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Original research

FACTORS RELATED TO DEPENDENCIES AMONG OLDER PATIENTS WITH PARKINSON'S DISEASE

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ABSTRACT

Background: *Patients with Parkinson's disease experience physical decline due to the disease's relentless progression, which may cause them unable to perform activity daily living. This study aimed to explore some factors related to ADL and IADL dependencies among older people with Parkinson's disease.*

Methods: *This cross-sectional study conducted on 190 older patients who were diagnosed with Parkinson's disease were being examined and treated at the National Geriatric Hospital from March to October 2023. Activities of Daily Living (ADL) was assessed using the Katz Index, Instrumental activities daily living (IADL) was assessed using the Lawton IADL.*

Results: *The rates of ADL and IADL dependence were 51.1% and 61.1%, respectively. Multivariate logistic regression analysis showed independent factors associated with an increased risk of ADL dependence were: stage of Parkinson's disease 3-5 (OR 3.47), Parkinson's disease duration (OR 1.10), symptom of rigidity (OR 2.96), cognitive impairment (OR 5.18) and upper limb strength impairment (OR 2.83). Some factors independently associated with an increased risk of IADL dependence were: osteoporosis (OR 11.25), stage of Parkinson 3-5 (OR 5.44), Parkinson's disease duration (OR 1.13), cognitive impairment (OR 3.74) and upper limb strength impairment (OR 4.54).*

Conclusions: *Stage 3-5 PD, longer disease duration, cognitive impairment, and upper limb weakness independently increase ADL/IADL dependence in older adults with PD. However, since this study was cross-sectional, this association should be interpreted with caution. Targeted interventions may help mitigate these risks.*

Keywords: *Dependence, Parkinson's disease, older adults, related factor.*

I. INTRODUCTION

Parkinson's disease (PD) is a neurodegenerative disorder of the brain, which is the second most prevalent after Alzheimer's diseases [1]. Over 8.5 million people worldwide are estimated to have PD, which is more prevalent in older people and typically manifests after the age of 50. The global prevalence of PD has doubled over the past 25 years [2]. According to the latest WHO data published in 2020, Parkinson's disease deaths in Vietnam reached 0.78% of total deaths [3]. Parkinson's disease has motor symptoms that negatively affect balance, quality of life, activities of daily living (ADL), and instrumental activities of daily living (IADL) [4].

Most people with Parkinson's disease experience physical decline as a result of the disease's relentless progression, which may cause them to lose the ability to perform ADL, especially in later stages [5]. This creates a burden on both the patient and the caregiver. In addition to affecting the performance of daily activities, many studies have found PD-related limitations in a variety of IADL even relatively early in the course of the disease, including driving, managing finances, managing medications, shopping, and household management. IADL limitations are linked to lower quality of life and disengagement from daily activities in patients with PD [6].

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The evaluation of ADL and IADL is a crucial component of routine patient assessment, helping medical professionals determine the patient's condition, make plans, and intervene when necessary. Futhermore, Parkinson's disease is associated with cognitive impairment, mental health difficulties, sleep disorders, pain and sensory disturbances as additional complications which may also impact independence. Therefore, the aim of this study was to explore some factors related to ADL and IADL dependencies among older people with Parkinson's disease.

II. MATERIALS AND METHODS

2.1. Subjects

Older patients aged 60 years old or over who were diagnosed with Parkinson's disease were being examined and treated at the National Geriatric Hospital from March to October 2023.

Included criteria: Patients who were diagnosed Parkinson's disease according to the United Kingdom Parkinson's Disease Society Brain Bank clinical diagnostic criteria; Patients ≥ 60 years old; Patients were able to interview and have the physical and cognitive abilities to do a face-to-face interview; Patients and the patient's family agreed to participate in the study

Excluded criteria: Patients with acute and malignant diseases (advanced cancers, end-stage chronic diseases, acute myocardial infarction, acute stroke, liver failure, kidney failure, severe heart failure...), or in severe conditions such as: respiratory failure, using ventilator...., or sever dementia (with total scose of the Montreal Cognitive Assessment (MoCA) < 10 points).

