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Original Article

The influences of behavioral and psychological interventions on the neurological function and MMSE scores in Parkinson's disease patients

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Abstract: Objective: To analyze the effects of behavioral and psychological interventions on the neurological function in Parkinson's disease (PD) patients. Methods: A total of 103 patients with PD admitted to our hospital were randomly divided into the observation group (OG, n=52) or the control group (CNG, n=51). The CNG was treated with routine nursing, while the OG was treated with behavioral and psychological interventions. Results: At 1, 2, and 3 months after the nursing, the National Institutes of Health Stroke Scale (NIHSS) scores, the unified PD disease rating scale III (UPDRS-III) scores, and the Pittsburgh Sleep Quality Index (PSQI) scores in both groups were lower than they were before the nursing, the NIHSS, UPDRS-III, and PSQI scores in the OG were lower than they were in the CNG, the General Self-efficacy Scale (GSES) and Mini-Mental State Examination (MMSE) scores and the Barthel scores in both groups were higher than they were before the nursing, and the GSES, MMSE, and Barthel scores in the OG were higher than they were in the CNG ($P < 0.05$). Conclusion: Behavioral and psychological interventions can improve PD patients' impaired neurological function, self-efficacy, cognitive function, motor dysfunction, sleep quality, and quality of life.

Keywords: Behavioral and psychological interventions, Parkinson's disease, neurological function, cognitive function, influences

Introduction

Parkinson's disease (PD), which is very common in the middle-aged and elderly population, is a neurodegenerative disorder characterized by the loss of dopamine neurons in the substantia nigra and the formation of Lewy bodies. PD symptoms include myotonia, static tremor, postural instability, gait disorders (PIGD), and bradykinesia [1, 2].

PD is a type of movement disorder. Clinically, the pathogenesis of PD has not been fully elucidated but is thought to be related to the environment, age, heredity, and other factors [3]. Medication plays a pivotal role in treating PD. Using medication, the progression of PD can be controlled, and the symptoms can be alleviated. However, sustained medication may lead to noticeable adverse reactions. Additionally, most elderly PD patients have poor medication compliance, leading to unsatisfactory medication effects [4]. In view of this, more and more scholars are seeking a non-medication method that can control the progression of PD and alleviate the symptoms. One study has shown that most PD patients have a negative psychological state and have a depression incidence rate approaching 30%, and over 20% of PD patients appear with cognitive dysfunction at the time of diagnosis [5]. A study has revealed that there is plasticity in dyskinesia in PD patients at the early stage, and early exercise intervention can improve their motor abilities [1]. A study has suggested that PD patients receiving behavioral intervention at the early stage show a remarkably improved motor function at 2 months after the intervention [6].

However, there is still a lack of systematic research on the psychological and behavioral interventions for PD patients, and the imple-

mentation methods for and effects of psychological and behavioral interventions remain to be validated. In this study, a total of 103 PD patients admitted to our hospital were selected as the study subjects to investigate the value of implementing behavioral and psychological interventions in the treatment of PD.

Materials and methods

Baseline data

A total of 103 PD patients admitted to our hospital from January 2017 to December 2019 were recruited as the study cohort and randomly divided into the observation group (OG, n=52) or the control group (CNG, n=51). Inclusion criteria: Patients who met the diagnostic criteria for PD formulated by the PD and Movement Disorders Group of the Chinese Medical Association Neurology Branch [7], at their initial onset, patients in the Hoehn-Yahr (H-Y) staging system stages 3-4 [8], patients not previously treated with medication for impaired neurological functions or cognitive function, and patients who received consistent treatment. All the patients or their families voluntarily signed the informed consent form. The study was reviewed and approved by the Ethics Committee of the First Affiliated Hospital of Jinan University. Exclusion criteria: Patients with secondary PD or Parkinsonism-plus syndrome (PPS) induced by other factors, patients with recurrent PD, patients with a previous history of cognitive dysfunction, patients with a recent use of drugs that may affect the study results, patients with a history of stroke, and patients also suffering from severe visceral diseases or underlying health conditions.

