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Original Article

The impact of motor and depressive symptoms on quality of life in patients with Parkinson's disease

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ABSTRACT

Objective: To identify factors that affect the quality of life (QoL) of patients with idiopathic Parkinson's disease (IPD).
Materials and Methods: Twenty-seven IPD patients from Hualien Tzu Chi Hospital were enrolled between May, 2008 and July, 2012. All patients completed a Parkinson's disease-specific QoL questionnaire and the Beck Depression Inventory (BDI). A structured questionnaire interview and complete neurological examination, including the motor part of the Unified Parkinson's Disease Rating Scale (UPDRS part III), the Schwab and England Disability Scale (S & E), the Hoehn and Yahr Scale, and the Mini-Mental State Examination (MMSE) were administered by a nurse and a neurologist.
Results: The degree of depression and severity of disease were significantly correlated with the QoL of IPD patients ($r = 0.49$, $p = 0.01$, and $r = 0.44$, $p = 0.02$, respectively). The UPDRS part III, S & E, and MMSE scores did not correlate significantly with QoL scores ($r = 0.22$, $p = 0.26$, $r = -0.36$, $p = 0.06$, and $r = -0.25$, $p = 0.22$, respectively). The BDI-IIdepression score accounted for 31.5% of the variance of the QoL scores.
Conclusion: Depression and disease severity have significant impacts on the QoL of IPD patients. Treatment profiles should encompass both motor and non-motor domains.

1. Introduction

Idiopathic Parkinson's disease (IPD) is a chronic neurodegenerative disease that causes a substantial burden on patients, their families and caregivers, as well as society. The prevalence of IPD rises with age, affecting 1% of people over 60 years old and 3% of people over 80 years [1]. It is characterized by limb muscle rigidity, resting tremor, bradykinesia, and postural imbalance. In addition, non-motor symptoms such as cognitive dysfunction and psychiatric disorders are common [2]. The progressive decline in motor function and comorbidity associated with IPD negatively affect health-related quality of life (HRQoL) [3]. The non-motor features of IPD, including depression, anxiety, cognitive decline, pain, fatigue, insomnia, autonomic dysfunction, constipation, and urinary symptoms, have also been identified as significant factors in the diminished HRQoL of people with PD [4]. Previous study showed that female patients and patients at higher Hoehn and Yahr stages were more likely to report worse emotional well-being [5]. IPD is frequently accompanied by mood disturbance, with 35% of patients reporting some level of depressive symptoms, including 17% with major depressive disorders and 22% with minor depression [6]. Depressive symptoms have been recognized as a major contributor to poor quality of life (QoL), worse motor and cognitive function, and caregiver burden in IPD [7].

Correction of depression or non-motor symptoms may improve overall patient function and facilitate the execution of activities of daily living without direct treatment of PD. We hypothesized that clarification of non-motor symptoms would be important for patients with PD prior to receiving surgical treatment. No previous studies have been done with preoperative patients about to

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undergo deep brain stimulation (DBS) neurosurgery. The aim of this study was to identify factors related to QoL of Taiwanese IPD patients prior to DBS surgery.

2. Materials and methods

2.1. Patients

From May, 2008 to July, 2012, 27 ethnic Taiwanese IPD patients were enrolled in this study. All patients met the diagnostic criteria for IPD. The study was approved by the Research Ethical Board of Tzu Chi General Hospital, Hualien, Taiwan (IRB097-32). All patients gave written informed consent prior to data collection. The inclusion criteria were a diagnosis of IPD and a cognitive functioning level sufficient to answer the questionnaires. The exclusion criteria were the presence of dementia, delirium, or a combination of neurological diseases, and any history of neurosurgery. All questionnaires were administered during the month prior to the DBS operation in the patient's best "medication on" state.

