The role of a clinical pharmacist in lifestyle modification in type 2 diabetic patients with peripheral neuropathy in Erbil, Iraq

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Abstract

Background: This study was designed to evaluate the effectiveness of clinical pharmacist intervention in lifestyle modification to improve glycemic control and diabetic peripheral neuropathic symptoms.

Methods: One-hundred diabetic peripheral neuropathic patients were randomly assigned into two groups, intervention, and usual care group. The intervention group has received the three months' lifestyle modification program by a clinical pharmacist. The usual care group has been provided with standard medical services. Lifestyle modification was assessed using a summary of diabetes self-care activity (SDSCA) scale while the Douleur Neuropathique 4 (DN4), Neuropathic Pain Scale (NPS), and Brief Pain Inventory (BPI) were used to assess diabetic peripheral neuropathy.

Results: Intervention patients had significant positive effects of self-management education on self-reported dietary habits, physical activity, and foot care. After lifestyle modification, a significant reduction in the percentage of the response of patients feeling electric shock, tingling, and 'pins and needles' were observed in the intervention patients. Lifestyle modification significantly improved all assessed pain qualities except of feeling cold to a greater extent than the usual care group. Significant reductions in pain interference were observed in the intervention group after the three months of follow-up.

Conclusion: The provision of lifestyle modification has positive effects on glycemic control and is a clinically effective approach for patients with DPN that improves peripheral neuropathic symptoms, their severity, and pain interference.

Key words: Clinical pharmacist,
Diabetic neuropathy, Life style modification

Introduction

Type 2 diabetes mellitus is a chronic disease that, if left uncontrolled, may cause microvascular and macrovascular complications in the long term, which are the main causes of increased morbidity and mortality and decreased health-related quality of life among patients (1). Although the existence of effective therapies and the established benefits derived from tight control of blood glucose and other cardiovascular risk factors, such as blood pressure and serum lipids, evidence shows that the achievement of recommended objectives for these factors remains suboptimal among patients with type 2 diabetes (2). This is because diabetes globally has been highly linked to the increasing rates of obesity, metabolic syndrome, westernized dietary patterns, and physical inactivity (3), also, lack of adherence to therapy and other recommendations might explain these findings, given that more than 50% of chronically treated patients do not take the prescribed pharmacotherapy (4).

Diabetic peripheral neuropathy (DPN) is a complex and frequent complication of diabetes that affects nearly 50% of diabetic patients (5). It affects the quality of life and often inhibits daily activities and work and is associated with the duration of diabetes, poor glycemic control, and metabolic syndrome (6). On the other hand, there is no pharmacological disease-modifying therapy available for diabetic peripheral neuropathy to reverse pathogenesis and progression and therapy is thus aimed largely at pain control (7). It is well established that diabetes and related complications such as peripheral neuropathy can be prevented by tightly regulating blood glucose and lifestyle intervention which involves diet and exercise (8). Diet improves neuropathic pain by improving glycemic control, blood lipid concentrations, and blood pressure (9).

Patients with DPN are more likely to be sedentary and to have decreased daily walking distances (10). Despite these difficulties, exercise contributes to improving glucose control, which slows or stops the progression of diabetic neuropathy (11). In addition, effective exercise interventions have been correlated with improvement in neuropathic symptoms, gait, stability, quality of life, and sensory function (12).

Because of their knowledge in pharmacotherapy and their availability in the community, pharmacists can create strong relationships with patients and become a dependable source of information (13). Consequently, pharmacists are in a perfect position to provide patient education, monitor and boost adherence to self-care and therapeutic plans, which have a positive influence on achieving therapeutic outcomes in diabetes (14).

Patients and Methods

This study was conducted at the Leila Qasm Diabetic Centre, Erbil, Iraq which is generalized and provides health care for diabetic patients, from October 2015 to August 2016. Patients were included in the study if they were aged 18 years or older, diagnosed with type 2 diabetes at least one year earlier, have at least one specified medication for diabetes, diagnosed as having diabetic peripheral neuropathy based on clinical examination by physician, and level of urea and creatinine within normal to exclude nephropathy. Patients were excluded from the study if they had a history of alcohol consumption, thyroid gland disorder, any kidney disorder, any conditions that could confound the assessment of pain due to diabetic peripheral neuropathy, and pregnant females or those who planned to become pregnant during the study period.

