IOSR Journal of Nursing and Health Science (IOSR-JNHS)
e-ISSN: 2320–1959.p- ISSN: 2320–1940 Volume 6, Issue 5 Ver. VIII. (Sep. -Oct .2017), PP 37-46
www.iosrjournals.org

Assessment of Quality of Life of Patients with Diabetic Peripheral Neuropathy

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Abstract
Background: *Peripheral neuropathy is one of the most common complications of diabetes that affects patients 'quality of life (QoL). The economic consequences of diabetic foot problems are major, both to society as well as to the patients and their families.*
Objective: *To assess the QoL of patients with diabetic peripheral neuropathy.*
Methods*: A convenience sample of 80 adult diabetic patients was selected. Two tools were used in the research study (Modified Neuropathy Disability Score and Neuropathy-Specific QoL Instrument).*
Results: *Significant differences were found between mean severity of diabetic peripheral neuropathy (DPN) and Neuro QoL domains; increased severity of DPN was associated with increased pain (P = 0.002**), loss or reduction of sensitivity (P = 0.000**) and diffused sensory motor symptoms (P = 0.000**). Patients' feeling of burning in the legs or feet, numbness, weakness in the feet, instability when standing or walking, and inability to take leisure activities had the greatest impact on patients' QoL. Concerning interpersonal problems and emotional burden, the highest ranks were for patients' feeling that they more emotionally dependent as a consequence of their foot problems, their family role changing, feeling that they were older than their years, feeling their life was a struggle, and feeling embarrassed. The results also revealed that there were highly significant relations between severity of peripheral neuropathy and age of the diabetic patients (P <0.000**), diabetes duration (P <0.000**) and history of foot ulcer (P = 0.030**). This study highlights the extent to which DPN can affect patients' QoL.*
Keywords: *Quality of life, diabetic peripheral neuropathy*

Date of Submission: 10-10-2017 Date of acceptance: 28-10-2017

I. Introduction

Diabetes mellitus (DM), a chronic degenerative disease, is an increasingly endemic global problem due to population growth, aging, sedentary lifestyles and unhealthy diet, leading to increased morbidity and mortality (Xavier et al., 2011). The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction and failure of various organs, especially the eyes, kidneys, nerves, heart and blood vessels **(**American Diabetes Association, 2008). In the context of the morbidities associated with DM, diabetic peripheral neuropathy (DPN) is a chronic complication with high prevalence, affecting 60% of DM patients. Furthermore, it is considered the most important precursor to plantar ulcers and amputations of feet among diabetes patients (Rathur&Boulton, 2007).Diabetic patients are at much higher risk of major amputation, and have a 50% chance of losing acontralateral limb within four years after the first amputation. Measuring sensory loss, such as impaired vibration perception, can identify significant risk factors for amputation (Rathur &Boulton, 2007; Singh, Armstrong&Lipsky, 2005). The neurological dysfunction starts in the distal portions of the peripheral nervous system (usually the feet) and can extend to the upper limbs (Patricket al., 1998). The impairment of the motor nerves of the lower limbs in people with DM determines muscular hypotrophy, deformities and abnormal pressure points (Rathur&Boulton, 2007).

Prevalence of diabetes in adults worldwide was estimated to be 4.0% in 1995and to rise to 5.4% by the year 2025 (King, Aubertr, &Herman, 1998).DM permanently changes patients' lives. Patients' self-care, consisting of daily insulin injections or oral anti-diabetic agents, self-monitoring of blood glucose and diabetic diet, has profound effects on quality of life (QoL). Health-related QoL(HRQoL) provides a multidimensional perspective that encompasses a patients' physical, emotional, and social functioning (Fortin et al., 2006). Generally, patients with more than one co-morbid condition report the poorest level of HRQoL, but some chronic conditions, like cancer, cardiovascular and pulmonary diseases and DM are more strongly associated with poor HRQoL than others (Hamdan, &Hailes, 2011; Porojan, 2012).

