

---

# Diabetic peripheral neuropathy and quality of life

S.J. BENBOW, M.E. WALLYMAHMED and I.A. MACFARLANE

*From the Diabetes and Endocrinology Research Group, Department of Medicine, University of Liverpool, Liverpool, UK*

*Received 1 July 1998 and in revised form 18 August 1998*

---

## Summary

The quality of life (QOL) of 79 people with type 1 and type 2 diabetes and 37 non-diabetic controls was assessed using the Nottingham Health Profile (NHP). The NHP consists of six domains assessing energy, sleep, pain, physical mobility, emotional reactions and social isolation. Symptomatic diabetic neuropathy was present in 41 of the patients. The neuropathy patients had significantly higher scores (impaired QOL) in 5/6 NHP domains than either the other diabetic patients ( $p < 0.01$ ) or the non-diabetic ( $p < 0.001$ ) controls. These were: emotional

reaction, energy, pain, physical mobility and sleep. The diabetic patients without neuropathy also had significantly impaired QOL for 4/6 NHP domains compared with the non-diabetic control group ( $p < 0.05$ ) (energy, pain, physical mobility and sleep). This quantification of the detrimental effect on QOL of diabetes, and in particular of chronic symptomatic peripheral diabetic neuropathy, emphasizes the need for further research into effective management of these patients.

---

## Introduction

Quality of life (QOL) measurements are increasingly recognized as important in the assessment of chronic diseases and in evaluating medical outcomes.<sup>1–4</sup> Until recently, there has been little investigation of the effect of diabetes and its complications on QOL and, in particular, little is known of the effects of chronic symptomatic diabetic neuropathy. Such information would be useful as an outcome measure in clinical intervention studies, and also to enable treatment strategies to be aimed at improving particular aspects of impaired health.

Chronic painful symptoms can have a considerable impact on an individual's life and may be associated with anxiety, depression, loss of mobility and independence. Despite diabetic neuropathic pain occurring in almost 10% of diabetic clinic patients,<sup>5</sup> there is little information available on its effects on QOL. The few studies already reported have not given details of the neuropathic symptoms present,<sup>6</sup> or have examined the effect of increasing severity of neuropathy on QOL but given no details of the presence or otherwise of pain.<sup>7</sup> We therefore

aimed to assess the effects of chronic neuropathic pain on QOL in people with diabetes, and to evaluate the relationship between this and individual aspects of pain.

## Methods

Forty-one patients with chronic painful diabetic neuropathy were recruited from an adult hospital diabetic clinic. All subjects had typical neuropathic symptoms such as tingling, burning and shooting pain, often with nocturnal exacerbation, for at least 6 months, principally effecting the lower limbs (Dyck's stage 2 or 3).<sup>8</sup> Patients with other forms of neuropathy were excluded by clinical history, examination and standard blood tests including renal, liver and thyroid function tests and vitamin B<sub>12</sub>. Both type 1 and type 2 patients were included. None of the patients had active foot ulceration, significant peripheral vascular disease or severe intercurrent illness. All patients had had past treatment for painful

---

*Address correspondence to Dr S.J. Benbow, University Clinical Department at Aintree, Fazakerley Hospital, Longmoor Lane, Liverpool L9 1AE. e-mail: S.J.Benbow@liverpool.ac.uk*

diabetic neuropathy but at the time of the study only 19 were on medication (3 mexiletine, 10 tricyclic antidepressants, 1 anticonvulsants, 2 dihydrocodeine and 3 NSAIDs).

Quality of life was assessed using the Nottingham Health Profile (NHP).<sup>9-11</sup> The NHP is a well-validated self-reported questionnaire assessing health-related QOL within six domains: energy, sleep, pain, physical mobility, emotional reactions and social isolation. The questionnaire takes only a few minutes to complete, requiring yes or no responses to 38 simple statements. Scores range from 0–100, a score of 100 indicating the presence of all the limitations listed.

The severity of chronic neuropathic pain was assessed using the McGill pain questionnaire.<sup>12</sup> This questionnaire consists of 20 subclasses of words describing pain, listed within each subclass in order of increasing intensity. The subclasses are grouped into three major classes of word descriptors: sensory, i.e. words that describe pain in terms of temporal, spatial, pressure, thermal and other properties; affective, i.e. words that describe pain in terms of tension, fear and autonomic symptoms; evaluative, i.e. describing the overall intensity of the experience of pain; and a fourth miscellaneous group of words. The patients with chronic pain also completed three separate visual analogue scale scores (VAS), using a 10-cm horizontal line,<sup>13</sup> representing their pain in the morning, before lunch and late evening. A mean of the three values was documented for each patient.

