

A Perspective of the Wearing-off Phenomenon in a Patient with Parkinson's Disease: A Case Report

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Dysphagia is a major disability in patients with Parkinson's disease. Unlike typical motor symptoms, dysphagia is relatively unresponsive to dopaminergic drugs. However, occasionally, swallowing difficulties are much improved by dopaminergic agonists and significantly affected by on/off periods. In such cases, it is difficult to assess the severity of dysphagia accurately if swallowing function evaluation is performed without considering the wearing-off phenomenon in patients with PD. Here, we report a case of dysphagia in a female patient with Parkinson's disease that was severely affected by the wearing-off phenomenon in response to prolonged use of levodopa. The patient presented with severe oral phase delay with choking symptoms during fluid intake. A videofluoroscopic swallow study performed during an 'off-period' showed massive aspiration with severely impaired swallowing function. However, when swallowing evaluation was performed during the 'on-period', almost no abnormal function was observed. After adopting an on/off period-tailored diet prescription, sufficient nutrition was possible without aspiration. Consideration of the wearing-off phenomenon is essential when evaluating swallowing function in patients with Parkinson's disease. Patient-specific swallowing evaluations and diet prescriptions are needed to establish optimal therapeutic strategies. (JKDS 2023;13:59-64)

Keywords: Parkinson's disease, Dysphagia, Levodopa, Videofluoroscopic swallow study

INTRODUCTION

Parkinson's disease (PD) is a major cause of death and disabilities, being the second most common neurodegenerative disease worldwide¹. Selective loss of dopaminergic neurons in the deep brain structure leads to various motor and non-motor symptoms^{2,3}. As a non-motor symptom of PD, dysphagia results in malnutrition, aspiration pneumonia, decreased quality of life and increased overall mortality. Unlike typical

motor symptoms, swallowing difficulty is detected in a relatively later phase after diagnosing PD and is often underestimated due to certain silent aspirations. Furthermore, it is known that dysphagia does not improve well with dopaminergic drugs⁴. Here, we report a case of dysphagia that has markedly fluctuated in a patient with PD due to the use of dopaminergic drugs, and the symptom was significantly affected by the wearing-off phenomenon.

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CASE REPORT

A 59-year-old woman attended our clinic presenting swallowing difficulty. She was diagnosed with PD eight years prior and had been managed at the outpatient clinic of the neurology department. She didn't have any other neurologic diseases causing dysphagia, and the brain magnetic resonance image didn't show any structural abnormality.(Fig. 1A) A 18-fluorodopa positron emission tomography scan showed reduction in bilateral putaminal radiotracer uptake.(Fig. 1B)

She presented severe limb rigidity, postural instability with Hoehn and Yahr stage 3, dysarthria, pathological crying, and irritability. She was taking levodopa with benserazide (Madopar) for five times a day

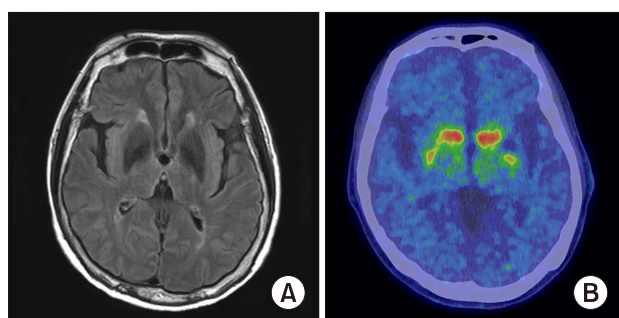


Fig. 1. Brain image at the time of diagnosis. (A) No evidence of stroke or other structural abnormality in magnetic resonance image. (B) Decreased bilateral putaminal uptake in 18-fluorodopa positron emission tomography scan.