Measuring QoL in chronically ill patients provides an important source of medical information in addition to laboratory or diagnostic tests and is becoming increasingly relevant to controlled clinical trials (Raspovic, Landorf, Gazarek, & Stark,2012).One goal of the measurement of QoL is to have objective evaluations of how much the disease influences patients' lives and how they cope with it. These evaluations may be useful as a baseline, and outcome measures can provide the framework to determine the impact of any change on patients'QoL (Porojan, 2012). To improve quality of care, more comprehensive health approaches are required that encompass the physical, emotional and social problems attributable to chronic disease, because the biological focus alone is unable to meet all patients' needs. Health professionals should encourage patient participation in decision-making and take bureaucratic and administrative processes into account, because these processes directly encourage stigma and affect QoL in DM patients. Achieving this aim requires not only training programs and willingness, but also adequate human and material resources (Pera, 2011). In this regard, trained nurses play a critical role in empowering patients to better manage diabetes through self-care and improving the QoL of these patients, through providing them and their families with the required information and consultations (Peimani,Tabatabaei,&Pajouhi, 2010).Nowadays, the role of nurses in the education of diabetic patients is universally acknowledged and implemented. While many years ago nurses were confined to hospital settings, nowadays they are involved in various levels of the health care system. Nurses nowadays are expected to play a key role in the prevention and treatment of diseases in various levels of the health care system, from the first level (individuals, schools, the home, nursing centers) to the fifth (rehabilitation centers) (Peimani, Tabatabaei,&Pajouhi, 2010;Raspovicet al., 2012). Peripheral neuropathy, peripheral vascular disease and infection are three major factors for diabetic foot ulcer that can lead to gangrene and amputation. However, peripheral neuropathy is solely responsible for more than 80% of foot ulcers in diabetic patients. This is important for neurological examination as the first criterion for screening patients at risk for foot ulcers, and it emphasizes nurses' role in performing diabetic foot examination with monofilament and collaboration with other diabetic foot team members. Nurses who specialize in foot care are involved in the early stages of care and treatment (Azizi, 2008).Nurses' role in diabetic foot care includes foot examination, wound dressing and encouraging patients and families to undertake appropriate care and follow-up visits regularly. The primary goal of screening is early detection of diabetic foot problems, identifying those at risk, planning to reduce the risk of ulcers and improving patients' QoL (Tabatabaeiet al., 2012).

II. Aim of the study

To assess the quality of life of patients with diabetic peripheral neuropathy.

III. Materials

Research design: A descriptive design was utilized for this study

Setting: The study was conducted at the outpatient diabetic clinic department at Main University Hospital in Alexandria, Egypt.

Subjects: A convenience sample of 80 adult diabetic patients (type I or type II DM) admitted to the above mentioned setting and diagnosed with DPN was recruited to the study using a self-administered questionnaire. Patients were diagnosed as having peripheral neuropathy if they had Neuropathy Disability Score (NDS) ≥3.

Patients were excluded if they had foot ulceration ,peripheral vascular disease (defined as <1 palpable foot pulse or previous bypass surgery/angioplasty), a history of amputation, or other severe chronic medical diseases or complications of diabetes that would affect the QoL.

Tools: Two tools were used, as explained below.

Modified Neuropathy Disability Score (NDS)

The modified neuropathy disability score was developed by Vileikyteet al. (2003). It was used to assess the severity of peripheral neuropathy. It was derived from examination of ankle reflex with the tendon hammer. Vibration Perception Threshold (VPT) was tested with a tuning fork (128 Hz) placed at the apex of big toe. Pain sensation was assessed by using 10-g monofilament (plantar surface of distal hallux was tested on each foot) and temperature sensation on the dorsum of the foot was assessed by a cold tuning fork. Patients were asked to close their eyes while being tested. The sensory modalities were scored as either present = 0 or reduced / absent = 1 for each side; and reflexes were scored as normal = 0, present with reinforcement = 1 or absent = 2 per side. The total maximum abnormal score is 10. Neuropathy scores of 2-5 indicated mild, 6-8 moderate and 9-10 severe.

