Examining the frequency of dysphagia and the predictive factors of dysphagia that require attention in patients with Parkinson's disease

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Abstract

Introduction. *Due to the prevalence of dysphagia in patients with Parkinson's disease (PD) and its complications such as aspiration pneumonia, which is the main cause of death in these patients, PD-related disability can be prevented by early diagnosis and treatment of dysphagia.*

Objective. *The present study was aimed at investigating the frequency of dysphagia in PD patients.*

Materials and methods. *This cross-sectional study included 150 PD patients visiting a Neurology Clinic. The severity of PD was determined based on the Unified Parkinson Disease Rating Scale (UPDRS) and modified Hoen and Yahr (HYS) Scale. The Munich Dysphagia Test-Parkinson's disease (MDT-PD) questionnaire was used to assess dysphagia. Comparisons were made using generalized Fisher exact, Chi-square, ANOVA, and Kruskal–Wallis tests. Predictive factors were analyzed using logistic regression. Statistical analyses were performed at significance level of 0.05.*

Results. *Out of all 150 patients referred to the Clinic, the prevalence of dysphagia requiring attention was 25.3% (n = 38). The patients of the three groups according to the MDT-PD (no noticeable dysphagia, noticeable oropharyngeal, and dysphagia with aspiration risk) had a significant difference only in terms of the PD duration ($p < 0.001$). In the predicting of dysphagia, the longer PD duration ($p = 0.011$) and homemaker occupation ($p = 0.033$) were protective factors, while female gender was a risk factor ($p = 0.011$).*

Conclusion. *The prevalence of dysphagia requiring attention in the studied patients was 25.3%. It decreased with the longer duration of the disease, and its prevalence was lower in homemaker patients, while the odds of dysphagia was 5.8 times higher in women than in men.*

Keywords: *Parkinson disease; dysphagia; risk factors; swallowing*

Ethics approval. The study was conducted after obtaining informed consent from the patients.

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Изучение частоты дисфагии и прогностических факторов дисфагии, требующих внимания, у пациентов с болезнью Паркинсона

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Аннотация

Введение. *Распространённой проблемой при болезни Паркинсона (БП) являются дисфагия и её осложнения, такие как аспирационная пневмония, которая представляет собой частую причину смерти при БП. В связи с этим ранняя диагностика и лечение дисфагии может способствовать предотвращению инвалидизации пациентов.*

Целью *настоящего исследования является изучение частоты дисфагии у пациентов с БП.*

Материалы и методы. *В поперечное исследование были включены 150 пациентов с БП, наблюдающиеся в неврологической клинике. Тяжесть БП определяли на основании Унифицированной шкалы оценки БП (UPDRS) и модифицированной шкалы Хен–Яра (HYS). Для оценки дисфагии использовали Мюнхенский тест для оценки дисфагии у пациентов с БП (MDT-PD). Сравнение проводили с помощью обобщённого точного теста Фишера, теста χ^2, ANOVA и теста Краскелла–Уоллиса. Прогностические факторы анализировали с помощью логистической регрессии. Статистический анализ осуществляли с использованием уровня значимости 0,05.*

Результаты. *Из 150 пациентов, наблюдавшихся в клинике, дисфагия установлена у 38 (25,3%). Пациенты, относящиеся к трем группам в соответствии с результатами оценки по MDT-PD (отсутствие заметной дисфагии, заметная орофарингеальная дисфагия и дисфагия с риском аспирации), значимо различались только по длительности БП (p < 0,001). При оценке прогностических факторов большая продолжительность БП (p = 0,011) и трудовая занятость в виде ведения домашнего хозяйства (p = 0,033) оказались протективными факторами, в то время как женский пол являлся фактором риска (p = 0,011).*

Заключение. *Распространённость дисфагии, требующей внимания, у исследованных пациентов составила 25,3%. Вероятность ее наличия снижалась с увеличением длительности заболевания. Кроме того, распространённость развития дисфагии оказалась в 5,8 раза выше у женщин, чем у мужчин.*

Ключевые слова: *болезнь Паркинсона; дисфагия; факторы риска; глотание*

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Источник финансирования. Авторы заявляют об отсутствии внешних источников финансирования при проведении исследования.