One hundred diabetic peripheral neuropathic patients were randomly assigned into two groups, intervention and usual care group (50 patients in each group). The intervention group has received the three months' lifestyle modification program run by a clinical pharmacist. The usual care group has been provided with standard medical services.

The patients who met the inclusion criteria and who agreed to participate in the study were asked to sign a consent form. A specific questionnaire form was designed to obtain the demographic characteristics and clinical data from each patient.

Glycemic levels (glycated hemoglobin (HbA1c) values and fasting blood glucose), blood urea, serum creatinine, blood pressure, and BMI were measured.

Peripheral neuropathic pain was measured using three pain measurement scales: Douleur Neuropathique 4 questionnaire (DN4), Neuropathic Pain Scale (NPS) and part of The Brief Pain Inventory (BPI) (15), (16), (17).

Lifestyle modification was assessed using a summary of diabetes self-care activity (SDSCA) (18).

All biochemical parameters and scales were determined at baseline and after three months follow up.

The patients in the intervention group were provided with lifestyle education sessions about diet and exercise following ADA (19) guidelines. The objective of this session was to recommend dietary changes based on the personalized diet analysis, and the determination of dietary behavior that was threatening blood glucose control. Also, present physical activity levels were assessed and data about the ADA exercise goal shared (150 minutes of light aerobic exercise each week) and initiation of an exercise plan that could be incorporated into the patient's daily schedule. Self-monitoring of glycemic control was initiated by counseling the patients to check their blood glucose levels daily. General foot self-care education was provided to patients and they were informed about the importance of foot examination. They were asked

to adhere to antidiabetic therapy as prescribed by the physician and were asked about any problems that they had faced in taking their medication. Finally, 3 weekly direct and indirect contacts were made by the clinical pharmacist to each intervention patient to emphasize the importance of adherence to the diet, exercise, treatment plan, and to answer patient questions. Patients in the usual care group received the usual care provided by the medical staff, which included standard medical services.

Data were analyzed using the Statistical Package for Social Sciences (SPSS, version 19). Chi-square test of association was used to compare proportions. When the expected count of more than 20% of the cells of the table was less than 5, Fisher's exact test was used. McNemar test was used to compare proportions of the same sample (before and after the intervention). For 3X3 tables, the McNemar-Bowker test was used (also for the same sample, before and after the intervention). Student's t-test was used to compare the means of the two study groups. A p-value of ≤ 0.05 was considered statistically significant.

Results

Around half (43%) of the studied sample was in the age group 50-59 years, and 75% of the whole sample were females. Twenty-six percent were illiterate, and another 26% were graduates of primary schools. No significant differences were detected in the proportions of the age categories, sex, educational level, and smoking of the two study groups.

Table 1 showed that lifestyle modification made a significant reduction (P<0.001) on biochemical (FBG, HbA1c) parameters and BMI in the intervention group while the usual care group did not significantly change the tested parameters after the three months follow up except FBG and HbA1c, which were significantly increased.

Table 2 represents the means of diabetic self-care activity scale at baseline visit and after three months. In the intervention group, significant increases in the means of all items of the mentioned scale were detected except for blood sugar testing, which remained the same. In the usual care group, the only mean of exercise was increased significantly (p = 0.006).

able 3 represents DN4 scale. In the intervention group, there was a significant reduction in the percentage of the response of patients feeling; electric shock (76% to 60%), tingling (80% to 66%), and pins and needles (78% to 60%) after the lifestyle modification (p = 008, 0.016, 0.004 respectively), whereas the other symptoms (cold, numbness, itching, hypoesthesia to touch, hypoesthesia to prick and brushing), remained the same or decreased non significantly.