Neuropathy-Specific QoL Instrument (Neuro QoL)

Neuro QoL is a multidimensional scale, developed by Vileikyteet al. (2003) to assess the QoL of diabetic patients with peripheral neuropathy. It comprises 26 items to evaluate diabetic peripheral neuropathy-related symptoms and psychosocial functioning in six primary domains: (1) painful symptoms and paresthesia (seven items), e.g. burning or throbbing in the feet; (2) symptoms of reduced/lost feeling in the feet (three items), e.g. inability to feel temperature and/or objects with the feet; (3) diffused sensory motor symptoms (three

items), e.g. unsteadiness while standing/walking; (4) limitations in daily activities (three items), e.g.in ability to perform paid work or leisure activities;5) interpersonal problems (four items), e.g. physical/emotional dependence on others; and 6) emotional burden (seven items), e.g. being treated differently from other people.
The Neuro QoL allows people to respond with the frequency of the symptoms or how the foot problems have affected their HRQoL over the previous four weeks, marking an X on the scale of one to five. Depending on the type of question, number one represents a "never or not at all", and the number five "all of the time or very much". After marking the response to a particular item, the participants were asked to also mark how much the contents of that item represent a discomfort or how important it is, on a scale of one to three, with a response of 1 = not at all, 2 = a little, and 3 = a lot. To obtain the weighted scores for each item of the respective domains, the value obtained on each item (1-5) is multiplied by the value assigned to the corresponding discomfort/importance (1-3). This multiplication provides the degree of impact of the items which compose the instrument. The total values of the scores in each domain are calculated by the mean of the weighted items of the respective domains, with the highest value corresponding to poor HRQoL.

Bio-sociodemographic sheet was attached with the questionnaire includes data on patients' age, gender, level of education, employment status, marital status, area of residence, types of diabetes, duration of diabetes, type of treatment, co-morbidities, present medical history, and past history of foot ulcer.

IV. Methods

Permission to conduct the study was obtained from the Director of the Hospital and the Head of the outpatient diabetic clinic department to collect the data after explanation the aim of the study. The tools were translated into Arabic by the researcher, and its Content validity was assessed by a panel of five experts for clarity, validity, and comprehensiveness. A pilot study with 10 participants was conducted to determine the clarity and feasibility of the questionnaire and the time required from each patient to complete the questionnaire. The reliability of the tools was tested, and the internal consistency of the tools ranged from 0.81 to 0.90, indicating that the tool was reliable. Patients who agreed to participate in the study and who met the inclusion criteria were asked to sign a written informed consent form. After neurological examination, the data was collected through individualized interview with patients in the outpatient diabetic clinic of the hospital. Furthermore, the patients were given the chance to ask any question related to the study.

Ethical considerations

The participants' rights were protected by explaining the purpose and significance of the study. Participants were reassured that their responses would remain anonymous, and no remarks were made that could identify patients. The clients were informed that their participation in the study would remain anonymous and that their privacy was respected. They were provided with a comprehensive explanation that their involvement in the study was voluntary and that they could withdraw at any time without it affecting the care they received or any other statutory rights.

V. Data Analysis

Data were analyzed using SPSS, version 20. Descriptive statistics were used and frequencies, means and standard deviations (SDs) are presented. Cross tabulation was used to determine relationship using Chi-square test, or Fisher exact test when Chisquare was not valuable. ANOVA test was used to compare sample means for the various categories. Weighted frequencies were used to rank items within each parameter of QoL; values of P $0.05 \leq$ were considered significant.

VI. Results

Bio-socio-demographic characteristics of the patients

The findings indicated that nearly two-thirds (62.5 %) of the patients were female. The mean age of patients was 53.31 years, and a third were aged51-60 years. The majority of patients had type II DM and no past history of foot ulcer. In terms of diabetes duration (i.e. time since diagnosis), 26% of patients had been diagnosed for 10-15 years and 25% for 15-20 years. NDS scores indicated that half of the patients had moderate peripheral neuropathy and 26.3% of the patients had severe neuropathy.