Two control groups were also studied: an age-, sex- and diabetic-treatment-matched group was recruited from the same diabetic clinic. These patients did not have a history of chronic pain (chronic pain defined as pain present for at least three months).<sup>14</sup> The second control group consisted of randomly recruited age- and sex-matched non-diabetic visitors to the same hospital. All subjects denied a history of chronic pain and none refused to participate. No other exclusion criteria were followed for these two groups. The NHP was completed by all three groups. In the patients with diabetes, metabolic control was assessed using glycated haemoglobin (Auto A1C, Biomen, Croyden: non-diabetic range 5–8%).

### Statistical analysis

Normality of data distribution was assessed by the Shapiro-Wilk test. Differences between the three groups were measured using one-way ANOVA (with comparison of means by modified t test) or the Kruskal-Wallis test, depending on whether data were normally distributed or not. For the latter test, multiple contrasts, using the method described by Conover for non-parametric data,<sup>15</sup> then elucidated statistically significant differences between individual

groups. Spearman's rank test was used to assess any correlation between variables. Fisher's exact test was used to compare categorical variables. Statistical analyses were performed using ARCUS (copyright Dr I.A. Buchan, Ormskirk, UK). Data are shown as mean  $\pm$  SEM, or median (95%CI) for non-parametric data.

### Results

Basic demographic details of the three groups are shown in Table 1. The groups were well matched for age and sex, and the two diabetic groups were matched for duration of diabetes, diabetic treatment and metabolic control. The NHP scores for the six individual domains in the three groups are shown in Table 2. Higher scores indicate a greater impairment of QOL within that particular domain.

The diabetic group with pain had significantly higher scores for five of the six domains of the NHP than either of the other two groups, the exception being social isolation where scores were similar in all three groups. In these patients there were no significant relationships between the duration of either diabetes or pain, metabolic control or body mass index with any of the individual sections of the NHP. There were significant relationships between both the severity of pain as measured by VAS ( $p < 0.001$ ) and the McGill pain questionnaire evaluative section ( $p < 0.001$ ) with the NHP pain subsection. Likewise there was a significant relationship between VAS pain scores and the NHP physical mobility section ( $p < 0.01$ ). There were no significant relationships between any of the other subsections of the MPQ or VAS with the other four domains of the NHP. There were no significant differences in NHP scores between those patients who were insulin-treated and those who were treated with oral hypoglycaemic agents or by dietary measures alone.

The diabetic group without chronic pain also had significantly higher scores for four of the six domains of the NHP than the non-diabetic control group, the exceptions being social isolation and emotional reaction. There was no correlation between individual domains of the NHP and the glycated haemoglobin in the patients without chronic pain.

### Discussion

Quality of life has been studied using a variety of measures in people with type 1 and type 2 diabetes. However results have been inconsistent, with several studies reporting little or no disruption,<sup>5,16-19</sup> whilst others report a considerable impact on QOL.<sup>3,20-21</sup> Studies have generally shown a reduction in QOL with worsening metabolic control,<sup>5,16,22</sup> although

**Table 1** Basic demographic details of the three groups

	Diabetic patients		Non-diabetic control group	<i>p</i>
	With pain	Without pain		
<i>n</i>	41	38	37	
Age (years)	56.0 ± 1.9	57.3 ± 1.7	54.5 ± 1.9	NS
Sex (M/F)	29/12	26/12	26/11	NS
Years of diabetes	11.3 ± 1.3	9.2 ± 1.2	–	NS
Years of pain	3.3 ± 0.4	–	–	
VAS (mm)	48.5 ± 4.2	–	–	
<i>Diabetes treatment</i>				
Diet	4	5	–	NS
OHA	14	11	–	
Insulin	23	21	–	
HbA1 (%)	11.0 ± 0.5	10.2 ± 0.5	–	NS
IHD	6	7	5	
BP	10*	4	1	
CVA	0	2	0	

Data are means ± SEM. VAS, visual analogue pain score; OHA, oral hypoglycaemic agents; IHD, ischaemic heart disease; BP, hypertension; CVA, cerebrovascular accident. \**p* < 0.01 vs non-diabetic controls.