(187.5 mg, 218.75 mg, 218.75 mg, 218.75 mg and 187.5 mg at 10 AM, 11:30 AM, 2:00 PM, 4:00 PM, and 6:00 PM, respectively). Dopaminergic drugs improved her motor symptoms, but she experienced a severe wearing-off phenomenon in response to prolonged use of levodopa. She could walk with assistance and use her hands for daily activities during the on-period, from 11:00 AM to 7 PM, but was totally dependent on a wheelchair with pathological crying, hallucinations, and delirium during the off-period.

Her swallowing difficulty had developed several months prior to her attendance to the clinic with frequent aspiration of liquids. Tongue pumping and oral bradykinesia worsened as the stiffness of the extremity increased, and it markedly delayed the whole mealtime. We performed a videofluoroscopic swallow study (VFSS) at approximately 9:00 AM, which is the routine VFSS schedule in our clinic. With 5 ml of nectar-thick liquid, the VFSS showed tongue disorganization, delayed oral transit time, and lack of laryngeal elevation with impairment of laryngeal vestibule closure. Aspiration was observed during swallowing, which showed a score of 8 on the penetration-aspiration scale (PAS).(Fig. 2A) A similar abnormality was observed with 3 ml of a thin liquid (PAS 8).(Fig. 2B) With semi-solid food using rice porridge, the study showed markedly reduced mastication and moderate retention of the food bolus in the oral cavity. Specifically, it showed a total score of

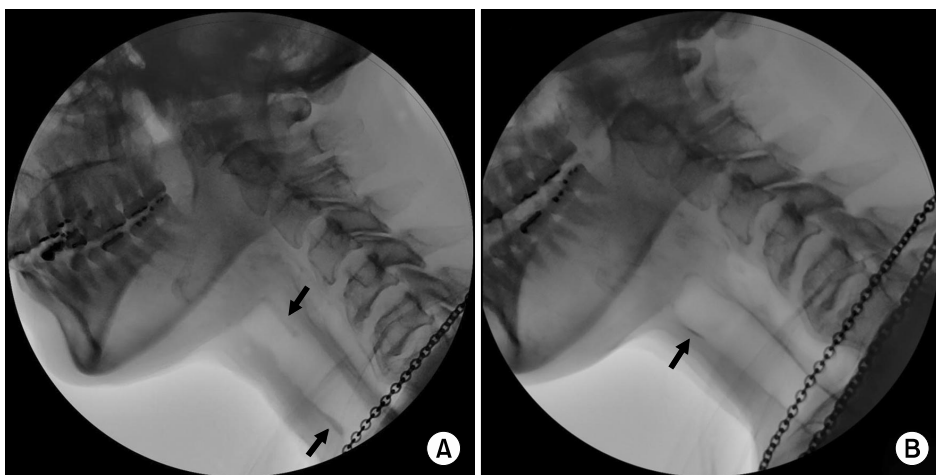


Fig. 2. Videofluoroscopic swallow study during the off-period in a patient with Parkinson's disease showed massive aspiration. (A) Nectar-thick liquid. (B) 3 ml of a thin liquid. Arrow: Aspiration.

15 in oral impairment components of the Modified Barium Swallow Impairment Profile (MBSImP)⁵.(Table 1)

We recommended rice porridge-based semisolid diet with thickened liquid as an alternative dysphagia diet, considering the lack of sufficient nutrition and hydration with maximum diet restriction. However, the patient and her caregiver refused our diet prescription because of her capability of previous oral intake.

After a more detailed history-taking of symptom variation during a day, we noted that the patient's

swallowing function had fluctuated significantly, which is affected by the wearing-off cycle. She was on a regular diet without any restriction during the on-period between 12:00 AM to 6:00 PM, but she had frequent choking and deglutition during the off-period in the morning and late afternoon. Considering the fluctuation in swallowing difficulty, we performed the VFSS again at approximately 2:00 PM, after she took levodopa on schedule. The second VFSS showed a significant improvement in swallowing function compared to the previous exam. There was no

Table 1. Improvement of dysphagia severity according to on/off-period.