Table 1 shows the ranking of the impact of painful symptoms and paresthesia on patients' QoL as reported by the diabetic patients. The highest ranking was for patients' feeling of burning in the legs or feet, followed by feeling heat or cold in the legs or feet (weighted frequency 241 and 233, respectively). The lowest ranking was for sensation of jumping and throbbing in the legs or feet (weighted frequency 122 and 135, respectively). The results also revealed that nearly half of patients (45%) stated that they feel of burning in their legs or feet all the time, and more than a third of patients mentioned that they feel excessive heat or cold in the legs or feet and shooting or stabbing in the legs or feet most of the time (37.5% and 36.3%, respectively).

Table 1: Ranking the impact of painful symptoms and paresthesia on patients' QoL

	never (Weight=0)		occasionally (Weight=1)		some of the time (Weight=2)		most of the time (Weight=3)		all the time (Weight=4)		Weighted Frequency Sum	Rank
	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent		
burning in the legs or feet	0	0.0	10	12.5	15	18.8	19	23.8	36	45.0	241	1
Excessive heat or cold in the legs or feet	1	1.3	5	6.3	19	23.8	30	37.5	25	31.3	233	2
Pins and pricks in the legs or feet	3	3.8	16	20.0	19	23.8	24	30.0	18	22.5	198	3
Shooting or stabbing in the legs or feet	8	10.0	29	36.3	12	15.0	29	36.3	2	2.5	148	5
Throbbing in the legs or feet	13	16.3	34	42.5	11	13.8	9	11.3	13	16.3	135	6
Sensations in the legs on feet that make patients jump.	25	31.3	15	18.8	21	26.3	11	13.8	8	10.0	122	7
Skin irritation caused by something in contact with the feet, for example sheets or socks	9	11.3	18	22.5	24	30.0	13	16.3	16	20.0	169	4

Table 2 shows the ranking of the impact of symptoms of reduced or lost feeling in the feet on patients' QoL. The highest ranking was for numbness in patients' feet (weighted frequency 226), followed by inability to differentiate between hot and cold with the feet and inability to feel object with the feet (weighted frequency 167 and 156, respectively). In addition, the results indicated that more than a third of patients reported that they feel numbness of their feet and inability to feel objects with the feet most of the time (36.3% and 35%, respectively).

Table 2: Ranking the impact of symptoms of reduced/lost feeling in the feet on patients' QoL.

Table 3 shows the ranking of the impact of symptoms of diffused sensory motor symptoms on patients' QoL. The highest ranking was for weakness in the feet, followed by balance problems or instability when standing or walking (weighted frequency 178 and 163, respectively).In addition, the results indicated that 30% of patients reported that they feel weakness in their feet most of the time.

Table 3: Ranking the impact of diffuse sensory motor symptoms on patients' QoL

	never (Weight=0)		occasionally (Weight=1)		some of the time (Weight=2)		most of the time (Weight=3)		all the time (Weight=4)		Weighted Frequency Sum	Rank
	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent		
Weakness in the feet	1	1.3	24	30.0	21	26.3	24	30.0	10	12.5	178	1
Balance problems on instability when standing	3	3.8	23	28.8	22	27.5	32	40.0	0	0.0	163	2
Balance problems on instability when walking	4	5.0	34	42.5	27	33.8	15	18.8	0	0.0	133	3

Table 4 shows the ranking of the impact of limitations in daily activities on patients' QoL. The highest ranking was for inability to take leisure activities and inability to perform tasks around the house (weighted frequency196 and 192, respectively).In addition, 45% of patients reported that they were unable to perform tasks around house most of the time.

Table 4: Ranking the impact of limitations in daily activities on patients' QoL.

	never (Weight=0)		occasionally (Weight=1)		some of the time (Weight=2)		most of the time (Weight=3)		all the time (Weight=4)		Weighted Frequency Sum	Rank
	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent		
Inability to perform work	1	1.3	10	12.5	49	61.3	14	17.5	6	7.5	174	3
Inability to perform task around house	0	0.0	12	15.0	28	35.0	36	45.0	4	5.0	192	2
Inability to take leisure activities	1	1.3	5	6.3	35	43.8	35	43.8	4	5.0	196	1

Table 5 shows the ranking of the impact of interpersonal problems on patients' QoL. The highest ranking was for feeling that they more emotionally dependent as a consequence of their foot problems, followed by their family role changing (weighted frequency 127 and 122, respectively).The interference of foot problems with family relationships received the lowest rank (weighted frequency 95).