Table 4 represents NPS. In the intervention group, there was a significant improvement in the mean scores of the items of neuropathy pain scale after the lifestyle modification, except for feeling cold sensation which was non significantly reduced, while in the usual care group, the changes in the mean scores of all items of the scale were not significant, except for intense and sensitive sensation, which had an increase in the mean scores of them after three months.

Table 5 represents BPI. There was a significant decrease in the means of the parameters of the brief pain inventory scale after the three months (in the intervention group), while in the usual care group, no significant changes were detected except for the sleep parameter, which was aggravated significantly (p=0.011).

Discussion

Patient education has recently become an important domain of medicine to enforce therapeutic outcomes (20). Many studies have shown the role of pharmacists in educating patients and improving their understanding of the disease, importance of medication adherence and lifestyle modifications, which decreases the morbidity and mortality rate (21,22,23).

This randomized controlled study provided evidence of the efficacy of lifestyle modification for patients with diabetic peripheral neuropathy. The intervention that consisted of individualized self-management education, adherence support, and regular contact follow-up lead to significant betterment in HbA1c, the primary outcome measurement in this study.

Although blood glucose levels change with a series of internal and external factors, reaching an ideal result regarding blood glucose is confirmed by the patient's active disease management (24).

The findings of this study indicated that the baseline mean of HbA1c values was higher in the intervention group than the mean of HbA1c for the usual care group. Moreover, the results of this study showed that the mean of HbA1c was significantly reduced for the intervention group while it was increased in the usual care group with significant differences between the two groups at the 3 months follow up period. This reduction of HbA1c was consistent with previous research findings of Farsaei et al (25) and Jarab et al (26). The improvements in HbA1c in the present study might be due to the clinical pharmacist's interventions about improving adherence to the diet, physical activity, and regular telephone follow-up.

The present study indicated a significant reduction in FBG levels in the intervention group patients when compared with the usual care group patients over the 3-month study period. This result is consistent with previous findings of Farsaei et al (25), and in agreement with the study of Jarab et al (26). This largest impact on glycemia is consistent with significant improvement in self-management which

Table 1. Mean scores of some of the studied variables at baseline and after three months visit in the study groups

Variables	Intervention group		P	Usual care		P
	Pre	Post		Pre	Post	
	Mean ± SD	Mean ± SD		Mean ± SD	Mean ± SD	
FBG	196.18 ± 87.41	148.82 ± 45.67	< 0.001	207.44 ± 72.25	227.54 ± 78.92	.043
HbA1c	9.04 ± 2.08	7.70 ± 1.54	< 0.001	9.04 ± 1.73	9.66 ± 1.34	< 0.001
BMI	31.06 ± 4.96	30.54 ± 4.72	< 0.001	31.87 ± 6.91	31.76 ± 6.99	.288
SBP	133.60 ± 15.88	131.60 ± 17.07	.236	132.70 ± 15.75	130.20 ± 17.78	.208
DBP	83.80 ± 6.74	81.80 ± 7.74	.042	81.60 ± 9.28	79.50 ± 8.88	.077
Mean BP	100.40 ± 8.77	98.40 ± 8.60	.032	98.63 ± 10.44	96.40 ± 10.60	.059
Pulse pressure	49.80 ± 12.97	49.80 ± 16.84	1.000	51.10 ± 11.84	50.70 ± 14.32	.838

Table 2. Mean scores of diabetic self-care activity scale in each of the studied groups

DM self-care Activity	Intervention group		P	Usual care group		P
	Before	After		Before	After	
	Mean ± SD	Mean ± SD		Mean ± SD	Mean ± SD	
General diet	3.26 ± 2.46	4.81 ± 2.23	< 0.001	2.8 ± 2.4	2.8 ± 1.7	.788
Specific diet	3.56 ± 1.72	5.02 ± 1.42	< 0.001	3.6 ± 1.7	3.5 ± 1.4	.520
Exercise	2.99 ± 1.81	4.93 ± 1.86	< 0.001	2.3 ± 2.1	2.6 ± 2.0	.006
Blood sugar testing	2.68 ± 2.71	2.86 ± 2.73	.376	1.9 ± 2.4	1.6 ± 2.1	.209
Foot care	4.61 ± 2.88	5.65 ± 2.15	< 0.001	4.0 ± 2.9	4.2 ± 2.8	.149