2.2. Instruments

The clinical assessment included the motor part of the Unified Parkinson's Disease Rating Scale (UPDRS part III), the Hoehn and Yahr stage (H & Y stage), the Schwab and England Disability Scale (S & E), the Beck Depression Inventory-II (BDI-II), the Mini-Mental State Examination (MMSE), and the Parkinson's Disease Quality of Life Questionnaire (PDQ-39).

2.2.1. The UPDRS part III total motor scores

The UPDRS part III is used to assess the motor skills of IPD patients and investigates features such as bradykinesia, tremor, rigidity and posture instability. A total of fourteen items are rated in the patient's best medication state. Each item is scored on a scale from 0 to 4 (total range of scores, 0 to 108), and a higher score indicates worse motor function [8].

2.2.2. H & Y stage

The H & Y stage classifies IPD symptoms into five stages according to motor symptoms and dependency as follows: 0 for no signs of the disease; 1 for unilateral disease; 1.5 for unilateral and axial impairment; 2 for bilateral disease, without impairment of equilibrium; 2.5 for bilateral disease with mild impairment of equilibrium; 3 for bilateral disease with mild and moderate impairment of equilibrium; 4 for severe disability, but able to stand and walk without help; and 5 for use of a wheelchair or confined to bed, in need of full help [9].

2.2.3. S & E

The S & E is widely used to assess the degree of disability of IPD patients in performing daily activities. It is a percentage scale divided into deciles, with 100% representing completely normal function and 0% representing total helplessness.

2.2.4. BDI-II

The BDI is one of the most widely used scales for measuring the severity of depression. The revised version, the BDI-II, contains 21 questions, with each answer scored on a scale value of 0 to 3. The cutoff scores used differed from the original as follows: 0–13, minimal depression; 14–19, mild depression; 20–28, moderate depression; and 29–63, severe depression. Higher total scores indicate more severe depressive symptoms [10]. The Chinese version of the BDI-II had good internal consistency (Cronbach's alpha = 0.94, split-half reliability = 0.91) [11].

2.2.5. MMSE

The MMSE is used to systematically and thoroughly assess mental status. It is an 11-question measure that tests five areas of cognitive function, orientation, registration, attention and calculation, recall, and language. The maximum score is 30. A score of 24 or lower indicates cognitive impairment [12]. In the Chinese version, Guo et al. suggested two cut-point scores for checking cognitive impairment, 23/24 for literate and 13/14 for illiterate subjects [13]. The MMSE had excellent test-retest and intra-rater reliability (test–retest = 0.88, intra-rater = 0.82) [14].

2.2.6. PDQ-39

The PDQ-39 is a questionnaire with 39 items covering eight discrete dimensions, mobility (10 items), activities of daily living (6 items), emotional well-being (6 items), stigma (4 items), social support (3 items), cognition (4 items), communication (3 items), and bodily discomfort (3 items). The scores for each item range from zero (0) to four (4) as follows: "never" = 0; "occasionally" = 1; "sometimes" = 2; "often" = 3; and "always" = 4 (range of scores, 0 to 156). A higher score signifies poor quality of life [15]. The Taiwanese version of the PDQ-39 demonstrated acceptable reliability. The internal consistency reliability was satisfactory for all domains (Cronbach's alpha = 0.80–0.96), except for the social support, cognition, and bodily discomfort domains (alpha = 0.58–0.63). The convergent validity was also supported by strong correlations between domains measuring related constructs of the PDQ-39 and UPDRS ($r = 0.81$–0.86) [16].

2.3. Statistical analysis

Mean values were compared by descriptive analysis, and Spearman rank correlation coefficients were calculated to assess the direction and magnitude of associations between variables. Stepwise multiple regression analysis was used to determine the factors that best accounted for variance in QoL scores. Statistical significance was accepted at $p < 0.05$.

3. Results

Twenty-seven IPD patients, 14 men and 13 women, were enrolled in this study. Their mean age of disease onset was 51.74 ± 8.15 years, and mean disease duration was 9.78 ± 3.42 years. The mean H & Y stage was 2.67 ± 0.57. All subjects had at least 6 years of education. No difference in PDQ-39 scores was found between men and women on the Mann-Whitney test (Table 1).