2.2. Study design

A cross-sectional descriptive study was conducted with the sample was selected according to the convenience sampling method. The sample size is calculated using the formula:

$$n = Z^2 \times \frac{p \times (1-p)}{e^2}$$

p = 0.8 (The proportion of IADL dependent patients in elderly people with Parkinson's disease) [7]. From the formula, the estimated sample size was 171 patients. In fact, 190 patients participated in this study.

2.3. Variables

General information: age, gender, comorbidities. Characteristics of Parkinson's disease: disease duration, stage of disease acording to Hoehn and Yarh Scale, symptoms (tremor, bradykinesia, rigidity).

Dependence assessments: Activities of Daily Living (ADL) was assessed using the Katz Index, total ADL score < 6 points was considered as having ADL dependence. Instrumental activities daily living (IADL) was assessed using the Lawton IADL, total IADL score < 8 points was considered as having IADL dependence.

Geriatric syndromes: Polypharmacy is defined as daily use of at least 5 medications. Sleep disturbance was assessed using the Pittsburgh Sleep Quality Index (PSQI): a total score ≥ 5 was considered as having sleep disorder. Cognitive function was assessed using the Montreal Cognitive Assessment (MoCA). Nutrition status was assessed using the Mini Nutritional Assessment - Short Form (MNA-SF). Depression was screening using the Geriatric Depression Scale (GDS-15). The Time Up and Go was used to evaluate the risk of fall: the cutoff time predicting high fall risk was 13.5 seconds or more. Upper limb strength: handgrip strength test (HGS) was measured using the handgrip strength dynamometer (Jamar TM Hidraulic Hand Dynamometer 5030 J1, USA). Low HGS was defined as < 28 kg for male and < 18 kg for female. Lower limb strength was assessed by the five times chair stand test. Individuals with times for 5 repetitions of this test ≥ 12 seconds following can be considered to have performed poorer than average.

2.4. Data collection method

Data were collected by using a research questionnaire through interviews, diagnosis tests, and medical records at National Geriatric Hospital.

2.5. Data processing and data analysis

The process of data coding, entry into REDCap, and analysis was done by using Statistical Package for Social Science (SPSS) software (version 26.0). Descriptive statistics were adopted to examine characteristic data: frequency, percentage, and mean.

T-test and Chi-square test were performed to evaluate factors associated with ADL and IADL dependence. Multivariable regression were performed to evaluate some independent factors

related to ADL/IADL dependence among older patients with Parkinson. Variables with $p < 0.2$ from the univariate logistic regression model were selected into the multivariate regression model. Statistical significance was accepted at the 95% of confidence level ($p < 0.05$).

III. RESULTS

3.1. General characteristics

Among 190 older patients with Parkinson's disease, the mean age was 68.8 ± 5.2 years old. Participants age 70 years old or over accounted for 41.1%. Female accounted for 58.9%. The average duration of disease was 6.6 ± 4.3 (years). The proportion of patients with Parkinson's disease duration more than 5 years is the majority at 53.7%. The majority of participants had Parkinson stage 2 accounting for 37.4%. Followed by stage 3 accounting for 26.3%, stage 1 accounting for 20.5%, stage 4 accounting for 14.7% and stage 5 accounting for smallest proportion of 1.1%. The rates of ADL and IADL impairment were 51.1% and 61.1%, respectively.

3.2. Association between ADL dependence and Parkinson's and geriatric characteristics

Parkinson's disease stage 3 - 5, Parkinson's disease duration, symptoms of bradykinesia and rigidity were statistically significantly associated with ADL dependence. The mean stage of Parkinson's disease and duration of Parkinson in the group of ADL dependent patients was significantly higher than that in the group of ADL independent patients ($p < 0.05$) (Table 1). Depression, risk of malnutrition/malnutrition, high risk of fall, cognitive impairment, upper limb strength impairment were statistically significant association with ADL dependence ($p < 0.05$) (Table 2).