Table 5: Ranking the impact of interpersonal problems on patients' QoL.

	never (Weight=0)		occasionally (Weight=1)		some of the time (Weight=2)		most of the time (Weight=3)		all the time (Weight=4)		Weighted Frequency Sum	Rank
	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent		
My foot problems interfere with my family relationship	2	2.5	31	38.8	30	37.5	16	20	1	1.3	95	4
I feel more physically dependant as consequence of my foot problems	6	7.5	9	11.3	43	53.8	21	26.3	1	1.3	99	3
I feel more emotionally dependant as consequence of my foot problems	2	2.5	23	28.8	40	50	9	11.3	6	7.5	127	1
My family role changed as a result of my foot problems	0	0.0	12	15	47	58.8	17	21.3	4	5.0	122	2

Table 6 shows the ranking of the impact of emotional burden on patients' QoL. The highest rank was for patients feeling that they older more than their years, feeling their life struggle, and feeling embarrassed (weighted frequency 164). The lowest ranking was for decreasing their self-confidence and feeling frustration (weighted frequency 128 and 150, respectively). Moreover, the findings indicated that 25% of patients reported that they feel older than their years most of the time.

Table 6: Ranking the impact of emotional burden on patients' QoL.

	never (Weight=0)		occasionally (Weight=1)		some of the time (Weight=2)		most of the time (Weight=3)		all the time (Weight=4)		Weighted Frequency Sum	Rank
	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent		
People treat me differently as a result of my foot problems.	1	1.3	19	23.8	41	51.3	19	23.8	0	0.0	158	5
I feel older more than my years	7	8.8	24	30.0	18	22.5	20	25.0	11	13.8	164	1
Myself confidence is affected	6	7.5	37	46.3	20	25.0	17	21.3	0	0.0	128	7
My foot make my life a struggle	0	0.0	20	25.0	39	48.8	18	22.5	3	3.8	164	1
I feel frustrated	5	6.3	31	38.8	13	16.3	31	38.8	0	0.0	150	6
I feel embarrassed	5	6.3	16	20.0	36	45.0	16	20.0	7	8.8	164	1
I feel depressed	7	8.8	26	32.5	15	18.8	25	31.3	7	8.8	159	4

Table 7illustrates that there was a high significant relation between severity of peripheral neuropathy and age of the diabetic patients (P <0.000*).Moreover, the findings indicated that there was a high significant relation between the severity of DPN and diabetic duration, where by increased duration of diabetes were associated with increasing severity of peripheral neuropathy (P <0.000*). The findings indicated that 50% of patients who had a history of foot ulcers have severe peripheral neuropathy. Moreover, the relation between neuropathy disability score and past history of foot ulcer was significant (P = 0.030*). Severe neuropathy was reported for 44.4% of patients aged50-59 years, 40% of those aged 30-39 years, 42.9% of those with a college degree, 64.7% of those with diabetes duration of 20-24 years and 40% of those with diabetes duration of 25-29 years.

Table 7: Relationship between bio-socio-demographic data of the patients and severity of diabetic peripheral neuropathy.