Methods

The CNG was treated with routine nursing, including the introduction of PD-related knowledge, medication instructions, reminders for subsequent visits, and guidance on daily life and activities.

The OG was treated with behavioral and psychological interventions. Behavioral intervention: the patients were instructed to engage in rehabilitation exercises, including facial muscle exercises, head and neck exercises, shoulder exercises, trunk exercises, upper extremity exercises, finger exercises, lower extremity exercises, gait exercises, and bed exercises. The nine types of rehabilitation exercises were conducted in sequence for half an hour to one hour once a day. Psychological intervention: positive event recording: the patients were asked to write down three happy things and the reasons contributing to their happiness in their notebooks before going to bed every night. The patients were guided to review and think daily happy thoughts and divert their attention to positive things, thereby improving their sense of happiness and improving their negative emotions. The benefits of self-perception: based on the understanding of the patients' interests and specialties through communication, their strengths were highly praised, and they were encouraged to recognize their own strengths, and understand that although they suffered from PD, they had their strong points. For example, some patients are good at playing table tennis, some can play two strings, some can sing opera, and some have a profound understanding of history. Nurses organized multiple interest groups based on the patients' specialties and interests, so that the patients could improve their negative emotions through participating in group activities and gaining confidence. Review of experience: most patients were prone to be pessimistic, world-weary, and depressed because of their restricted motor function and self-care abilities. The patients were guided to look back on the past days and encouraged to gain pleasure from normally pleasurable experiences and draw lessons from undesirable experiences. Through constant reviews, the patients could realize that it is normal to experience the ups and downs of life, they should live peacefully, and they can return to a pre-illness state of health as long as they actively receive treatment and carry out rehabilitation exercises.

The interventions in the two groups were performed during the patients' hospital stays.

Observational indices

Neurological function: the neurological function was evaluated using National Institutes of Health Stroke Scale (NIHSS) [9]. The scale covers consciousness, gaze, visual field, facial paralysis, upper extremity exercises, lower extremity exercises, limb ataxia, sensations, language, dysarthria, and neglect syndrome,

Table 1. Comparison of the general data between the two groups ($\bar{x} \pm s$)/[n (%)]

Data		Observation group (n=52)	Control group (n=51)	t/X^2	*P*
Gender	Male	34 (65.38)	30 (58.82)	0.471	0.492
	Female	18 (34.62)	21 (41.18)		
Age (years)		60.28±8.73	62.18±7.19	1.204	0.231
Course of disease (years)		5.18±1.37	5.26±1.42	0.291	0.772
HY scale scores (points)		1.89±0.72	1.85±0.76	0.274	0.784
Daily dose of Levodopa (mg)		318.42±76.18	321.13±70.13	0.188	0.852
Degree of illness	Mild	19 (36.54)	22 (43.14)	0.329	0.281
	Moderate	29 (55.77)	24 (47.06)		
	Severe	4 (7.69)	5 (9.80)		

and the total scores range from 0-42 points. A higher score indicates more serious neurologic damage.

Self-efficacy: the self-efficacy was evaluated using the General Self-Efficacy Scale (GSES) [10]. The scale comprises 10 questions, each scored from 0-4 points. The total score range of the scale is 0-40 points. A higher score indicates a higher self-efficacy.

Cognitive function: the cognitive function was evaluated using the Mini-Mental State Examination (MMSE) [11]. The MMSE covers orientation to time and place, immediate memory, attention and calculation, delayed memory, language, and visual space. The MMSE consists of 30 questions overall, and each question is scored 0-1 points. The total MMSE scores range from 0-30 points. 27-30 points indicates no cognitive dysfunction, and < 27 points indicates cognitive dysfunction (21-26 points indicates mild cognitive dysfunction, 10-20 points indicates moderate cognitive dysfunction, and 0-9 points indicates severe cognitive dysfunction).