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Introduction

Parkinson's disease (PD) is a progressive neurodegenerative disorder associated with the loss of dopaminergic neurons in the *pars compacta* of the *substantia nigra* [1]. PD is the second most common neurodegenerative disorder after Alzheimer's disease [2].

Various studies describe PD as a disease that affects the whole body and suggest that its source is the intestines before affecting the brainstem, often leading to gastrointestinal disorders in the early stage of the disease [3]. PD as a neurological disorder that can affect the efficiency of the swallowing function with increased muscle tone, involuntary movements, and lack of coordination between movements resulting in dysphagia [4]. Although little is known about the pathophysiology of dysphagia in patients with PD, it seems that dopaminergic and non-dopaminergic mechanisms are involved in the development of dysphagia in these patients [3].

More than 80% of patients with PD develop dysphagia during their life. In developed countries, the prevalence of dysphagia in patients over 60 years is 0.3 to 1% and 3% in patients over 80 years [5, 6]. Dysphagia in PD is associated with significant clinical complications such as malnutrition, drug consuming problems, dehydration, and aspiration pneumonia that is the main cause of death in patients with PD. One of the reasons mentioned for unrecognized dysphagia in these patients is the lack of attention to swallowing function during neurological examination [3].

Various methods can detect dysphagia in patients with PD, for example, fiberoptic endoscopy, videofluoroscopy, and high-resolution manometry [3]. But the first step is a proper questionnaire. One of the standard questionnaires for PD is the Munich Dysphagia Test- Parkinson's disease (MDT-PD) with a sensitivity of 82.4% and a specificity of 61.9% [7]. MDT-PD identifies even mild oropharyngeal dysphagia with and without risk of aspiration in patients with PD [3]. Studies showed that early treatment of dysphagia can provide safer feeding for patients with PD in the long-term perspective [4]. However, the effect of dopaminergic drugs, especially levodopa, on swallowing function and their role in the treatment of dysphagia is controversial [8–10]. Some studies showed significant improvement in dysphagia after using dopaminergic drugs in some patients with PD [7–22].

Concerning the prevalence of dysphagia in patients with PD, which was reported to be as high as 80%, as well as its complications such as aspiration pneumonia that is the most important cause of death in these patients, early diagnosis and treatment of dysphagia are important [3]. Therefore, the current study was aimed to evaluate the frequency of dysphagia in patients with PD using the MDT-PD.

Materials and methods

Population of patients

This cross-sectional analytic study included 150 patients with a clinically confirmed diagnosis of Idiopathic PD based on classic symptoms of the disease (tremor, bradykinesia, rigidity and postural instability). The patients were referred to Rouhani Teaching Hospital in Babol from March 2018 to February 2020 [1].

The exclusion criteria were neuroleptic-induced Parkinson's syndromes and a history of other diseases that affected swallowing function such as stroke or gastrointestinal diseases leading to dysphagia. Also, patients with severe mental disorders or dementia were excluded. This study was approved by the Ethics Committee of Babol University of Medical Sciences under the code of MUBABOL.REC.1399.205. All individuals signed written informed consent.

In order to determine the severity of PD, the scoring systems of the Unified Parkinson Disease Rating Scale (UPDRS) [23] and the modified Hoen and Yahr Scale (HYS) [24] were used.

UPDRS includes the following parts:
1) mind, behavior and mood (4 questions);
2) activities of daily living (13 questions);
3) motor examination (14 questions);
4) complications of therapy (11 questions).

HYS consists of 8 stages according to motor severity of PD. It includes scores from zero (no signs of disease) to five (wheelchair bound or bedridden unless aided) [25]. In both scales, a higher score indicates more disability. Definite diagnosis of PD and its varying stages was made by one neurologist.

MDT-PD was used to determine dysphagia in patients with PD. The Persian version of MDT-PD was found to be reliable (Cronbach's alpha: 0.897) and valid based on the viewpoint of five neurologists. The MDT-PD questionnaire consists of 26 questions presented in 4 sections:
1) difficulty swallowing food and liquids;
2) difficulty swallowing independent from food intake;
3) further swallowing-specific and accompanying burden;
4) swallowing-specific health questions.