	Severity of Peripheral diabetic neuropathy								FET
	Mild		Moderate		Severe		Total		P
	N	%	N	%	N	%	N	%	
Gender									
Male	6	20.0	18	60.0	6	20.0	30	100.0	1.958
Female	13	26.0	22	44.0	15	30.0	50	100.0	0.376
Age									
	0	0.0	3	75.0	1	25.0	4	100.0	
20-29	2	40.0	1	20.0	2	40.0	5	100.0	22.897**
30-39	9	60.0	6	40.0	0	0.0	15	100.0	0.000
40-49	3	11.1	12	44.4	12	44.4	27	100.0	
50-59	5	17.2	18	62.1	6	20.7	29	100.0	
60-69									
Level of education									
Illiterate	3	37.5	4	50.0	1	12.5	8	100.0	
Primary	9	21.4	21	50.0	12	28.6	42	100.0	5.132
Secondary	4	25.0	10	62.5	2	12.5	16	100.0	0.527
College	3	21.4	5	35.7	6	42.9	14	100.0	
Marital status									
Single	0	0.0	3	50.0	3	50.0	6	100.0	
Married	16	26.7	31	51.7	13	21.7	60	100.0	5.239
Widow	2	28.6	2	28.6	3	42.9	7	100.0	0.514
Divorced	1	14.3	4	57.1	2	28.6	7	100.0	
Types of diabetes									
Type 1	1	7.1	7	50.0	6	42.9	14	100.0	3.754
Type 2	18	27.3	33	50.0	15	22.7	66	100.0	0.153
Duration of diabetes									
< 5 Yrs	8	88.9	0	0.0	1	11.1	9	100.0	
5-9 yrs	6	75.0	2	25.0	0	0.0	8	100.0	
10-14 yrs	5	23.8	14	66.7	2	9.5	21	100.0	59.977**
15-19 yrs	0	0.0	15	75.0	5	25.0	20	100.0	0.000
20-24 yrs	0	0.0	6	35.3	11	64.7	17	100.0	
25-29 yrs	0	0.0	3	60.0	2	40.0	5	100.0	
Past foot ulceration									
No	18	28.1	33	51.6	13	20.3	64	100.0	7.033*
Yes	1	6.3	7	43.8	8	50.0	16	100.0	0.030

Fisher exact test

* Statistically significant at $p \leq 0.05$

Table 8 shows that significant differences were found between three domains of Neuro QoL (mean pain, loss of sensitivity and diffused sensory motor symptoms) and severity of DPN (P = 0.002**, P = 0.000**, P = 0.000**, respectively).Increased pain was associated with increased severity of DPN(mean = 57.8). Moreover, loss or reduction of sensitivity and diffused sensory motor symptoms increased with increase severity of DPN (mean = 65.1 and60.3, respectively).

Table 8: Differences between severity of peripheral neuropathy and domains of Neuro QoL of diabetic patients.

Neuro QoL Domains	Severity of DPN								F	Sig.
	Mild (n=19)		Moderate (n=40)		Severe (n=21)		Total (n=80)			
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
Pain	24.1	23.83	48.6	33.43	57.8	26.91	45.2	31.94	6.929	0.002 **
Loss / reduction of sensitivity.	22.8	29.51	41.7	37.55	65.1	22.30	43.3	35.34	8.618	0.000 **
Diffuse sensory Motor Symptoms.	10.5	22.37	30.8	25.47	60.3	17.06	33.8	28.80	24.377	0.000 **
Limitations in daily activities.	26.3	32.54	50.8	41.34	36.5	44.60	41.3	41.17	2.572	0.083
Interpersonal problems .	27.6	34.25	20.0	31.11	26.2	42.92	23.4	34.98	0.389	0.679
Emotional distress	24.1	38.11	36.1	32.19	27.9	41.52	31.1	36.14	0.818	0.445

ANOVA test

VII. Discussion

Peripheral neuropathy is one of the most common complications of diabetes and it has extensive impacts on patients' QoL. The economic consequences of diabetic foot problems are major, both to society as well as to the patients and their families (Goiet& Naidoo, 2016). The findings indicated that half of the patients had moderate peripheral neuropathy and over one quadrant of the patients had severe neuropathy. The interpretation may be related to a quadrant of the studied patients being diabetic from 15-20 years. In this respect, another study indicated that prevalence of DPN ranges from 16% to as high as 66% and its prevalence is believed to increase with the duration of diabetes and poor glucose control (International Diabetes Federation, 2017).

Concerning the impact of painful symptoms and paresthesia on patients' QoL, the findings indicated that the highest rank was for patients' feeling of burning in the legs or feet followed by feeling of heat or cold in the legs or feet. Similarly, Marchettini et al. (2006) reported that pain is a significant medical issue with a moderate-to-substantial impact on QoL in some patients with diabetic neuropathy. The most common type of peripheral neuropathy in diabetic patients is the chronic distal symmetrical polyneuropathy, is often associated positive sensory symptoms, i.e. numbness, paraesthesia, dysesthesia and pain. This condition represents the major source for Painful Diabetic Neuropathy (PDN) patients in clinical trials. Switlyk and Smith (2016) mentioned that neuropathic pain affects 20-30% of patients with DPN and is one of the main reasons this group seeks medical care.