3.1. Correlations between IPD patient motor and non-motor functions on the PDQ-39

The PDQ-39 total score correlated significantly and positively with depression as measured by the BDI-II score ($r = 0.49$, $p = 0.01$)

Table 1
Patients characteristics ($n = 27$).

	Mean (SD)	Range of scores
Age of PD onset	51.74 (8.15)	
PD duration	9.78 (3.42)	
LEDD (mg)	829.88 (387.30)	
UPDRS part III (drug-on)	22.74 (9.88)	0–108
S & E (%) (drug-on)	88.52 (6.62)	0–100
Hohen & Yahr stage (drug-on)	2.67 (0.57)	0–5
BDI-II	16.78 (9.25)	0–63
MMSE	25.78 (5.81)	0–30
PDQ-39	53.37 (24.71)	0–156

BDI-II = Beck Depression Inventory-II; LEDD = levodopa equivalent daily dose; MMSE = Mini-Mental State Examination; PD = Parkinson's disease; PDQ-39 = Parkinson's Disease Quality of Life Questionnaire; S & E = Schwab and England Activities of Daily Living.

and disease severity as measured by the H & Y stage ($r = 0.44$, $p = 0.02$). Correlations between age of disease onset, disease duration, and levodopa equivalent daily dose (LEDD) were not significant ($r = 0.34$, $p = 0.09$, $r = 0.37$, $p = 0.06$, and $r = 0.01$, $p = 0.95$, respectively). The UPDRS part III ($r = 0.22$, $p = 0.26$), S & E ($r = -0.36$, $p = 0.06$), and MMSE scores ($r = -0.25$, $p = 0.22$) also failed to correlate significantly with the PDQ-39 (Table 2).

3.2. Regression analysis of PDQ-39 scores

To determine the factor which contributed most to the PDQ-39 score, we performed stepwise linear regression, and entered age of disease onset, disease duration, LEDD, and all clinical assessment scales shown in Table 1 into the regression in a stepwise fashion. The significant affecting factor was the BDI-IIdepression score, which accounted for 31.5% of the variance of quality of life scores (Table 3).

4. Discussion

In this study, the strongest predictor of QoL in Parkinson's disease was the presence of depression, which accounted for 31.5% of the variance of the quality of life scores. Correlation of QoL with depression has also been found in other studies of QoL in Parkinson's disease, accounting for up to 50% of impairment in PDQ-39 scores [4,17]. Depression has also been found to have a major influence on QoL scores in patients with other chronic diseases [18]. In a population-based survey using the PDQ-39 and BDI, Schrag and colleagues found that the factor most strongly related to poorer QoL was depression, although motor disability was also significantly associated [17]. In a model predicting PDQ-39 scores, the BDI score accounted for 54% of the variance, whereas motor disability scores accounted for only 15% [17]. In this study, motor disability did not significantly account for variance of QoL. It could be argued that the PDQ-39 and the BDI measure the same content and hence have a strong correlation. However, the PDQ-39 comprises eight distinct dimensions of which emotion features in only one. Additionally, depression scores also correlated with age of disease onset ($r = 0.38$, $p = 0.09$). When two variables are strongly associated, collinearity is a potential source of error in regression analysis [17]. Nevertheless, the correlation between the measure of depression and age of disease onset was only 0.38. However, association of PD with depression is well known, but patients' non-motor symptoms are often under-recognized [19], and treatment of depression in the disease is frequently insufficient. The results of this study highlight the need to diagnose and treat depression in PD more effectively to improve QoL. Healthcare professionals should be aware of not only motor dysfunction, but also emotional problems affecting the lives of individuals as well.

Table 2
Correlations of clinical scores with PDQ-39.

