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BRIEF COMMUNICATION

Validation of the Japanese translation of the Swallowing Disturbance Questionnaire in Parkinson's disease patients

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Abstract
Purpose The Swallowing Disturbance Questionnaire (SDQ) was developed as a self-rated screening tool for dysphagia in patients with Parkinson's disease (PD). We developed the Japanese version of this questionnaire (SDQ-J), according to the cross-cultural adaptation guidelines, and examined its reliability.
Methods Subjects were 61 Japanese patients with PD (mean age, 67.0 ± 9.2 years) who answered the SDQ-J before undergoing videofluoroscopic examination of swallowing (VF). We compared the findings of the questionnaire with the patients' aspiration status during VF.
Results Cronbach's alpha coefficient for the 15 questions of the SDQ-J was 0.84. According to the SDQ-J, 15 patients (24.6%) were diagnosed with dysphagia, while 9 patients (14.8%) aspirated liquid during VF. The sensitivity and specificity of the SDQ-J in predicting aspiration were 77.8 and 84.6%, respectively; therefore, the SDQ-J significantly predicted aspiration during VF ($P < 0.01$). The positive predictive value (PPV) and negative predictive value (NPV) for the SDQ-J were 0.46 and 0.96, respectively.
Conclusions The SDQ-J appears to be a reliable and useful screening tool for Japanese PD patients with aspiration. As the NPV was higher than the PPV in the SDQ-J, this questionnaire could potentially be used for early identification of severe dysphagia in patients with PD.

Keywords Parkinson's disease · Dysphagia · Questionnaires · Fluoroscopy

Abbreviations

PD	Parkinson's disease
VF	Videofluoroscopic examination of swallowing
SDQ	Swallowing Disturbance Questionnaire
SDQ-J	Japanese version of the SDQ
H&Y	Hoehn–Yahr
PPV	Positive predictive value
NPV	Negative predictive value
SLP	Speech and language pathologist
FEES	Fiberoptic endoscopic evaluation of swallowing

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Introduction

Patients with Parkinson's disease (PD) who experienced dysphagia have reported greatly reduced quality of life (QOL) [1]; therefore, early diagnosis and treatment of the dysphagia of such patients is important. Videofluoroscopic examination of swallowing (VF) is the standard method used to diagnose dysphagia; however, it cannot be frequently used because it involves exposure to X-rays. The Swallowing Disturbance Questionnaire (SDQ), a self-rated

scale comprising 15 questions regarding the frequency of the dysphagia symptoms of during every meal, was developed as a screening tool for dysphagia in PD patients ("Appendix"). The worst total score of SDQ has been 44.5 points, and dysphagia is diagnosed when the total score is 11 points or more [2]. The SDQ is not yet recommended for widespread use because it has only been tested on a relatively small number of patients in a single PD population. Its translation into other languages followed by further extensive testing of the questionnaire has, therefore, been advised [3]. Accordingly, we created a Japanese version of the SDQ (SDQ-J) and examined its reliability in relation to the patients' aspiration status during VF.

Patients and methods

Patients

The subjects of this study were 61 Japanese patients with PD who were able to consume food orally (mean age, 67.0 ± 9.2 years; 40 men, 21 women). These subjects were selected for inclusion in the study, irrespective of the subjective symptoms of dysphagia, from among 82 PD patients who were admitted for short periods to our hospital for evaluation or treatment of parkinsonism between April 6, 2010, and March 29, 2011.

All patients had been diagnosed with clinically definite PD [4] and were effectively treated with L-dopa. Cranial magnetic resonance imaging was performed on all subjects to exclude cerebral infarction and other neurodegenerative disorders. We excluded patients with other diseases that cause dysphagia and those who were being fed by tube or undergoing treatment for complications such as dehydration, pneumonia, delirium, or depression. Patients who had undergone VF within the previous year were also excluded to avoid overexposure to excessive radiation. Patients who could not fill out the questionnaire by themselves because of parkinsonism or dementia were also excluded.

This study was approved by the ethics committee of our institution (A2010-003), and written informed consent was obtained from all patients before beginning this study.

Japanese version of the Swallowing Disturbance Questionnaire

We created the SDQ-J according to the guidelines for the cross-cultural adaptation of self-reported measures [5]. With the permission of the original author, two translators translated the SDQ into Japanese and a native English language speaker reverse-translated it into English. We sent the back translation to the original author for proofreading, following which permission to use the complete SDQ-J was granted. Because of the difference in the meal cultures, we made certain revisions in the questionnaire like "a cracker" was changed to "a rice cracker" and "pureed food" to "mashed food." All patients answered the SDQ-J without being supervised by the assessors before VF.