The findings of this study also revealed that the highest rank was for numbness in patients' feet followed by inability to differentiate between hot and cold with the feet. In addition, the results indicated that nearly a third of patients reported that they feel numbness in their feet all the time. These symptoms may be related to nerve damage due to metabolic factors such as high blood glucose, and long duration of diabetes. According toBradbury and Price (2011), participants described their pain in various ways — sharp, unexpected, variable in occurrence but of severe intensity, intermittent, spontaneous, continuous and unrelenting. One patient described it 'as if my foot were in a bed of stinging nettles', while another stated it was the worst pain he had ever experienced. Switlyk and Smith (2016) revealed that the pathogenesis of DPN is complex and is marked by both metabolic and vascular factors. Hyperglycemia is only one of many key metabolic events known to cause axonal and microvascular injury.

Regarding the impact of interpersonal problems on patients' QoL, the findings indicated that the highest ranking was reported for patients feeling that they more emotionally dependent as a consequence of their foot problems, followed by their family role changing, while the interference of patients' foot problems with their family relationships received the lowest ranking. Zamanzadehet al. (2015) revealed that all participants remarked that they were unable to perform all their activities of daily living independently, while help and support from family members enabled them to cope.

Regarding diffused sensory motor symptom, the results indicated that weakness in the feet was considered the highest problem, followed by instability when standing or walking. Difficulty in maintaining the balance may be related to instability in the muscles. These is in agreement with the finding of Irshad et al. (2017) that 30% of people with DPN experience muscle weakness, loss of ankle reflexes, and decreased

balance, coordination and gait control. Irshad et al. (2017) also mentioned that balance and gait characteristics change as one's age progresses, and the presence of DPN in elderly populations plays a significant role in the incidence of falls. Static as well as dynamic balance are both affected in DPN. In addition, proprioception is one of the main causes for alteration in balance in this population. With increased severity of DPN, a positive Romberg's sign and ataxia may be found due to the weakness in the ankle plantar flexors and dorsiflexors (Andreassen, Jakobsen, &Andersen, 2006).On other hand, the results of Vileikyteet al. (2009) also indicated that the symptom of unsteadiness had the strongest association with depressive symptoms, and it was linked to depressive symptoms by the perceptions of diminished value of the self-due to inability to perform family roles.

Concerning the impact of limitations in daily activities on patients' QoL, the results indicated that the highest rank for inability to undertake leisure activities, followed by inability to perform tasks around the house. This was in the same line with Mazlinaet al. (2011),who reported that DPN has been found to be significantly associated with reduced physical aspects of diabetic patients' QoL, while patients with Charcot arthropathy reported poor physical and mental health. The findings suggest the need to have a better understanding of the consequences of diabetic foot problems on patients' QoL. Moreover, Porjan et al. (2012) stated that patients with DM have statistically significant impairment of all aspects of QoL, not simply physical functioning. DM put a substantial burden on affected individuals by influencing physical, psychological and social aspects of QoL.

In relation to the impact of emotional burden on patients' QoL. The findings indicated that the highest rank was for patients feeling that they are older than their years, feeling their lives are a struggle, and feeling embarrassed. The lowest rank was for decreasing their self-confidence. These results support that the impact of physical limitations from DPN pain has the same prevalent effect on psychosocial well-being. These findings highlight the need for increased awareness among clinicians of the potential for such issues to arise when dealing with patients with diabetic peripheral neuropathy. In this respect, Peimani et al. (2010) reported that as diabetes educators, nurses should consider patient-centered care and effective communication with patients and their families, deploying their unique skills as patient advocates and the health providers who spend the most time interfacing with service users to comprehensively assess patients' stress, provide useful problem solving strategies to help them make decisions and to explain medical information and the relative advantages and disadvantages of treatment options.