Motor dysfunction: the motor function was evaluated using unified the Parkinson's disease rating scale III (UPDRS-III) [12]. The scale covers speech, facial expressions, static tremors, hand action tremors or postural tremors, rigidity, a finger flapping test, hand motion, alternate motion, leg flexibility, standing up, posture, gait, posture stability, and hypokinesia. Each item is scored from 0-4 points. The total score ranges from 0-56 points. A higher score indicates more serious motor dysfunction.

Sleep quality: the sleep quality was evaluated using the Pittsburgh sleep quality index (PSQI) [13]. The PQSI covers sleep quality, sleep times, sleep duration, sleep efficiency, sleep disorders, hypnotics, and daytime dysfunction. Each item is scored from 0-3 points based on the severity, and the total score ranges from 0-21 points. A higher score indicates lower sleep quality.

Quality of life: the self-care abilities were evaluated using the modified Barthel index [14]. The index includes feeding, bathing, dressing, decoration, bladder or bowel control, toilet use, bed and chair transfers, walking on flat ground, and going up and down stairs. Each item is scored from 0-100 points. A higher score indicates higher self-care ability and higher quality of life.

The aforementioned scores were evaluated before the nursing and at 1, 2, and 3 months after the nursing.

Statistical methods

SPSS 23.0 was used for the statistical analysis. The enumeration data were expressed as [n (%)], and measured using X^2 tests. The measurement data were expressed as ($\bar{x} \pm s$), and measured using t tests. The multi-point comparisons were performed using analyses of variance (ANVOA), and measured using *F* tests. The graphs were plotted using GraphPad Prism 8. $P < 0.05$ indicated statistical significance.

Results

General data

There was no statistically significant differences in the male-to-female ratio, average age, average course of the disease, average Hoehn & Yahr (HY) scale scores, average daily dose of levodopa, or the ratio of disease severity between the two groups ($P > 0.05$) (**Table 1**).