Table 3. Comparison of the percentages of responses (to DN4 scale items) at baseline and after three months follow up, in each of the intervention group and the usual care group

DN4 scale items	Intervention group			Usual care group		
	Response %		P*	Response %		P*
	Pre	Post		Pre	Post	
Burning	78	74	0.5	72	72	1
Cold	34	30	0.5	42	42	1
Electric shock	76	60	0.008	64	62	1
Tingling	80	66	0.016	76	72	0.5
Pins and needles	78	60	0.004	70	68	1
Numbness	48	48	1	50	48	1
Itching	48	42	0.25	52	52	1
Hyposthesia to touch	4	4	1	8	8	1
Hyposthesia to prick	6	6	1	28	30	1
Brushing	10	10	1	22	22	1

*By McNemar test

Table 4. Mean scores of neuropathy pain scale at baseline and after three months follow up, in each of the intervention group and the usual care group

NPS	Intervention			Usual care		
	Before	After	P	Before	After	P
	Mean ± SD	Mean ± SD		Mean ± SD	Mean ± SD	
Intense	5.78 ± 2.22	4.60 ± 2.37	< 0.001	6.16 ± 2.49	6.52 ± 2.30	.035
Sharp	4.30 ± 3.40	3.26 ± 3.05	< 0.001	4.44 ± 3.51	4.72 ± 3.39	.061
Hot	5.08 ± 3.11	3.36 ± 2.75	< 0.001	4.54 ± 3.55	4.56 ± 3.39	.931
Dull	3.38 ± 3.12	2.56 ± 2.70	< 0.001	3.08 ± 3.47	3.10 ± 3.47	.811
Cold	2.46 ± 3.51	2.12 ± 2.99	.094	2.94 ± 3.79	2.86 ± 3.69	.681
Sensitive	4.36 ± 3.04	3.82 ± 2.81	.001	4.10 ± 3.30	4.30 ± 3.45	.032
Itchy	2.44 ± 2.96	1.74 ± 2.42	.002	3.28 ± 2.85	3.58 ± 2.93	.149
Unpleasant	5.64 ± 2.31	4.34 ± 2.55	< 0.001	6.20 ± 2.19	6.38 ± 1.96	.276
Deep pain	5.38 ± 2.60	4.42 ± 2.60	< 0.001	5.36 ± 2.72	5.48 ± 2.70	.204

*P<0.05 when compared to its baseline.

Table 5. Mean scores of brief pain inventory scale at baseline and after three months follow up, in each of the intervention group and the usual care group.

Brief pain inventory scale	Intervention group			Usual care group		
	Pre	Post	P	Pre	Post	P
	Mean ± SD	Mean ± SD		Mean ± SD	Mean ± SD	
General activity	4.56 ± 2.89	3.04 ± 2.70	< 0.001	3.88 ± 2.48	4.20 ± 2.49	.051
Mood	5.50 ± 3.22	3.70 ± 2.84	< 0.001	4.22 ± 3.07	4.36 ± 2.79	.431
Walking ability	3.94 ± 2.85	2.38 ± 2.72	< 0.001	3.62 ± 2.57	3.90 ± 2.51	.070
Normal work	3.72 ± 2.59	2.38 ± 2.69	< 0.001	3.60 ± 2.37	3.68 ± 2.33	.542
Relations	.76 ± 1.73	.42 ± 1.25	0.02	.68 ± 1.45	.74 ± 1.56	.322
Sleep	5.16 ± 2.85	3.28 ± 2.65	< 0.001	4.90 ± 2.75	5.52 ± 2.56	.011
Enjoyment	1.30 ± 1.96	.94 ± 1.49	0.015	2.12 ± 2.33	2.30 ± 2.30	.095

*P<0.05 when it's compared to its baseline.

includes significant improvements in physical exercise and a healthy diet, which is expressed by the diabetic self-management education scale.