Several hypotheses have been proposed to explain the link between physical illness and depression. In keeping with the activity restriction model of depression, it is postulated that illness-related functional disability and restrictions in activities of daily living (ADL) are responsible for depressive affect. In the context of diabetes, for example, the results of a large community-based study indicate that functional limitations play an important role in the development of depression in people with type 2 diabetes (Vileikyte et al., 2009). Moreover, Kazama et al.(2011) argue that the impact of ADL restrictions on depression may depend on the extent to which being unable to perform daily activities has a negative impact on sense of self. Dempsey et al. (2012) reported that the perception of the self as a burden on one's caregiver is a mediator of depressive symptoms among chronically ill care recipients.

The results of this study indicated a high significant relation was found between the severity of DPN and diabetic duration, corroborating Ahmed et al. (2017), who revealed that the incidence of developing DPN increases with the chronicity of the disease and poor glycemic control. The findings also indicated that a high significant relation was found between the severity of DPN and patients 'history of foot ulcer. This is in-line with other research findings indicating that the presence of diabetic peripheral neuropathy, even with trivial trauma, is the initiating factor of the development of foot ulceration in patients with diabetes. It has been reported that the risk for diabetic foot ulceration increases sevenfold among patients with DPN (Amin& Doupis, 2016;Fawzy et al., 2014).

The study showed that increased severity of DPN was associated with three domains of Neuro QoL (increase pain, loss of sensitivity and diffuses sensory motor symptoms) with statistically significant differences. In this respect, previous studies (Al-Shehri, 2014; Kulkantrakorn& Lorsuwansiri, 2013) reported that the presence of DPN significantly affects patients' QoL, especially physical function. Moreover, it was associated with a significantly worse trajectory of QoL outcomes over time and long-term increased total costs. Other researchers found that the presence and severity of neuropathic pain were associated with greater impairments in a number of important HRQoL domains. Almost all patients have many types of pain, of which sharp pain is the most common (daCosta, DiBonaventura, Cappelleri, &Joshi, 2011; Jensen, Chodroff, &Dworkin, 2007;Taylor, 2006).Patients with DPN have statistically significant impairment of all aspects of QoL, not simply physical functioning. Finally, the study findings indicated that measuring QoL of patients with DPN is greatly needed for medical and nursing staff. Clinical and QoL instruments should be used together to get an appropriate overview of the health status of patients with diabetes and QoL measures should be routinely employed in clinical situations.

Limitations of the study

There were some strengths and limitations of this study which should be mentioned. This study was based on an outpatient clinic population which reflected a real-life practice. However, it was a single center study with a small number of patients, thus the findings are not generalizable for broader populations.

Conclusion and recommendations

The findings of this study concluded that DPN has a profound effect on patients'QoL in numerous physical and psychosocial areas of their lives. Evaluation of patients with DPN is usually based on objective clinical outcomes and complementary examinations, but measuring patients' QoL is increasingly recognized as important. QoL requires better monitoring of patients with diabetic peripheral neuropathy, as it cannot be extrapolated from routine clinical variables. The treatment of non-physical aspects of chronic disease should be considered as part of the management of diabetes.

Recommendations

- Educational booklets and audiovisual materials about coping with DPN should be provided for diabetic patients and their care givers.
- Educational sessions should be developed for diabetic patients about how to improve their QoL.
- Diabetic patients should be familiar with the principles of foot care.
- It is recommended that the health care team for diabetics (e.g. nurses, general practitioners, diabetologists etc.) should consciously avoid the delivery of disease-centered (biomedical) care; they should specifically consider impacts on the QoL of diabetic patients and regularly assess and improve lifestyle issues along with treatment.
- Proper diabetes control should be enforced, and reasons for suboptimal diabetes control should be investigated and managed accordingly.

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Dr. Amal Samir Ahmed. "Assessment of Quality of Life of Patients with Diabetic Peripheral Neuropathy." IOSR Journal of Nursing and Health Science (IOSR-JNHS) , vol. 6, no. 5, 2017, pp. 37–46.