Measurement tools and components		First study (off-period)	Second study (on-period)
A. MBSImP	Score		
Oral impairment total score		15	6
Sub components of oral phase			
1. Lip closure	0=No labial escape 1=Interlabial escape 2=Escape from interlabial space or lateral juncture 3=Escape progressing to mid-chin 4=Escape beyond mid-chin	0	0
2. Tongue control during bolus hold	0=Cohesive bolus between tongue to palatal seal 1=Escape to lateral buccal cavity/floor of mouth 2=Posterior escape of less than half of bolus 3=Posterior escape of greater than half of bolus	3	2
3. Bolus preparation/ Mastication	0=Timely and efficient chewing and mashing 1=Slow prolonged chewing/mashing with complete re-collection 2=Disorganized chewing/mashing with solid pieces of bolus unchewed 3=Minimal chewing/mashing with majority of bolus unchewed	3	1
4. Bolus transport/ Lingual motion	0=Brisk tongue motion 1=Delayed initiation of tongue motion 2=Slowed tongue motion 3=Repetitive/disorganized tongue motion 4=Minimal to no tongue motion	3	1
5. Oral residue	0=Complete oral clearance 1=Trace residue lining oral structures 2=Residue collection on oral structures 3=Majority of bolus remaining 4=Minimal to no clearance	3	1
6. Initiation of pharyngeal swallow	0=Bolus head at posterior angle of ramus 1=Bolus head in valleculae 2=Bolus head at posterior laryngeal surface of epiglottis 3=Bolus head in pyriforms 4=No visible initiation at any location	3	1
Pharyngeal impairment total score		5	4
B. PAS		8	3

The worst score observed across all consistencies and volumes was recorded. Only the total score was recorded in pharyngeal phase. (MBSImP: modified barium swallow impairment profile, PAS: penetration aspiration scale).

aspiration, and the laryngeal elevation with laryngeal vestibule closure was nearly intact. In particular, mastication, lip closure, and tongue disorganization improved noticeably, with the reduced oral transit time.(Fig. 3A, B) The total score in oral impairment components of MBSImP was markedly decreased to 6.(Table 1) She could swallow semi-solid and solid diets without any aspiration or time delay.(Fig. 3C, D)

Regarding the second VFSS, we decided to try oral intake with food modification using a soft-minced diet and liquid with a thickener only during the on-period of the day. After strict adherence to mealtime schedule and diet modification, most of her swallowing difficulties were alleviated, and sufficient nutritional support was also possible. During the follow-up period of several months, the medication regimen was partly changed to control her motor

symptoms, but her swallowing function has been maintained successfully.

DISCUSSION

Dysphagia is one of the most common complications of non-motor symptoms in patients with Parkinson's disease. The prevalence of dysphagia is reported to vary from 18% to 100%, and it decreases the quality of life while increasing overall mortality⁶. Degeneration of the dopaminergic system in the substantia nigra has a major role in the disabilities and typical motor symptoms, including oral bradykinesia, rigidity, and coordination impairment, which can cause dysphagia in patients with PD⁷. However, several other pathophysiological conditions can result in dysphasia, as suggested by different studies.