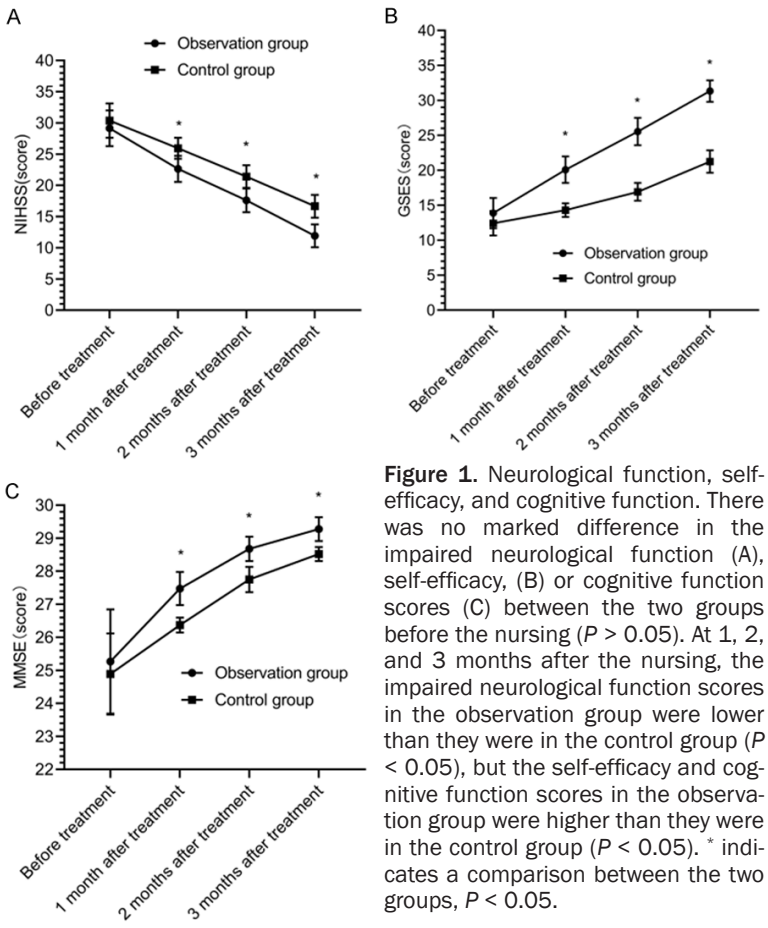

Figure 1. Neurological function, self-efficacy, and cognitive function. There was no marked difference in the impaired neurological function (A), self-efficacy, (B) or cognitive function scores (C) between the two groups before the nursing ($P > 0.05$). At 1, 2, and 3 months after the nursing, the impaired neurological function scores in the observation group were lower than they were in the control group ($P < 0.05$), but the self-efficacy and cognitive function scores in the observation group were higher than they were in the control group ($P < 0.05$). * indicates a comparison between the two groups, $P < 0.05$.

Neurological function, self-efficacy, and cognitive function

There were no statistically significant differences in the NIHSS scores, GSES scores, or the MMSE scores between the two groups before the nursing ($P > 0.05$). At 1, 2, and 3 months after the nursing, the NIHSS scores in both the OG and the CNG were lower than they were before the nursing, and the NIHSS scores in the OG were lower than they were in the CNG, with a significant difference ($P < 0.05$). At 1, 2, and 3 months after the nursing, the GSES and MMSE scores in both the OG and the CNG were higher than they were before the nursing, with a significant difference ($P < 0.05$), and the GSES and MMSE scores in the OG were higher than they were in the CNG, indicating a significant difference ($P < 0.05$) (**Figure 1**).

Motor dysfunction

There was no statistically significant difference in the UPDRS-III scores in the two groups before the nursing ($P > 0.05$). At 1, 2, and 3 months after the nursing, the UPDRS-III scores in both the OG and the CNG were lower than they were before the nursing, and the UPDRS-III scores in the OG were lower than they were in the CNG, indicating a significant difference ($P < 0.05$) (**Figure 2**).

Sleep quality

There was no statistically significant differences in the PSQI scores in the two groups before the nursing ($P > 0.05$). At 1, 2, and 3 months after the nursing, the PSQI scores in both the OG and the CNG were lower than they were before the nursing ($P < 0.05$), and the PSQI scores in the OG were lower than they were in the CNG, indicating a significant difference ($P < 0.05$) (**Figure 3**).

Quality of life

At 1, 2, and 3 months after the nursing care, the Barthel scores in both the OG and CNG were higher than they were before the nursing ($P < 0.05$), and the Barthel scores in the OG were higher than they were in the CNG, indicating a significant difference ($P < 0.05$) (**Figure 4**).

Discussion

Currently, multiple drugs are available to treat PD, yet none of them can help patients achieve a complete cure. Therefore, scholars are seeking non-medication methods. So far, acupuncture and moxibustion of traditional Chinese medicine, physiotherapy, and surgery have been widely implemented [15, 16]. However, efficacies vary greatly as a result of the differences in physicians' technical levels and equipment capabilities, and some patients do not consider such options due to the high therapeutic cost. In this study, the psychological and behavioral interventions had low requirements on the nurses' technical levels and could be directly implemented by the nurses without increasing the medical expenses. Therefore,

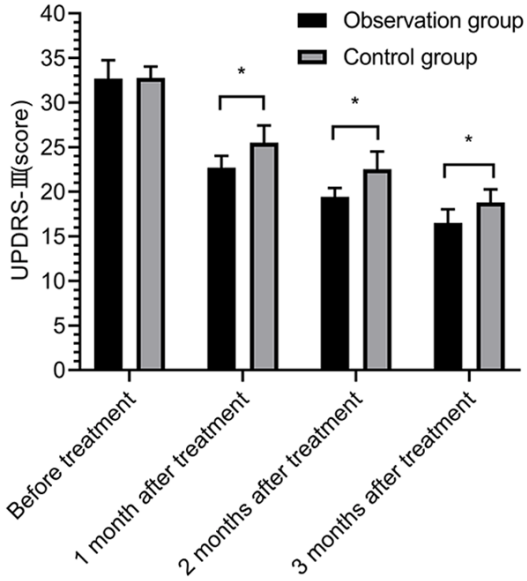

Figure 2. Motor dysfunction. There was no significant difference in the motor dysfunction scores between the two groups before the nursing ($P > 0.05$). At 1, 2, and 3 months after the nursing, the motor dysfunction scores in the observation group were higher than the motor dysfunction scores in the control group ($P < 0.05$). * indicates a comparison between the two groups, $P < 0.05$.