Weight loss has long been a recommended plan for obese adults with diabetes (27). Modest weight decline may provide clinical benefits (improved blood pressure, lipids, and glycemia) in some individuals with diabetes, especially those early in the disease process (28). The challenge for every obese person is to keep up in lifestyle changes that will permit him or her to preserve weight loss (29). Results revealed that the intervention group achieved a significant reduction in BMI while the usual care group showed an increase in BMI values over the 3-month study period. This weight loss achieved in this study was a successful outcome for patients with diabetic peripheral neuropathy and suggests that subjects, who lose weight, and who met physical activities and dietary fat goals, could reduce their risk of diabetes and its complications as peripheral neuropathy. Jarab et al (26) did not find any significant improvement in BMI.

The common coexistence of high blood pressure and high lipid profile in diabetic neuropathic patients needs monitoring of metabolic parameters to guarantee successful health outcomes (28). When a patient has both high blood pressure and hyperglycemia, the risk of vascular complications is increased by 66 to 100% as compared with those with only one of these conditions (30). In the current study, lifestyle modification had minor effects in lowering SBP, DBP and mean blood pressure among patients with diabetic peripheral neuropathy.

Good knowledge about diet, exercise, and self-monitoring of blood glucose is essential in the effective self-management of diabetes, however, knowledge alone does not guarantee required behavior modifications or effective self-management. The inclusion of the assessment tool is an important consequence measure in diabetes education programs (31).

Many randomized controlled trials have been conducted to evaluate the impact of Diabetic self-management education (DSME) on clinical outcomes in individuals with T2DM (32, 33).

The significant improvement in dietary habits in intervention patients at the end of the present study is likely due to the powerful content of the educational material that determined types and proportions of healthy diet utilized. This result is consistent with findings of Jarab et al (26) who reported that pharmacists were successful at increasing the number of days per week that patients spent engaging in a healthy diet by helping basic meal scheduling, explaining the misunderstandings, and/or providing reinforcement of the nutrition program developed collaboratively by the registered dietitian nutritionist and the patient.

It is well known that patients with high physical activity levels have improved glycemia because exercise therapy induces glucose and free fatty acid utilization by skeletal muscles and ameliorates insulin resistance (30). It is worth mentioning that this study included not only walking but also other forms of aerobic exercise, such as bicycling

or running. Also in this study, the patients were advised to walk at a moderate intensity, 120–150 minutes/week.

In the present study, patients who received the clinical pharmacist services had significantly better self-reported physical activity than did patients in usual care, as well patients in the usual care group showed an increase in the mean number of days in performing exercise but this increase was found not to be significant. For patients with diabetic peripheral neuropathy, this improvement in physical activity was to gain benefits on glycemic control and neuropathic symptoms.

Self-monitoring blood glucose (SMBG) plays a significant role in glycemic control and is part of the therapeutic strategy in both type 1 and type 2 diabetes mellitus (34). Many studies have confirmed the role of SMBG in providing better glycemic control in patients with diabetes. Farham, (35) in his study suggested that clinical management of diabetic patients who committed self-monitoring of blood glucose levels have a significant reduction in HbA1c compared with those patients who do not have self-monitoring of blood glucose.

Many patients might not understand the value of checking their feet daily. The poor foot wear gives rise eventually to neuropathic foot ulceration and higher HbA1c levels itself results inneuropathy again, causing a vicious circle for pathology to develop again and again (36).

The significant improvement in foot care in the intervention patients of this study was most probably attributed to the provision by a clinical pharmacist of high-quality information about foot care.

In this study, the presence of painful diabetic peripheral neuropathy was determined using the Douleur Neuropathique 4 questionnaire (DN4). After lifestyle modification, the result of this study showed improvements in neuropathic pain symptoms in the intervention group. Improvement in burning, cold, electric shock, tingling, itching, and pin and needles sensation, without any improvement in numbness, hypoesthesia to touch, hypoesthesia to prick, and brushing symptoms.