**Table 2** Nottingham Health Profile scores for the six individual sections

	Diabetic patients		Non-diabetic control group
	With pain	Without pain	
EM	27.3 (12–43.8) <sup>a,b</sup>	0 (0–16.4)	0
EN	63.2 (38.6–76) <sup>c,b</sup>	24 (0–63) <sup>e</sup>	0
P	53.5 (43.6–79.1) <sup>d,b</sup>	0 (0–14.8) <sup>f</sup>	0
PM	22.0 (21.4–32.6) <sup>c,b</sup>	10.7 (0–22.1) <sup>f</sup>	0 (0–9.3)
SO	0 (0–22)	12.6 (0–16.1)	0
SL	50.4 (12.6–77.6) <sup>c,b</sup>	0 (0–19.4) <sup>f</sup>	0 (0–12.6)

Data are medians (95% CIs). EM, emotional reactions; EN, energy; P, pain; PM, physical mobility; SO, social isolation; SL, sleep. <sup>a</sup>*p* < 0.001; <sup>c</sup>*p* < 0.01; <sup>d</sup>*p* < 0.0001 vs. diabetic control group; <sup>b</sup>*p* < 0.0001 vs. non-diabetic control group; <sup>e</sup>*p* < 0.01, <sup>f</sup>*p* < 0.05 vs. non-diabetic control group.

within a single study, disparate results have been shown with varying QOL measures.<sup>6</sup> In the present study, there was no relationship between metabolic control and QOL in both groups of patients.

This study clearly demonstrates that painful diabetic neuropathy has a considerable impact on QOL as assessed by the NHP. Little information has previously been available on the effects of diabetic neuropathic pain on QOL. In one study, it was reported that patients with neuropathic symptoms had a reduced QOL when assessed by the NHP and the Functional Limitations Profile, although details of the exact symptoms were not given.<sup>6</sup> In another, the severity of neuropathy, assessed by clinical examination, was inversely related to QOL but no

details of the presence or otherwise of pain were given.<sup>7</sup> In an earlier study of diabetic patients with chronic pain, pain was associated with a reduction in sleep, walking and ability to perform domestic duties,<sup>23</sup> although no formal QOL questionnaire was used, and patients had pain from a variety of causes.

In the present study, five of the six domains of the NHP scored higher (indicating more problems) in the diabetic group with pain than in either the diabetic or non-diabetic control groups. As the two diabetic groups in this study were well matched in terms of age, treatment type, metabolic control, diabetes duration, ischaemic heart disease and cerebrovascular disease, these factors probably did not influence the results. The findings were not surprising, as pain is associated with anxiety, depression, loss of mobility and independence, and these factors may contribute to the perception of well-being.<sup>24</sup> In studies of cancer patients, freedom from pain is an important aspect of QOL.<sup>25,26</sup> In the diabetic group with pain, difficulty with sleep was probably due to neuropathic pain being typically worse at night, although depression could be a contributory factor. Chronic pain patients who are poor sleepers usually have a greater degree of pain and physical disability, as well as higher scores of depression and anxiety.<sup>27</sup> The finding that the diabetic control group had a higher score in the sleep domain of the NHP than non-diabetic controls confirms previous evidence that diabetes itself can adversely affect sleep.<sup>28</sup> A reduction in energy has previously been reported in both type 1 and type 2 diabetes,<sup>20,22</sup> and the present study confirmed this, particularly in the patients with pain. The association of sleep loss and energy reduction is obvious.

The reduction in physical mobility was related to the VAS pain score. Although diabetic neuropathic pain is typically worse at night, it can also be present during exercise, contributing to the difficulty sometimes in differentiating the cause of pain in the diabetic leg.<sup>29</sup> Recently, it has been shown that when chronic diabetic neuropathic pain is reduced there is an associated increase in exercise tolerance.<sup>30</sup> In the present study, reduced mobility was not due to peripheral vascular disease or the presence of foot ulceration, as neither were present in those with pain.

In those with chronic neuropathic symptoms, the pain score of the NHP was high, as expected, and was related to the VAS score. Also, the relationship of the pain sub-section of the NHP to the evaluative section of the MPQ was not unexpected, as the latter is a measure of the intensity of the overall pain experience. The score in the emotional reactions domain was particularly high in the neuropathic pain group in comparison with the other two groups without pain. Such symptoms, along with poor sleep and reduced energy, can also be associated with depression. The association of chronic pain and depression has been recognized for a long time,<sup>31–33</sup> although the exact relationship is not yet clear.<sup>34</sup> Depression has been variably reported in 10–100% of chronic pain patients,<sup>35</sup> and conversely pain is often found in patients with depression.<sup>36</sup> Such findings emphasize the difficulties of treating chronic pain patients.<sup>37</sup> Interestingly, social isolation was similar in the three groups. This finding is surprising when one considers the impact pain and reduced physical mobility can have on the ability to carry on with normal social activities.