This questionnaire is available online at www.mdt-parkinson.de. By completing it, patients can be classified into the following three groups: no noticeable dysphagia, noticeable oropharyngeal dysphagia, and dysphagia with aspiration risk. Data such as PD duration and demographic information including age, sex, body mass index (BMI), occupation (employed, unemployed, homemaker), educational level (illiterate, middle school, diploma, upper diploma), marital status (married, unmarried), residency (urban, rural) and smoking (yes/no) were collected from the patients.

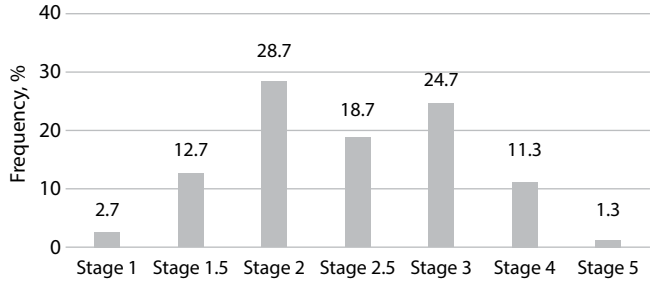
Statistical analysis

The categorical variables were described by frequency (percentage), whereas continuous variables were described by the mean (± SD). The generalized Fisher exact test and Chi-square test (for categorical variables) and ANOVA and Kruskal–Wallis tests (for continuous variables) were used to compare characteristics between the patients with no noticeable dysphagia, noticeable oropharyngeal, and dysphagia with aspiration risk.

By merging two groups of patients with noticeable oropharyngeal dysphagia and dysphagia with aspiration risk, as dysphagia requiring attention, predictive factors were analyzed using logistic regression. The regression model was fitted using the backward stepwise; odds ratio (OR) and confidence interval (CI) were reported. Statistical analyses were carried out with SPSS v. 22.0. The level of statistical significance was set at $\alpha = 0.05$ for all analyses.

Results

Patients with no noticeable dysphagia, noticeable dysphagia and dysphagia with aspiration risk were compared in terms of research variables. The results are presented in Table 1. Among 150 patients with PD, 84 (56%) were male and 66 (44%) were female with the mean ± Standard Deviation (SD) age of 70.07 ± 9.38 years. Based on the results of MDT-PD (Table 2), 112 patients (74.67%) had no noticeable dysphagia, 14 patients



Distribution of PD severity based on HYS stage.

(9.33%) had noticeable dysphagia and 24 patients (16.00%) had dysphagia with aspiration risk. In total, this study reported that 38 patients (25.33%) had dysphagia requiring attention. The Figure represents the frequency of PD severity based on HYS.

The results from Table 1 show that the patients under investigation in the three groups no noticeable dysphagia, oropharyngeal dysphagia and dysphagia with aspiration risk had a significant difference only in terms of Parkinson's disease duration ($p < 0.001$).

After merging two groups (noticeable oropharyngeal dysphagia and dysphagia with aspiration risk) as dysphagia requiring attention (Table 2), in order to find predictive factors for dysphagia, the multivariate logistic regression with backward method was used. The results (the final step) are presented in the Table 3.

As shown, the longer PD duration ($p = 0.011$) and homemaker occupation ($p = 0.033$) are protective factors for dysphagia. In other words, with the longer PD duration, the possibility of dysphagia requiring attention decreases (OR = 0.987) and the possibility of dysphagia for homemaker patients is lower (OR = 0.202).

Female gender has been a risk factor for the occurrence of dysphagia that needs attention ($p = 0.011$); the chance of dysphagia requiring attention for women is estimated to be 5.863 folds higher that in male.

Discussion

The study showed that the frequency of dysphagia requiring attention in patients with PD was 25.33%. A few studies were found using the MDT-PD to determine dysphagia in patients with PD. Based on a meta-analysis study, the prevalence of dysphagia according to PD patients' self-reports varied from 16% to 55%, and when dysphagia was diagnosed by objective assessments, its prevalence was 72% to 87%. The above study stated that oropharyngeal dysphagia develops in at least one third of patients with PD, which depends on the severity of the disease and the assessment technique [26]. E. Michou and colleagues found that the prevalence of swallowing disorders in patients with PD by using Swallowing disturbance questionnaire (SDQ) was 50% [27]. Therefore, the low prevalence of dysphagia in the present study could be attributed to the fact that the information obtained in the MDT-PD was based on the patients' reports.