At baseline, the patients in this study had DPN of varying severity and showed that intense pain was the most common while the least common was itching. Nearly all patients had more than one type of pain, which boosts the complication of any clinical evaluation. This may propose that the mechanism of pain is most possible from small nerve fibers, rather than from large fiber dysfunction. Previous clinical and electrophysiological studies also presented that neuropathic pain in diabetic polyneuropathy is not related to the degree of involvement of large diameter sensory fiber or diabetes severity (37).

Persons with neuropathic pain generally represent differential treatment effects on the various pain qualities they suffer. For this cause, neuropathic pain scale (NPS) items can be a more sensitive and clinically effective measure of neuropathic pain treatment effects than a single measure of total pain intensity.

This study demonstrates that self-management education palliates all of the most usual pain qualities related to neuropathic pain, as measured in the certified neuropathic pain scale (NPS). Three months of the intervention of patients with peripheral neuropathy resulted in statistically significantly greater reductions in the mean of neuropathic pain qualities.

In an analysis covering a numeric item of NPS, which involves the different pain qualities (“sharp,” “cold,” “itchy,” “hot,” “skin sensitivity,” “dull,” and “deep pain,”), a global “pain intensity” measure, and a measure of “pain unpleasantness,” the intervention group demonstrated statistical reduction in the mean scores of items of neuropathy pain scale except for feeling cold.

This improvement in the scales of peripheral neuropathy suggested that the lowering of HbA1c and meaningful changes in this study in a healthy lifestyle (diet and exercise) have had real effects in the intervention group. The mechanism by which the diet enhances neuropathy pain may include improved insulin sensitivity, resulting in good glucose control (9).

In this study, exercise was another important part of the self-management of diabetic peripheral neuropathic patients. It is clear that routine exercise may be a highly effective means of promoting recovery from, and improving some of the suffering symptoms associated with, peripheral neuropathy (38). Routine exercise has been shown to both preserve and promote the function of the peripheral nerves (39).

Chronic neuropathic pain generally restricts a patient’s ability to accomplish important daily activities, thereby boosting the negative impact of pain. At the baseline visit, patients experienced substantial diabetic peripheral neuropathy pain-related interference in normal work, walking ability, enjoyment of life, sleep, general activity, and mood. The walking distance was of special care, being one of the main indicators of the physical health of diabetic patients (40). The other important factor is mental health because lower mood status decreases the capability of diabetic patients to take care of themself and this might aggravate the glycemic control and complications. Also, they complained of nocturnal exacerbations due to neuropathic pain therefore evaluation of sleep impairment is a key element of the patient-level load among painful DPN sufferers. Thus, a painful DPN may be one of several factors responsible for impairing quality of life among diabetic patients. It has been proposed that the level of neuropathic pain severity is associated with the experience of sleep problems, mood, and walking (41).

The result in this study showed significant reductions in how the intervention patients described that their diabetic neuropathic pain conflicted with their daily activities including normal work, walking, relationships with others, and sleep. This significant reduction in the mean of pain interference scale exhibits that lifestyle modification may have played a role in declining the impact of pain on the quality of daily life.

Conclusions

The engagement in diabetes self-management education results in a statistically significant improvement in glycemic control, significant improvement in Douleur Neuropathique 4 (DN4) questionnaire-based DPN, reduction in the intensity of general neuropathic pain qualities associated with peripheral neuropathic pain conditions, improvement in perceived neuropathic pain interference that is positively correlated with the extent of neuropathic pain relief. The present study has established the importance of the clinical pharmacist in lifestyle modification for patients with diabetic peripheral neuropathy in Erbil. Further research is also needed to evaluate which intervention elements contribute the most observed effects. Also clinical pharmacists should be integrated into the healthcare team to deliver an educational programme to improve patient safety, create awareness of a healthier lifestyle, and high-quality responsive clinical care.

Limitation

First, this study was based on self-report and this may be subject to recall bias and human error. Second, this study evaluates outcomes only after 3 months, and longer follow-up is important to ascertain if the short-term outcomes are continued from the clinical pharmacist intervention.

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