The NHP has limitations in that it measures only negative aspects of health-related QOL and does not reflect positive well-being.<sup>38–39</sup> Also, a number of different QOL measurements have been specifically developed for use with diabetic patients.<sup>40–43</sup> However none of these measures is designed to assess pain. Sampling a normal population with the NHP may yield a large number of zero scores because only significant health problems are revealed.<sup>39</sup> However, it is important to assess the NHP in an age- and sex-matched population of the same social class, as results can vary according to these three factors. The hospital visitors used in this study were reasonably representative of the local population

The NHP can reveal differences in QOL between diabetic treatment groups and between patients with diabetes, other chronic illnesses and the general population.<sup>44</sup> Also, QOL measures such as the NHP can help identify patients and areas of intervention. The findings of this study suggests that management of this group of patients, where simple treatment modalities have been ineffective, could be aimed at

treating other aspects of the disorder, not just the pain. For instance, the beneficial role of pain clinics and the use of multi-disciplinary teams in the management of chronic pain disorders should be considered.<sup>45</sup>

In conclusion, chronic neuropathic pain impairs QOL. The severity of the problem emphasizes the need for further research into effective management of such pain.

## References

1. Evans R, Manninen D, Garrison L, Hart G, Blagg C, Gutman R, Hull A, Lowrie E. The quality of life of patients with end stage renal disease. *N Engl J Med* 1985; **312**:553–9.
2. Croog S, Levine S, Tecta M, Brown B, Bulpitt C, Jenkins C, Klerman G, Williams G. The effects of antihypertensive therapy on the quality of life. *N Engl J Med* 1986; **314**:1657–64.
3. Stewart AL, Greenfield S, Hays RD, Wells K, Rogers WH, Berry SD, McGlynn EA, Ware JE. Functional status and well-being of patients with chronic conditions. *JAMA* 1989; **262**:907–13.
4. Fitzpatrick R, Fletcher A, Gore S, Jones D, Spiegelhalter D, Cox D. Quality of life measures in health care. 1: Applications and issues in assessment. *Br Med J* 1992; **305**:1074–7.
5. Chan AW, MacFarlane IA, Griffiths K, Wells JDC, Bowsher DR. Chronic pain in patients with diabetes mellitus: comparison with a non-diabetic population. *Pain Clinic* 1990; **3**:147–59.
6. Bardsley MJ, Astell S, McCullum A, Home PD. The performance of three measures of health status in an outpatient diabetes population. *Diabetic Med* 1993; **10**:619–26.
7. Trautner C, Schulenburg MGVD, Langefeld W, Auer P, Berger M. Quality of life in diabetic neuropathy (Abstract). *Diabetes* 1994; **43**(suppl 1); 206A.
8. Dyck, P.J. Detection, characterization, and staging of polyneuropathy: assessed in diabetics. *Muscle Nerve* 1988; **11**:21–32.
9. Hunt SM, McKenna SP, McEwen J, Backett EM, Williams J, Evelyn P. A quantitative approach to perceived health status: a validation study. *J Epidemiol Comm Health* 1980; **34**:281–6.
10. Hunt SM, McKenna SP, McEwen J, Williams J, Evelyn P. The Nottingham Health Profile: subjective health status and medical consultations. *Soc Sci Med* 1981; **15A**:221–9.
11. Hunt SM, McKenna SP, Williams J. Reliability of a population survey tool for measuring perceived health problems. A study of patients with osteoarthritis. *J Epidemiol Comm Health* 1981; **35**:297–300.
12. Melzack R. The McGill pain questionnaire: major properties and scoring methods. *Pain* 1975; **1**:277–99.
13. Huskisson EC. Measurement of pain. *Lancet* 1974; **ii**:1127–31.
14. Merskey H. Classification of chronic pain. *Pain* 1986; **3**(suppl):215–17.
15. Conover WJ. *Practical non-parametric statistics*. New York, Wiley, 1980.