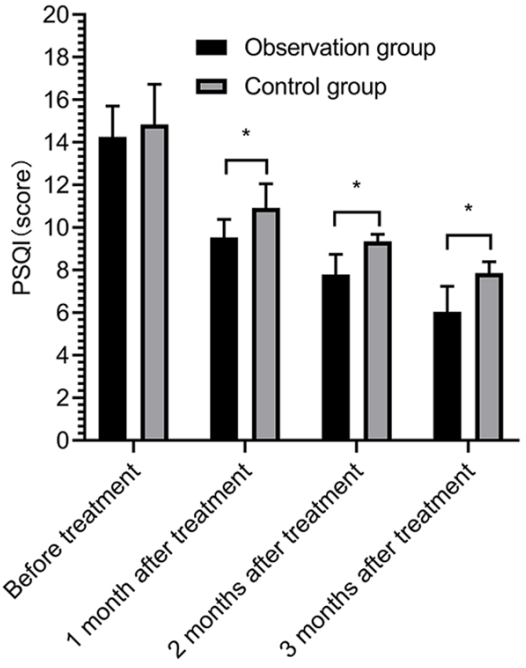

Figure 3. Sleep quality. There was no notable difference in the sleep quality scores between the two groups before the nursing ($P > 0.05$). At 1, 2, and 3 months after the nursing, the sleep quality scores in the observation group were higher than the sleep quality scores in the control group ($P < 0.05$). * indicates a comparison between the two groups, $P < 0.05$.

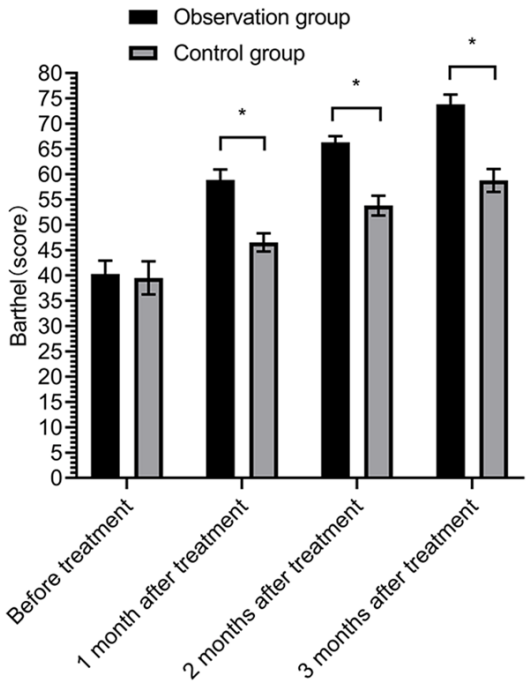

Figure 4. Quality of life. There was no significant difference in the quality of life scores between the two groups before the nursing ($P > 0.05$). At 1, 2, and 3 months after the nursing, the quality of life scores in the observation group were lower than the quality of life scores in the control group ($P < 0.05$). * indicates a comparison between the two groups, $P < 0.05$.

the interventions were extensively appreciated by the nurses and patients [17].