Videofluoroscopy

During VF, the patients were seated in the same posture in which they ate their everyday meals, and fluoroscopy was performed from the side. The investigator used a syringe to inject a twofold dilution of 110% w/v liquid barium into the patient's oral cavity and gave the patient the signal to start swallowing. Patients who experienced wearing-off were tested during the "on" state. The patient's swallowing movements were recorded on DVD at 30 frames/s and evaluated for aspiration by an assessor after the test. In order to confirm the reliability of the evaluation of VF results, the same assessor re-evaluated thirty-five VF results and another evaluated same VF results independently. None of the assessors evaluating the VF results was notified of the findings of the SDQ-J.

Statistical analysis

We compared the Hoehn–Yahr (H&Y) stage, sex, and age of the patients with aspiration with that of the patients without aspiration using Mann–Whitney U test. The inter-rater and intra-rater reliability of the evaluation of VF were tested by κ coefficient. Receiver operating characteristic (ROC) analysis was used to determine the cutoff point for the total score of the SDQ-J [6]. We compared SDQ-J findings with aspiration status during VF using the Fisher's exact test. Values of $P < 0.05$ were regarded as significant, and IBM SPSS® (ver. 18.0) statistical software was used for all analyses.

Results

None of the subjects had difficulty comprehending the questionnaire or asked questions about its contents. Cronbach's alpha coefficient for the 15 questions of the SDQ-J was 0.84. With VF, 9 patients (14.8%) aspirated liquid and 52 patients did not aspirate (Table 1). The patients with aspiration had a significantly more severe H&Y stage than those who did not ($P = 0.01$). No significant differences were observed in terms of age and sex. Evaluation of aspiration during VF was highly consistent, with significant internal consistency (κ coefficient 1.00), and consistency between assessors (κ coefficient 0.91, 95% confidence interval (CI) 0.88–0.94).

Table 1 Results of videofluoroscopic examination of swallowing in patients with Parkinson's disease

	n (M:F)	Mean age	H&Y-I	H&Y-II	H&Y-III	H&Y-IV	H&Y-V
Aspiration (+)	9 (8:1)	69.6 ± 9.6	0	0	3	3	3
Aspiration (−)	52 (32:20)	66.5 ± 9.2	4	8	25	12	3
Total	61 (40:21)	67.0 ± 9.2	4	8	28	15	6

M male, *F* female, *H&Y* Hoehn–Yahr stage, aspiration (+), patient with aspiration during videofluoroscopic examination (VF); aspiration (−), patient without aspiration during VF

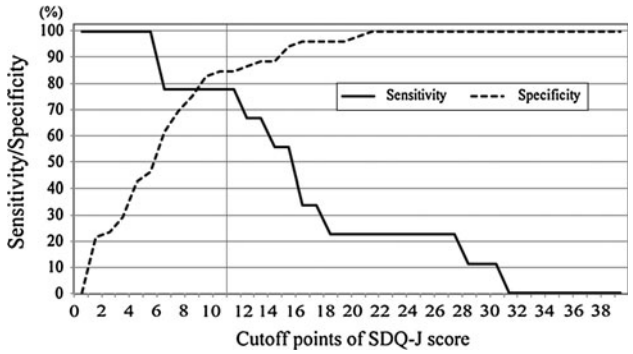

Fig. 1 The receiver operating characteristics curve. This graph enables us to visualize the sensitivity and specificity curves on a single axis. The *x-axis* represents the cutoff points for the SDQ-J score, and the *y-axis* represents the sensitivity and specificity. The sensitivity and specificity curves cross at 9 points, but the sensitivity curve is flat between 6.5 and 11.5 points. When the cutoff score of the SDQ-J is equal to 11 points, its sensitivity is 77.8% and its specificity is 84.6%

In ROC analysis, the sensitivity and specificity curves crossed at 9 points and the sensitivity curve became flat between 6.5 and 11.5 points (Fig. 1). We determined 11 points to be an appropriate cutoff point for the SDQ-J because in a screening tool, when sensitivity is same, higher specificity is better. Then, 15 patients (24.6%) who scored more than 11 points on the SDQ-J were assessed to have dysphagia. The sensitivity of the SDQ-J in predicting aspiration was 77.8%, and its specificity was 84.6%; therefore, the SDQ-J significantly predicted aspiration ($P < 0.01$) (Table 2). The positive predictive value (PPV) and negative predictive value (NPV) were 0.47 and 0.96, respectively. The pre- and post-test probabilities of aspiration were relatively low, at 14.7 and 46.7%, respectively.