16. Hanestad BR. Self-reported quality of life and the effect of different clinical and demographic characteristics in people with type 1 diabetes. *Diabetes Res Clin Pract* 1993; **19**:139–49.
17. Jacobson AM, de Groot M, Samson JA. The evaluation of two measures of quality of life in patients with type 1 and type 11 diabetes. *Diabetes Care* 1994; **17**:267–74.
18. Wallymahmed ME, Baker GA, MacFarlane IA. Quality of life assessment in diabetes: a preliminary study of young adults in Liverpool. *Pract Diabetes* 1992; **9**:193–6.
19. Wilkinson G. The influences of psychiatry, psychological and social factors on the control of insulin dependent diabetes mellitus. *J Psychosom Res* 1987; **31**:277–86.
20. Nerenz DR, Repasky DP, Whitehouse FW, Kahkonen DM. Ongoing assessment of health status in patients with diabetes mellitus. *Med Care* 1992; **30**:MS112–24
21. Sturrock NDC, Moriarty KT, Allison SP, Tattersall RB. Perceived well-being of patients with insulin-dependent diabetes mellitus (Abstract). *Diabetic Med* 1994; **11** (suppl 2):s41
22. Mayou R, Bryant B, Turner R. Quality of life in non-insulin dependent diabetes and a comparison with insulin-dependent diabetes. *J Psychosom Res* 1990; **34**:1–11.
23. Chan AW, MacFarlane IA. The impact of chronic pain on quality of life in diabetes. *Pract Diabetes* 1989; **6**:251–3.
24. Erskine A, Williams A de C. Chronic Pain. In: Broome A, ed. *Health Psychology*. London, Chapman and Hall, 1989:427–33.
25. Zweibal NR. Measuring quality of life near the end of life. *JAMA* 1988; **260**:839–40.
26. Padilla G, Ferrell B, Grant M, Rhiner G. Defining the content domain of quality of life for cancer patients with pain. *Cancer Nursing* 1990; **13**:108–15.
27. Pilowsky I, Crettenden I, Townley M. Sleep disturbance in pain clinic patients. *Pain* 1985; **23**:27–33.
28. Sridhar GR, Madhu K. Prevalence of sleep disturbances in diabetes mellitus. *Diabetes Res Clin Pract* 1994; **23**:183–6.
29. Ward JD. The diabetic leg. *Diabetologia* 1982; **22**:141–7.
30. Tesfaye S, Watt J, Benbow SJ, Pang K, Miles J, MacFarlane IA. Spinal cord stimulation in painful diabetic neuropathy. *Lancet* 1996; **348**:1698–701.
31. Merskey H, Spear FG. *Pain, psychological and psychiatric aspects*. London, Bailliere Tindall and Cassell, 1967.
32. Large R. The psychiatrist and the chronic pain patient. *Pain* 1980; **9**:253–63.
33. Kraemlinger KG, Swanson DW, Maruta T. Are patients with chronic pain depressed? *Am J Psychiat* 1983; **140**:747–9.
34. Krishnan KRR, France RD, Pelton S, McCann UD, Davidson J, Urban BJ. Chronic pain and depression. 1. Classification of depression in chronic low back pain patients. *Pain* 1985; **22**:279–87.
35. Romano JM, Turner JA. Chronic pain and depression: does the evidence support a relationship? *Psychol Bull* 1985; **37**:18–34.
36. France RD. Chronic pain and depression. *J Pain Symptom Management* 1987; **2**:234–6.
37. Wells JCD. The place of the pain clinic. *Clin Rheumatol* 1987; **1**:123–53
38. Bowling, A. *Measuring Disease*. Buckingham, Open University Press, 1995.
39. Hunt SM, McEwen J, McKenna SP. Measuring health status: a new tool for clinicians and epidemiologists. *J Royal Coll Gen Pract* 1985; **35**:185–8.
40. Bradley C, Lewis KS. Measures of psychological well-being and treatment satisfaction developed from the responses of people with tablet-treated diabetes. *Diabetic Med* 1990; **7**:445–51.
41. Hornquist JO. The concept of quality of life. *Scand J Soc Med* 1982; **10**:57–61.
42. Hornquist JO. Quality of life. Concept and assessment. *Scand J Soc Med* 1989; **18**:67–79.
43. DCCT Research Group: Reliability and validity of a diabetes quality of life measure for the diabetes control and complications trial. *Diabetes Care* 1988; **11**:725–32.
44. Keinanen-Kiukaanniemi S, Ohinmaa A, Pajunpaa H, Koivukangas P. Health related quality of life in diabetic patients measured by the Nottingham Health Profile. *Diabetic Med* 1996; **13**:382–8.
45. Hardy PAJ, Hill P. A multidisciplinary approach to pain measurement. *Br J Hosp Med* 1990; **43**:45–7.