Table 1: Association between ADL dependence and Parkinson's characteristics

Characteristics		**ADL independence (n=93)**		**ADL dependence (n=97)**		**p-value**
		n	**%**	**n**	**%**	
Stage of disease (Hoehn and Yarh)	Stage 1 - 2	72	77.4	38	39.2	< 0.01
	Stage 3 - 5	21	22.6	59	60.8	
Disease duration	≤ 1 year	13	14.0	5	5.2	< 0.01
	2 - 5 years	40	43.0	30	30.9	
	≥ 6 years	40	43.0	62	63.9	
Tremor	Yes	81	87.1	86	88.7	0.74
	No	12	12.9	11	11.3	
Bradykinesia	Yes	69	74.2	91	93.8	< 0.01
	No	24	25.8	6	6.2	
Rigidity	Yes	37	39.8	68	70.1	< 0.01
	No	56	60.2	29	29.9	
		Mean ± SD				
Stage of disease		1.91 ± 0.9		2.8 ± 0.9		< 0.01
Disease duration (year)		5.8 ± 4.3		7.3 ± 4.3		0.02

Table 2: Association between ADL dependence and geriatric characteristics

Characteristics		ADL independence (n=93)		ADL dependence (n=97)		p-value
		n	%	n	%	
Polypharmacy	Yes	72	77.4	69	71.1	0.32
	No	21	22.6	28	28.9	
Depression	Yes	48	51.6	74	76.2	< 0.01
	No	45	48.4	23	23.8	
Cognitive impairment	Yes	14	15.1	47	48.5	< 0.01
	No	79	84.9	50	51.5	
Sleep disturbance	Yes	79	84.9	87	89.7	0.33
		14	15.1	10	10.3	
Risk of malnutrition/ Malnutrition	Yes	33	35.5	59	60.8	< 0.01
	No	60	64.5	38	39.2	
Upper limb strength impairment	Yes	52	55.9	81	83.5	< 0.01
	No	41	44.1	16	16.5	
Lower limb strength impairment	Yes	73	78.5	90	92.8	0.05
	No	20	21.5	7	7.2	
High risk of fall	Yes	64	68.6	86	88.7	0.01
	No	29	31.2	11	11.3	

3.3. Association between IADL dependence and Parkinson's and geriatric characteristics

Parkinson's disease stage 3 - 5 group, Parkinson's disease duration, symptoms of bradykinesia and rigidity were statistically significantly associated with IADL dependence. The mean stage of Parkinson's disease and duration of illness in the group of IADL-impaired patients were significantly higher than those in the group of IADL-independent patients ($p < 0.05$) (Table 3). The proportion of IADL dependence in the group with depression, risk of malnutrition/ malnutrition, high fall risk, cognitive impairment, upper limb strength impairment and lower limb strength impairment were statistically significantly higher than those in the group without these above geriatric syndromes ($p < 0.05$) (Table 4).

Table 3: Association between IADL dependence and Parkinson's characteristics

Characteristics		IADL independence (n=74)		IADL dependence (n=116)		p-value
		n	%	n	%	
Stage of disease (Hoehn and Yarh)	Stage 1 - 2	62	83.8	48	41.4	< 0.01
	Stage 3 - 5	12	16.2	68	58.6	
Disease duration	≤ 1 year	12	16.2	6	5.2	< 0.01
	2 - 5 years	34	45.9	36	31.0	
	≥ 6 years	28	37.8	74	63.8	

Characteristics		IADL independence (n=74)		IADL dependence (n=116)		p-value
		n	%	n	%	
Tremor	Yes	66	89.2	101	87.1	0.66
	No	8	10.8	15	12.9	
Bradykinesia	Yes	55	74.3	105	90.5	0.03
	No	19	25.7	11	9.5	
Rigidity	Yes	29	39.2	76	65.5	< 0.01
		45	60.8	40	34.5	
		Mean ± SD				
Stage of disease		1.77 ± 0.75		2.78 ± 0.95		< 0.01
Disease duration (year)		5.38 ± 3.95		7.33 ± 4.42		0.02

Table 4: Association between IADL dependence and geriatric characteristics

Characteristics		IADL independence (n=74)		IADL dependence (n=116)		p-value
		n	%	n	%	
Polypharmacy	Yes	58	78.4	83	71.6	0.29
	No	16	21.6	33	28.4	
Depression	Yes	37	50.0	85	73.3	0.001
	No	37	50.0	31	26.7	
Cognitive impairment	Yes	12	16.2	49	42.2	< 0.001
	No	62	83.8	67	57.8	
Sleep disturbance	Yes	62	83.8	104	89.7	0.24
	No	12	16.2	12	10.3	
Risk of malnutrition/ Malnutrition	Yes	27	36.5	65	56.0	< 0.01
	No	47	63.5	51	44.0	
Upper limb strength impairment	Yes	36	48.6	97	83.6	< 0.001
	No	38	51.4	19	16.4	
Lower limb strength impairment	Yes	58	78.4	105	90.5	0.02
	No	16	21.6	11	9.5	
High risk of fall	Yes	50	67.6	100	86.2	< 0.01
	No	24	32.4	16	13.8	