Multiple studies have proved that some neurons can regenerate within a certain time frame after a central nervous system (CNS) injury [18, 19]. The plasticity theory of the brain suggests that the functions lost due to injuries can be restored through continuous brain training and learning [20]. In this study, the OG had lower NIHSS scores and higher Barthel scores compared with the CNG at 1, 2, and 3 months after the nursing ($P < 0.05$). This shows that psychological and behavioral interventions can improve the impaired neurological functions of PD patients. After the nursing, the neurological function is significantly improved, showing time dependence. The restoration of neurological function leads to an improvement in the patient's self-care abilities, thus reducing dependence on others. As a result, the patients will discard the thought "I am the burden of my family", and will enjoy an improved quality of life [21]. The psychological intervention is helpful to arouse the patients' potential, promote the vitality of their brain cells, exercise their brains,

and improve some of their brain functions. Therefore, impaired neurological functions can be repaired. In this study, the UPDRS-III scores in the OG were lower than they were in the CNG at 1, 2, and 3 months after the nursing ($P < 0.05$), suggesting that psychological and behavioral interventions can improve the motor dysfunction of PD patients. This is related to active and continuous behavioral intervention, and the psychological intervention can ensure the patients' high compliance with behavioral intervention. Multiple PD symptoms affect motor function, and the psychological state of the patients is poor, leading to restricted motor functions and prominent motor dysfunction [22]. Some elderly patients have a poor understanding of rehabilitation exercises and fail to realize the importance of active functional exercises, leading to the ineffective restoration of their motor functions. The patients receiving active behavioral intervention are instructed to perform systemic rehabilitation exercises every day. The comprehensive and systematic exercises can arouse the subjective initiatives of patients. Meanwhile, patients undergoing a psychological intervention can re-establish the correct rehabilitation course and actively engage in rehabilitation exercises, thus improving their motor functions.

In this study, the PSQI scores in the OG were lower than they were in the CNG at 1, 2, and 3 months after the nursing ($P < 0.05$). This indicates that psychological and behavioral interventions can help improve the influence of PD on PD patients' sleep and the sleep quality. A study has indicated that people's sleep quality is subjected to multiple factors. Since PD patients are prone to recurrent symptoms, and nocturnal attacks directly affect their sleep, resulting in a decreased sleep quality [23]. A study has suggested that PD patients often also suffer from depression, and they feel more depressed at night, and the patients' concerns about PD lead to poor sleep quality [24]. In this study, the PD patients were treated with active psychological and behavioral interventions. The psychological intervention can alleviate their adverse emotions, and behavioral intervention can relieve their symptoms, thus reducing or even eliminating the influencing factors and improving their sleep quality. In this study, the GSES and MMSE scores in the OG were higher than they were in the CNG at 1, 2, and 3 months after the nursing ($P < 0.05$), indicating that active psychological and behavioral interventions can improve the self-efficacy of PD patients, lead to a higher sense of self-identity and can help patients willingly accept themselves after being diagnosed with PD and peacefully and positively view their diseases. This is attributable to the fact that the nurses encourage patients receiving psychological intervention to note down positive events, and through reviewing the positive events, the patients can realize that their lives are filled with positive things and it is unnecessary to be over-concerned about their diseases, thereby eliminating their adverse emotions. Additionally, the nurses should guide patients to recognize their strengths and avoid being excessively pessimistic, and help them enrich their daily lives based on their own strengths. Meanwhile, the patients should be encouraged to review the positive and negative things, feel the nostalgia of life through positive things, and draw lessons from the negative things, and they should be guided to compare their past negative experiences with their current diseases, so as to help them realize that they will go through their diseases, and they should bear positive expectations for and gain confidence in the future life. A study has proved that active psychological intervention can alleviate the adverse emotions of PD patients and improve their cognitive functions [25].

In summary, behavioral and psychological interventions can improve the impaired neurological function, self-efficacy, cognitive function, motor dysfunction, sleep quality, and quality of life of PD patients. However, this study also has some limitations, such as the lack of exploration on the differences in the effects of psychological and behavioral intervention on PD patients with different degrees of severity, and the lack of an in-depth investigation on the specific mechanisms of the psychological and behavioral interventions on the neurological and cognitive functions of PD patients, so this needs to be addressed in future studies.

Disclosure of conflict of interest

None.

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