Discussion

The original study for the SDQ reported that its Cronbach's alpha coefficient was 0.89 [2]. Cronbach's alpha coefficient was similar between the SDQ-J and the original scale, suggesting that the internal consistency of the SDQ-J was good and that this questionnaire would be reliable. According to the ROC analysis for the SDQ-J, 11 points was an appropriate

Table 2 Results of the Japanese version of the Swallowing Disturbance Questionnaire in comparison with those of videofluoroscopic examination while swallowing liquid

SDQ-J finding	Aspiration during VF		
	Positive	Negative	Total
Dysphagia (+)	7	8	15
Dysphagia (−)	2	44	46
Total	9	52	61
Sensitivity	77.8%		
Specificity	84.6%		
Positive predictive value	0.46		
Negative predictive value	0.96		
Pre-test probability	14.8%		
Post-test probability	46.7%		

SDQ-J The Japanese version of the Swallowing Disturbance Questionnaire, *VF* videofluoroscopic examination of swallowing

cutoff point for the SDQ-J, and this cutoff point was the same as that of original study. The SDQ comprised of questionnaire about the swallowing function, and there were few culture-related questions. Therefore, unlike subjective QOL assessment tools, physical assessment tool such as SDQ may be less influenced by culture.

In the original study, the subjects were PD patients who were referred to a speech and language pathologist (SLP), and the authors suggested that the subjects might have experienced speech, voice, or swallowing disturbances. Indeed, 41 of the 57 subjects (71.9%) were diagnosed with swallowing disturbance by the SLP and fiberoptic endoscopic evaluation of swallowing (FEES). The original study reported that the sensitivity of the SDQ was 80.5%, and its specificity was 81.3%. The pre- and post-test probabilities of aspiration in the original study were high, at 71.9 and 91.7%, respectively. We selected the present patients from our inpatient population, irrespective of subjective symptoms of dysphagia; moreover, we defined dysphagia as the presence of aspiration on VF. VF shows various abnormal findings in PD patients with dysphagia [7, 8], but the clinical importance of these findings has not been determined. However, aspiration during VF is a risk factor for the onset of pneumonia and the discontinuation of oral intake in patients with Lewy body disease, and the

cumulative rate of pneumonia up to 24 months after VF is higher in PD patients with aspiration [9]. Our wide selection of subjects and strict definition of dysphagia may be the reasons of the sensitivity of the SDQ-J being lower than those of the original SDQ.

For the original SDQ, the PPV and NPV were calculated as 0.92 and 0.62, respectively. The relationships between the PPV and NPV in the original SDQ were opposite to those in the SDQ-J. The PPV was relatively low in the SDQ-J, so a potential use of the SDQ-J might be for the early identification of severe dysphagia in PD patients, and some type of further objective test, such as VF or FEES, would be required to diagnose the dysphagia.

A higher modified H&Y stage and lower body mass index are useful clinical parameters to screen for severe dysphagia in PD [10]. Anxiety and depression are also known to adversely affect the results of the SDQ [11]. Even though SDQ is a questionnaire for dysphagia in PD patients, there are no questions associated with parkinsonism. Hence, when the SDQ or SDQ-J is combined with other parameters that are related to parkinsonism, their diagnostic accuracy may change.

To conclude, this study shows the reliability of the SDQ-J and suggests its usefulness to screen for aspiration in PD patients; therefore, we recommend using the SDQ as a screening tool to diagnose dysphagia in PD patients. In the future, we intend to evaluate the SDQ-J and other clinical findings in a larger subject population and improve the diagnostic accuracy of dysphagia in PD patients.

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Appendix

The questions of the original SDQ are enlisted below:

(1) Do you experience difficulty chewing solid food like an apple, cookie, or a cracker?
(2) Are there any food residues in your mouth, in your cheeks, under your tongue or stuck to your palate after swallowing?
(3) Does food or liquid come out of your nose when you eat or drink?
(4) Does chewed-up food dribble from your mouth?
(5) Do you feel you have too much saliva in your mouth; do you drool or have difficulty swallowing your saliva?
(6) Do you swallow chewed-up food several times before it goes down your throat?
(7) Do you experience difficulty in swallowing solid food (i.e., do apples or crackers get stuck in your throat)?
(8) Do you experience difficulty in swallowing pureed food?
(9) While eating, do you feel as if a lump of food is stuck in your throat?
(10) Do you cough while swallowing liquids?
(11) Do you cough while swallowing solid foods?
(12) Immediately after eating or drinking, do you experience a change in your voice, such as hoarseness or reduced?
(13) Other than during meals, do you experience coughing or difficulty breathing as a result of saliva entering your windpipe?
(14) Do you experience difficulty in breathing during meals?
(15) Have you suffered from a respiratory infection (pneumonia, bronchitis) during the past year?

Questions 1–14 have following options and scores; Never, 0 point; Seldom (once a month or less), 1 point; Frequently (1–7 times a week), 2 points; Very Frequently (more than 7 times a week), 3 points. For the 15th question, "Yes" is 2.5 points and "No" is 0.5 points.

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