	Correlation coefficient	*p*
Age of PD onset	0.34	0.09
PD duration	0.37	0.06
LEDD (mg)	0.01	0.95
UPDRS part III (drug-on)	0.15	0.45
S & E(%) (drug-on)	−0.33	0.09
Hohen & Yahr stage (drug-on)	0.44	0.02
BDI-II	0.49	0.01
MMSE	−0.25	0.22

BDI-II = Beck Depression Inventory-II; LEDD = levodopa equivalent daily dose; MMSE = Mini-Mental State Examination; PD = Parkinson's disease; PDQ-39 = Parkinson's Disease Quality of Life Questionnaire; S & E = Schwab and England Activities of Daily Living; UPDRS = Unified Parkinson's Disease Rating Scale.

Table 3
Result of stepwise multiple regression analysis of PDQ-39 scores with BDI-II.

Predictor	Standardized regression coefficient	R^2	R^2 change	*p*
Beck Depression Inventory-II	0.56	0.315	0.315	0.002

Association was only observed between depression, disease severity, and poor QoL. A previous study pointed out that psychological adaptation to the disease, measured by indices of cognition, anxiety, depression, self-esteem, acceptance and attitude, is a contributing factor to and also impacts directly on the QoL, as well as the severity of the disease [20]. Conversely, a low level of psychological adaptation may be more relevant than the severity of the disease to the worsening of QoL. The severity of PD can have an impact on the quality of life, within the physical mobility and activities of daily living [20].

The motor part of the UPDRS, which is the primary outcome measure for most PD treatment trials, correlated less strongly with QoL scores ($r = 0.15$, $p = 0.45$). This scale, in contrast to the H & Y stage, involves a detailed assessment of parkinsonian features, comprising items of speech, hypomimia, tremor, and rigidity, in addition to bradykinesia and axial features such as postural instability and gait. However, these subscores did not have a significant influence on QoL scores when the patient was on their best medication status. In contrast, the H & Y stage correlated more strongly with QoL scores than the motor part of the UPDRS. However, this should not be taken to mean that motor function is unimportant in the QoL of PD patients, but rather that the relationship between motor function and QoL must be viewed in both the "on" and "off" medication status.

The LEDD did not correlate with QoL scores in this study. The Global Parkinson's Disease Survey Steering Committee [21] reported that motor severity and PD medications (levodopa, either alone or in combination with other dopaminergic drugs) together explained only 17% of the variability of QoL in PD. However, the presence of medication side effects such as dyskinesia, dystonia and hallucinations may impact daily activities.

The MMSE was not significantly associated with the PDQ-39 ($r = -0.25$, $p = 0.22$) in our study, in agreement with the majority of other studies that failed to confirm a relationship between cognitive compromise and worsened QoL [22,23]. Our patients' mean MMSE score was 25.78 ± 5.81, which did not reveal cognitive impairment, but these patients may not be fully representative of all patients with PD.

QoL is a complex concept to which many factors other than health contribute. The complexity of the concept of QoL is also the main limitation of this study, as many variables that potentially contribute to QoL, such as social support and individual coping strategies, were not measured in the PDQ-39 [24]. The other limitation of our study was the small study group. The sample size from one hospital was too low to make inferences and generalizations. We did not have a control group of depressed patients to compare with the results of both depressed and non-depressed PD patients. The findings of this study need to be treated circumspectly, as they may reflect, in part, the patients whose data were collected. Prospective, longitudinal studies with larger patient populations are needed to understand factors such as non-motor symptoms which may influence the QoL of patients with this disease.

5. Conclusion

QoL in IPD was significantly correlated with depression as well as disease severity in this study. Prior to DBS surgery,

treatment profiles should encompass both motor and non-motor domains to ensure good QoL outcomes for IPD patients. Nevertheless, QoL is affected by many factors, especially personal experience. Further studies are needed to understand individual perceptions and other determinant components of QoL in patients with PD.

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