It was concluded that the patients under investigation in three groups of no noticeable dysphagia, oropharyngeal dysphagia and dysphagia with aspiration risk had a significant difference only in terms of the duration of their disease. According to X. Ding and colleagues' study, there was no significant difference in PD

Table 1. Comparison of descriptive indices of research variables in patients with no noticeable dysphagia, significant oropharyngeal dysphagia and dysphagia with aspiration risk

Variables		Total	Dysphagia			Statistics	*p*-value
			no noticeable dysphagia	noticeable oropharyngeal dysphagia	dysphagia with aspiration risk		
Demographic variables and smoking status							
Age		70.07 ± 9.38	70.48 ± 9.16	72.07 ± 9.81	67.00 ± 9.88	1.726a	0.182
BMI		25.97 ± 4.55	25.60 ± 4.71	27.52 ± 4.62	26.79 ± 3.49	1.985b	0.159
Gender	male	84 (56.00)	64 (76.19)	7 (8.33)	13 (15.48)	0.297c	0.862
	female	66 (32.00)	48 (72.73)	7 (10.60)	11 (16.67)		
Education	illiterate	78 (52.00)	57 (73.08)	11 (14.10)	10 (12.82)	8.487d	0.075
	middle school	48 (32.00)	35 (72.92)	1 (2.08)	12 (25.00)		
	diploma and upper	23 (15.33)	19 (82.60)	2 (8.70)	2 (8.70)		
	unkown	1 (0.67)	–	–	–		
Occupation	unemployed	42 (28.00)	30 (71.42)	6 (14.29)	6 (14.29)	2.846d	0.584
	homemaker	54 (36.00)	43 (79.63)	4 (7.41)	7 (12.96)		
	employed	54 (36.00)	39 (72.22)	4 (7.41)	11 (20.37)		
Marriage status	single	32 (21.33)	21 (65.62)	3 (9.38)	8 (25.00)	2.505d	0.286
	married	118 (78.67)	91 (77.12)	11 (9.32)	16 (13.56)		
Residency	rural	77 (51.33)	61 (79.22)	5 (6.49)	11 (14.29)	2.097c	0.350
	urban	73 (48.67)	51 (69.86)	9 (12.33)	13 (17.81)		
Smoking	no	143 (95.33)	109 (76.22)	13 (9.09)	21 (14.69)	4.498d	0.105
	yes	7 (4.67)	3 (42.86)	1 (14.28)	3 (42.86)		
Disease related and clinical variables							
PD duration (months)		69.39 ± 56.85	76.82 ± 59.81	32.43 ± 37.57	56.25 ± 39.94	12.600b	< 0.001
Severity based on UPDRS		52.43 ± 25.72	50.59 ± 24.83	63.79 ± 34.88	54.38 ± 22.86	1.486b	0.223
Severity based on HYS	stage 1	4 (2.67)	3 (75.00)	1 (25.00)	–	10.417d	0.579
	stage 1.5	19 (12.67)	14 (73.68)	2 (10.53)	3 (15.79)		
	stage 2	43 (28.67)	35 (81.40)	4 (9.30)	4 (9.30)		
	stage 2.5	28 (18.67)	22 (78.57)	1 (3.57)	5 (17.86)		
	stage 3	37 (24.67)	25 (67.57)	3 (8.11)	9 (24.32)		
	stage 4	17 (11.33)	12 (70.59)	2 (11.77)	3 (17.65)		
	stage 5	2 (1.33)	1 (50.00)	1 (50.00)	–		
Tremor	no	13 (8.67)	10 (76.92)	–	3 (23.08)	1.784d	0.410
	yes	137 (91.33)	102 (74.45)	14 (10.22)	21 (15.33)		
Bradykinesia	no	14 (9.33)	11 (78.57)	1 (7.14)	2 (14.29)	0.139d	0.933
	yes	136 (90.67)	101 (74.26)	13 (9.56)	22 (16.18)		
Rigidity	no	19 (12.67)	14 (73.68)	3 (15.79)	2 (10.53)	1.382d	0.501
	yes	131 (87.33)	98 (74.81)	11 (8.40)	22 (16.79)		
Postural instability	no	67 (44.67)	54 (80.59)	6 (8.96)	7 (10.45)	2.922c	0.232
	yes	83 (55.33)	58 (69.88)	8 (9.64)	17 (20.48)		

Note. For quantitative variables; mean (± SD) and qualitative variables; frequency (%). [a]ANOVA test; [b]Kruskal–Wallis test; [c]Chi-square test; [d]Generalized Fisher exact test.