3.4. Some independent factors were associated with ADL/IADL dependence

Some factors independently associated with an increased risk of ADL dependence were: stage of Parkinson's disease 3 - 5 (OR 3.47), Parkinson's disease duration (OR 1.10), symptom of rigidity (OR 2.96), cognitive impairment (OR 5.18) and upper limb strength impairment (OR 2.83). Some factors independently associated with an increased risk of IADL dependence were: osteoporosis (OR 11.25), stage of Parkinson 3 - 5 (OR 5.44), Parkinson's disease duration (OR 1.13), cognitive impairment (OR 3.74) and upper limb strength impairment (OR 4.54) (Table 5).

Table 5: Multivariable logistic regression analysis of some related factors with ADL/IADL dependence

Some related factors	ADL dependence		IADL dependence	
	OR	95%CI	OR	95%CI
Age (year)	1.05	0.97 - 1.14	1.05	0.96 - 1.13
Have osteoporosis	3.45	0.74 - 16.13	11.25	1.72 - 73.79
Stage of Parkinson's disease 3 - 5	3.47	1.61 - 7.50	5.44	2.19 - 13.49
Disease duration (year)	1.10	1.00 - 1.21	1.13	1.03 - 1.24
Have tremor	1.98	0.50 - 5.38	-	-
Have bradykinesia	2.17	0.68 - 6.87	1.94	0.65 - 5.83
Have rigidity	2.96	1.29 - 6.74	2.18	0.95 - 5.06
Polypharmacy	0.59	0.25 - 1.41	-	-
Sleep disturbances	1.38	0.46 - 4.19	-	-
Risk of malnutrition/malnutrition	2.00	0.93 - 4.30	-	-
Depression	-	-	1.12	0.49 - 2.59
Cognitive impairment	5.18	2.13 - 12.62	3.74	1.39 - 10.07
Upper limb strength impairment	2.83	1.18 - 6.81	4.54	1.91 - 10.79
Lower limb strength impairment	-	-	0.40	0.08 - 2.02

IV. DISCUSSION

Our study showed that some independent factors were associated with ADL/IADL dependencies among older patients with Parkinson's disease.

Through analysis, it showed that the proportion of ADL impairment patients in the Parkinson's group with disease stages 3 - 5 is higher, with a statistically significant relationship compared to the Parkinson's group with disease stages 1 - 2 (60.8% versus 39.2%). The mean Parkinson's disease stage of the ADL impairment patient group was statistically significantly higher than the ADL independent patient group (2.8 versus 1.91). The results of this study were similar to the study of Yao He et al. (2021), who found that disease severity affects physical function through ADL [8]. In our study, we also found that the group of people with PD with disease stages 3 - 5 was associated with an increased risk of ADL impairment (OR = 3.47) compared to the group of patients with PD with disease stages 1 - 2.

The proportion of ADL impairment patients in the group with Parkinson's disease duration ≥6 years was statistically significantly higher than the group with Parkinson's disease duration <6 years. The mean disease duration in the ADL impairment patient group was statistically significantly higher than the ADL independent patients. For every 1 year of Parkinson's disease increased, the patient's risk of ADL impairment increased 1.10 times ($p < 0.05$). This study was similar to Maria Sperens's research,

which also shows that ADL related to the duration of the disease, especially in their study, which found that eating, hygiene, dressing, and transporting have a significant impact on the disease, including the disease duration [5].

Previous study had found that elderly people with Parkinson's disease have difficulty performing ADL due to motor symptoms such as bradykinesia, gait disturbances and rigidity [9]. Our study also found that the group of patients with symptoms of rigidity is associated with an increased risk of ADL impairment (OR = 2.96).

Many studies had shown that ADL impairment is associated with cognitive impairment [10]. Research by Logan Wolff and Jared Benge shows that ADL difficulties correlate with cognitive status [11]. In our study also found that the group of patients with cognitive impairment was associated with an increased risk of ADL impairment (OR = 5.18).