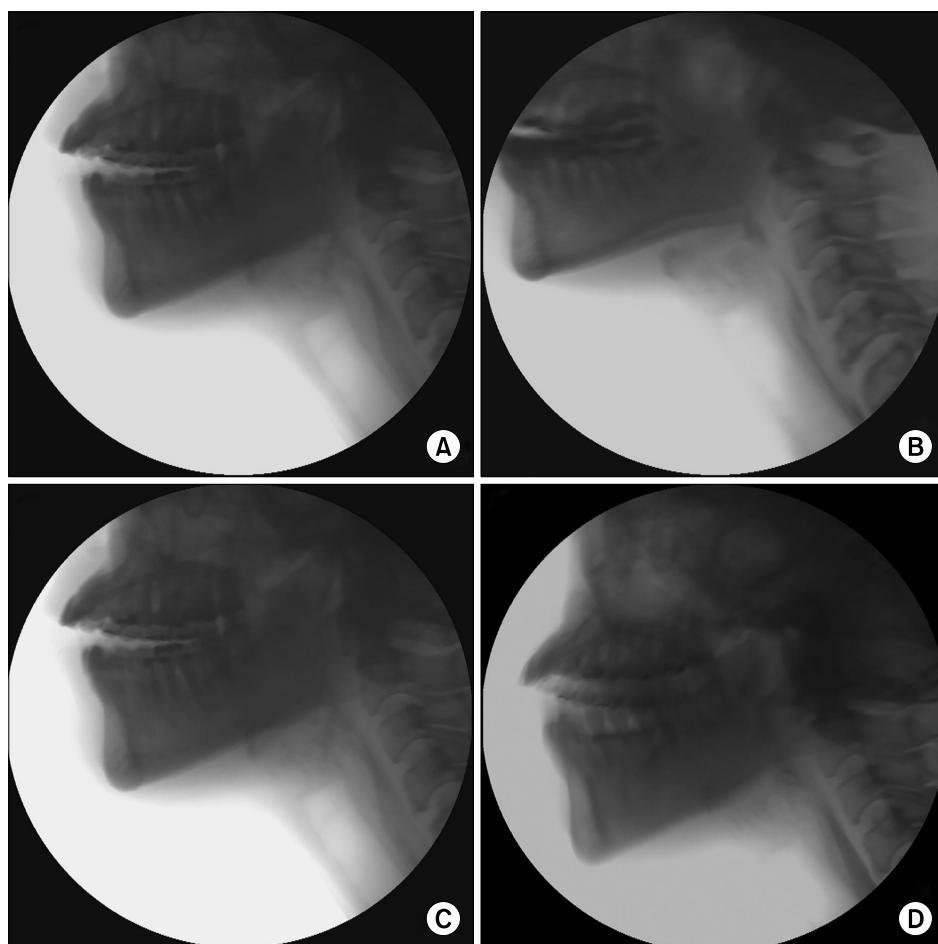


Fig. 3. Videofluoroscopic swallow study during the on-period in a patient with Parkinson's disease without any aspiration. (A) Nectar-thick liquid. (B) 5 ml of a thin liquid. (C) Semi-solid. (D) Solid.

The involvement of extra-striatal and non-dopaminergic systems associated with the basal ganglia may play a crucial role⁸, and Lewy bodies located in the various non-dopaminergic brainstem and cortical areas impact medullary central pattern generator leading to sequential swallowing pattern impairment⁹. In addition, alpha-synuclein deposition in the peripheral sensory nerve causes more frequent silent aspiration in PD¹⁰.

Dopaminergic medication reportedly has a controversial effect on dysphagia in PD. A previous meta-analysis revealed an absence of correlation between levodopa intake and improvement in swallowing¹¹. Others described that swallowing function in PD is resistant to dopaminergic medication^{4,12,13}. Although these characteristics of dysphagia are common in patients with Parkinson's disease, some patients have a improvement in swallowing function following levodopa administration^{14,15}. The patient in our case report also showed a remarkable improvement in the swallowing function in VFSS during the on-period, which is consistent with previous reports. The reason for improvement in the patient's dysphagia symptoms is unclear, but we hypothesize that the resolution of oral phase delay after dopaminergic drugs administration results in swallowing function improvement. In such cases, routine swallowing evaluation protocol without considering the wearing-off effect does not accurately evaluate the comprehensive swallowing function, leading to overestimating the severity of dysphagia.

In summary, detailed history-taking regarding the on-off period of dysphagia according to levodopa intake in PD is needed. Furthermore, a patient-tailored swallowing evaluation should be performed to establish optimal treatment strategies.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by the local Institutional Review Board.

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