant changes in any of the SF-36 domains. Dobrota et al. (2014) also showed that the presence of diabetic nephropathy would significantly affect patients' QoL, especially in the physical domains, MH and GH[22].

It is noteworthy that although several authors have already associated the presence of diabetic foot with the worsening quality of life[23,24], our study found no such relationship, which could be explained by the small sample size, since only one patient (4% of the total) had that complication.

Studies show that the presence of painful symptoms exerts a negative impact on HRQOL in patients with DPN[25,26,27.] Comparing patients with painful versus non-painful DPN, Dobrota et al. (2014) found a significant difference between the two groups, and

individuals with pain had worse HRQoL, negatively reflecting on their mental health[28]. Patients with painful DPN had lower values in the SF-36 mental domains, in addition to having high scores on the depression scale - Beck Depression Inventory (BDI). Moreira et al. (2009) demonstrated in a sample of the Brazilian population that among diabetics, depressive symptoms were more severe in those with painful symptoms[29].

Among the individuals analyzed in our study, ten (40%) presented pain due to DSPN. When comparing patients with and without pain and their relationship with HRQOL, we found that patients with pain had significantly lower mean values in the domains: MH ($p = 0.002$) and RE ($p = 0.04$) of the SF-36, although they also presented mean values inferior to patients without pain for all other domains analyzed, despite the absence of statistical difference. In our sample, BP had the lowest median value (11) among all domains, corroborating that this was the isolated domain that had the greatest impact on the QOL of these patients, besides presenting the lowest mean values in all age groups analyzed (except for the range between 25-34 years, which was represented by only one individual).

Analyzing the clinical and sociodemographic characteristics of the study population, we observed that some of them: T2DM duration ($p = 0.002$), symptoms duration ($p = 0.004$) and HbA1c levels ($p = 0.02$) showed a positive and increasing correlation as the severity of DSPN increased. Such findings are compatible with those found by Qureshi et al. (2017), who also demonstrated a consistent correlation between these parameters and the severity of DPN[30].

Neurophysiological findings obtained by EMG had a direct and inverse relationship with the severity of DSPN, with decreasing amplitude values (CMAP and SNAP) and conduction velocity (MCV) as this complication worsens.

Correlating neurophysiological data with the QOL of patients with DSPN, our study showed no significant relationship between EMG evaluation of the peroneal nerve (MCV and CMAP) with any of the SF-36 domains. However, the evaluation of the sural nerve (SNAP) showed a significant and positive relationship with the RP domain, which is consistent with the data obtained by Padua et al. (2001), who in their study states that peripheral nerve involvement would not be related to the mental aspects of diabetic patients' QOL, but only to their physical aspects[31].

Given the limited role of EMG in the evaluation of QOL of these patients, the study of peripheral nerves through methods that evaluate the impairment of small fibers, such as CCM, QST and CHEPs could instrumentally measure DPN in its early stage,

where the disease is often underdiagnosed and there is already evidence that it affects those individuals' QOL, even before the onset of significant pain.

11 CONCLUSION

In this study, we concluded that there is a significant inverse relationship between the severity of DSPN and the QOL of the evaluated patients, as evidenced by lower values in the SF-36 specific RP domain, as polyneuropathy becomes more severe. This domain also presented significantly lower values in patients with associated nephropathy. Thus, these individuals have a worse perception of QOL due to the limitation of their daily activities because of the physical impairment caused by the disease complications.

The presence of pain negatively affected the QOL of patients with painful DPN, who presented significantly lower mean values in the MH and RE domains when compared to patients without pain.

The correlation between electrophysiological findings and QOL was not consistent, with only sural nerve amplitude values (SNAP) showing a significant relationship with the RP domain.

Limitations of the study include the small sample size, the absence of a control group of diabetic patients without polyneuropathy, and the use of a generic scale for HRQoL assessment, as DM-specific scales have not yet been validated in Brazil.

Future studies using more specific questionnaires such as HRQoL for DM, pain and depression assessment, as well as the application of electrophysiological tests for the study of small fibers, could more reliably evaluate the influence of DPN on the patients' QOL.

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