In our study, the results showed that the proportion of ADL impairment patients in the group with upper limb strength impairment was higher than the group with normal upper limb strength (83.5% versus 16.5%). It also found that the group of patients with upper limb strength impairment was associated with an increased risk of ADL impairment (OR = 2.83). The motor sequelae of PD, particularly the gradual loss of muscle strength [12], cause serious functional limitations and interfere with the performance of ADL and outside tasks.

Through analysis, we saw that the proportion of IADL impairment patients in the PD stage 3-5 group was statistically significantly higher than the PD stage 1 - 2 group (58.6% versus 41.1%). The average PD stage of the IADL impairment patient group was statistically significantly higher than the IADL-independent patient group (2.78 versus 1.77). The group of people with PD stage 3-5 is associated with an increased risk of IADL impairment (OR = 5.44) compared to the group of people with PD stage 1 - 2. This result was similar to the study of Choi Seong-Min et al. (2019), their Pearson's correlation analysis showed significant associations between the IADL and stage of disease (according to Hoehn and Yarh scale) [13].

The proportion of IADL impairment patients in the group with Parkinson's disease duration ≥ 6 years was statistically significantly higher than the group with Parkinson's disease duration < 6 years. The average duration of Parkinson's disease in the IADL impairment patient group was statistically significantly higher than the IADL-independent patient group (7.33 years versus 5.38 years). For every additional year of illness, the risk of IADL impairment increased by 1.13 times. In Maria Sperens et al.'s study (2020), which also showed IADL impairment according to illness duration, they found that the three domains of cooking, shopping, and cleaning were significantly affected by disease duration [5].

Research by Sulzer et al. (2020) found a relationship between cognitive impairment and IADL. Their study found that 29.2% of subjects with mild cognitive impairment had early IADL impairment and were severely impaired in attention [14]. In our study also found that the group of patients with cognitive impairment was associated with an increased risk of IADL impairment (OR = 3.74).

In our study, the results were showed that the proportion of IADL impairment patients in the group with upper and lower limb strength impairment was higher than the group with normal upper and lower limb strength with ($p < 0.01$). It also found that the group of patients with upper limb strength impairment was associated with an increased risk of IADL impairment (OR = 4.54). In Judge et al. 'study, it also demonstrated that there were significant associations between hand grip strength and IADL score [15]. Upper limb strength impairment can indeed be a marker of more advanced neurodegeneration in Parkinson's disease. As the disease progresses, the motor symptoms become more severe, and upper limb weakness or dysfunction becomes more pronounced. This can indicate the spreading of neurodegeneration to areas of the brain responsible for voluntary and fine motor control, marking a more advanced stage of PD.

Furthermore, our study showed that osteoporosis increases IADL dependence. Osteoporosis contributes to IADL dependence in PD patients by increasing the risk of falls and fractures, exacerbating mobility issues, and promoting frailty, all of which lead to greater difficulty in managing daily tasks. It is important to consider osteoporosis as part of a comprehensive care plan for PD patients to help mitigate its impact on their functional independence.

Our study suggests that by emphasizing targeted interventions such as physical therapy, occupational therapy, bone health management, and frailty prevention, healthcare professionals can significantly improve the functional independence of PD patients, especially those with reduced upper limb strength and osteoporosis. Addressing these issues early and providing multidimensional care is essential to maintaining quality of life, reducing caregiver burden, and potentially slowing disease progression. The inclusion of these clinical implications in the study not only underscores their relevance, but also provides practical, evidence-based strategies to improve patient outcomes.

However, our study has some limitations. First, this is a cross-sectional study with convenience sampling method, so it cannot determine the causal relationship between factors and dependency status. Second, the study was conducted in a geriatric hospital, so it is not representative of the elderly Parkinson's disease population in Vietnam. Finally, the study did not consider social and economic factors such as access to health services and family support. Therefore, future longitudinal and intervention studies are necessary to evaluate the association as well as to improve dependency status for this population.

V. CONCLUSIONS

Stage 3 - 5 PD, longer disease duration, cognitive impairment, and upper limb weakness independently increase ADL/IADL dependence in older adults with PD. However, since this study was cross-sectional, this association should be interpreted with caution. Targeted interventions may help mitigate these risks.

Disclosure

The authors report no other conflicts of interest in this work.

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