Table 2. The frequency of dysphagia requiring attention in PD patients

Group		Frequency, %
No noticeable dysphagia		112 (74.67)
Dysphagia requiring attention Total = 38 (25.33)	noticeable oropharyngeal dysphagia	14 (9.33)
	dysphagia with aspiration risk	24 (16.00)

Table 3. Final step of the multivariate logistic regression analysis (backward selection) to investigate the factors that predict dysphagia requiring attention (noticeable oropharyngeal dysphagia and dysphagia with aspiration risk)

Variables		Odds ratio (CI 95%)	*p*-value
Gender	male (reference)		
	female	5.863 (1.496–22.972)	0.011
Occupation	unemployed (reference)		
	homemaker	0.202 (0.047–0.879)	0.033
	employed	1.025 (0.381–2.760)	0.960
Smoking	no (reference)		
	yes	4.408 (0.861–22.556)	0.075
PD duration		0.987 (0.977–0.997)	0.011

duration in patients with or without dysphagia [28], whereas E. Cereda and colleagues showed that PD duration and dementia were associated with swallowing disorders in PD patients [29].

In the study of K. Lam and colleagues, BMI in patients with PD who had dysphagia was significantly lower than patients without dysphagia [12], while in our study the difference of BMI was not significant.

A. Galib and colleagues demonstrated that the disease severity and PD duration were not predictors of dysphagia in these patients. According to their study, although patients with dysphagia had a shorter time from diagnosis, but this association was not statistically significant [30].

According to the results of the regression model fitted in this study, the longer PD duration was a protective factor for dysphagia. In order to justify this relationship, it could be said that patients with longer PD duration might have benefit in terms of dose adjustment rather than patients who had recently been diagnosed. Evidence showed that levodopa has a good effect on the swallowing function as well as motor symptoms in limbs [31].

T. Warnecke and colleagues found that increasing the daily dose of levodopa could be effective for 50% of patients with oropharyngeal dysphagia and motor fluctuations. According to the same study, dopaminergic stimulation of the central nervous system is highly associated with the earlier onset of the swallowing reflex, which is very effective in clearing the pharynx [32].

One of the major strengths of our study is that we included PD patients with all HYS stages. Based on the current study, stage 2 and 3 of PD were most frequent, 28.7% and 24.7% respectively. Interestingly, PD severity based on HYS was not associated with dysphagia. X. Ding and colleagues found that patients at more severe stages were 3.26 times more likely to develop dysphagia [28]. In the present study, a few patients were at stages of 4 and 5, which might explain the lack of association between disease severity and dysphagia.

In this study, among the demographic variables, the effect of gender and housework were significant in predicting dysphagia. But according to X. Ding and colleagues 's study, there was no significant difference between gender in patients with or without dysphagia [28], whereas Cereda and colleagues showed that age and gender were associated with swallowing disorders in PD patients [29].

Also, the homemaker occupation was effective as a protective factor. As a result, it could be said that householders are less likely to have oropharyngeal dysphagia or dysphagia with aspiration risk. Of course, to prove this claim more detailed studies are required.

The limitations of this study included inability of patients with higher stages to arrive at hospital and not considering the effects of patient's lifestyle, dental hygiene and the on-off status of PD. Further large-scale studies are needed to evaluate the prevalence of dysphagia in patients with PD considering these limitations.

Conclusion

This study reported that the prevalence of dysphagia in patients with PD was relatively low being about 25%. The mean PD duration in patients with no noticeable dysphagia was longer than in patients with dysphagia requiring attention. The longer PD duration and homemaker occupation were protective factors and female gender was a risk factor of dysphagia.

Findings of this study can help neurologists to detect swallowing disorders in patients with PD at the mild stage, so that it can be treated earlier. In this way, the progression of dysphagia and its complications can be prevented and the quality of life can be improved.

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