Early Impairment of Chopsticks Skills in Parkinsonism Suggests Progressive Supranuclear Palsy

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Background and Purpose Chopsticks are a primary eating utensil in East Asia, but systematic assessments of chopsticks skills in parkinsonian disorders is lacking. We aimed to identify any differences in chopsticks skills in the early stages of Parkinson's disease (PD) and atypical parkinsonism (AP), including progressive supranuclear palsy (PSP), multiple system atrophy (MSA), and corticobasal syndrome (CBS).

Methods We consecutively recruited 111 patients with PD and 74 with AP (40 with PSP, 30 with MSA, and 4 with CBS) who were in a drug-naïve state. The motor and cognitive functions of the patients were evaluated using a standardized protocol. Everyday chopsticks skills were evaluated using a chopsticks questionnaire developed in-house. The chopsticks skills test (CST) involved counting the number of pills that the subject was able to carry using chopsticks between two dishes separated by 20 cm within 20 seconds.

Results Patient responses to the questionnaire indicating poor chopsticks skills ("I cannot pick up some of the food items" or "I cannot use chopsticks anymore") were present in 23.0% of AP patients and 30% of PSP patients, compared to only 5.6% of PD patients [odd ratio (OR)= 5.07 and OR=7.29, $p \leq 0.001$ in both]. The performance in the CST was worse in PSP than in PD ($p < 0.001$). The CST results were correlated with hand motor skills including in the coin-rotation test, timed figure-tapping test, and motor Unified Parkinson's Disease Rating Scale scores in all of the patient groups ($p < 0.001$). In PSP, a decline in visuospatial function and frontal executive function was associated with a poor performance in the CST in addition to poor motor performance ($p < 0.05$).

Conclusions Impairments in chopsticks skills were more common in PSP than in PD during the early stages of parkinsonism. This suggests that early functional impairment of chopsticks skills can be used as a warning sign for PSP.

Key Words Parkinson disease, atypical parkinsonism, progressive supranuclear palsy, chopsticks, activities of daily living.

INTRODUCTION

Eating tasks and handling utensils are important motor tasks when performing the activities of daily living. Chopsticks are the primary utensils used by many East and Southeast Asians, followed by spoons, with a knife and fork infrequently being used for cutting during meals. On clinical rating scales for Parkinson's disease (PD), items such as 'cutting food and handling utensils' on the Unified Parkinson's Disease Rating Scale (UPDRS) and 'eating task' on the Movement Disorder Society-Sponsored Revision of the Unified Parkinson's Disease Rating Scale (MDS-UPDRS) cannot be directly translated into assessments of chopsticks skills due to the different types of movement and usage involved.[1,2] Using a knife and fork for cutting requires both upper extremities, whereas using chopsticks to eat

food requires movement of the dominant upper extremity only. Chopsticks skills require higher finger dexterity in the dominant hand compared to using a knife and fork. East and Southeast Asians learn to use chopsticks with the dominant hand during early childhood, and so an inability to eat with chopsticks—which therefore represents a skilled or learned movement—may reflect apraxia. In addition to motor programming, successfully grasping a piece of food using the fine tips of chopsticks may require cognitive processes in multiple domains.[3,4] The early presence of apraxia is a warning sign in PD, and apraxia is a prominent feature of corticobasal syndrome (CBS) and is not uncommonly observed in progressive supranuclear palsy (PSP).[5] In a patient with multiple system atrophy (MSA), dysmetria secondary to cerebellar degeneration may affect chopsticks skills, especially when attempting to precisely grasp food.

Despite the complex requirements of chopsticks skills, they have never been systemically studied in Asian populations with parkinsonian disorders. We therefore aimed to identify any differences in chopsticks skills during the early stage of PD and atypical parkinsonism (AP) using a questionnaire and a simple motor task designed to assess these skills.

METHODS

Patients and study design
We consecutively recruited 111 patients with drug-naïve PD and 74 patients with AP at Hallym University Sacred Heart Hospital from March 2014 to July 2018. The patients with AP consisted of 40 patients with PSP, 14 with multiple system atrophy-cerebellar type (MSA-c), 16 with multiple system atrophy-parkinsonism (MSA-p), and 4 with CBS. Patients with PD dementia, dementia with Lewy bodies, and secondary parkinsonism were excluded—only patients with probable diagnoses of PD or AP confirmed during the follow-up period were included in this study.[6-9] All patients were drug naïve with a disease duration of less than 5 years since the onset of motor symptoms at the initial evaluation. Patients with motor weakness and a previous history of stroke or traumatic hand injury were excluded. The Institutional Review Board of our institution approved this study (IRB no. 2014-I047).

Evaluation of chopsticks skills
All evaluations were performed at the initial visit with the patients in a drug-naïve state. The history of current chopsticks skills was evaluated using a chopsticks questionnaire (CQ) with responses on the following 5-point scale: 0, normal; 1, slower and more clumsy than before but no difficulty eating a meal; 2, slowness and clumsiness prolong the meal time but can still eat with chopsticks; 3, cannot pick up some

of the food items; and 4, cannot use chopsticks anymore.

We also developed a chopsticks skills test (CST) for performing quantitative assessments of chopsticks skills. Using chopsticks with their dominant hand, patients were asked to pick up a drug tablet (Tylenol-ER®, 19×10×10 mm with rounded edges, white) in a dish (90 mm in diameter) and move it on to another dish 20 cm away as quickly as possible. The total number of drug tablets moved within 20 seconds was counted, and the test was repeated three times (Fig. 1A).

In timed finger-tapping tests (FTTs), the activity of the index finger was used to measure the motor performance of the upper extremities.[10] In the two-tapper test (FTT-A), the tappers were separated by 30 cm. The subject was asked to place his/her index finger on the tapper and alternate between tapping on one level and then another as quickly as possible for 20 seconds. The number of taps made with the dominant hand was recorded. The second test was a one-tapper test (FTT-B), in which the subject tapped on one lever as quickly as possible for 10 seconds (Fig. 1B). A coin-rotation test (CRT) was performed to measure the finger dexterity of the dominant hand. The subject was asked to rotate a small coin (21.6 mm in diameter and weighing 4.16 g) using his/her first, second, and third fingers as quickly as possible for 10 seconds. The number of half turns performed using the dominant hand was recorded (Fig. 1C).

Evaluation of parkinsonism
The UPDRS parts I−III score and Hoehn and Yahr stage (H&Y stage) were assessed at the initial evaluation. The UPDRS motor hand score corresponded to the sum of both hand scores for items 20−25.[11] Using UPDRS items 20−25, we calculated a right-minus-left difference score by subtracting the left-handed values from the right-handed values to decide the laterality of the hand motor symptom. In PD, the right and left sides were the more-affected motor sides in 59 (53.2%) and 39 (35.1%) patients, respectively, while the remaining patients were symmetric. In PSP, the right and left hands were involved more in 17 (42.5%) and 14 (35.0%) patients, respectively. In CBS, the right and left sides were more affected in two and two patients, respectively. In MSA, the right and left sides were more affected in 12 (40%) and 8 (26.7%) patients, respectively.

Evaluation of cognitive function
Cognitive function was evaluated at the time of the chopsticks skills assessment. The backward digit span test was used to measure attention. The Korean version of the Boston Naming Test, the Rey Complex Figure Copy Test, and the delayed recall of the Seoul Verbal Learning Test were administered to
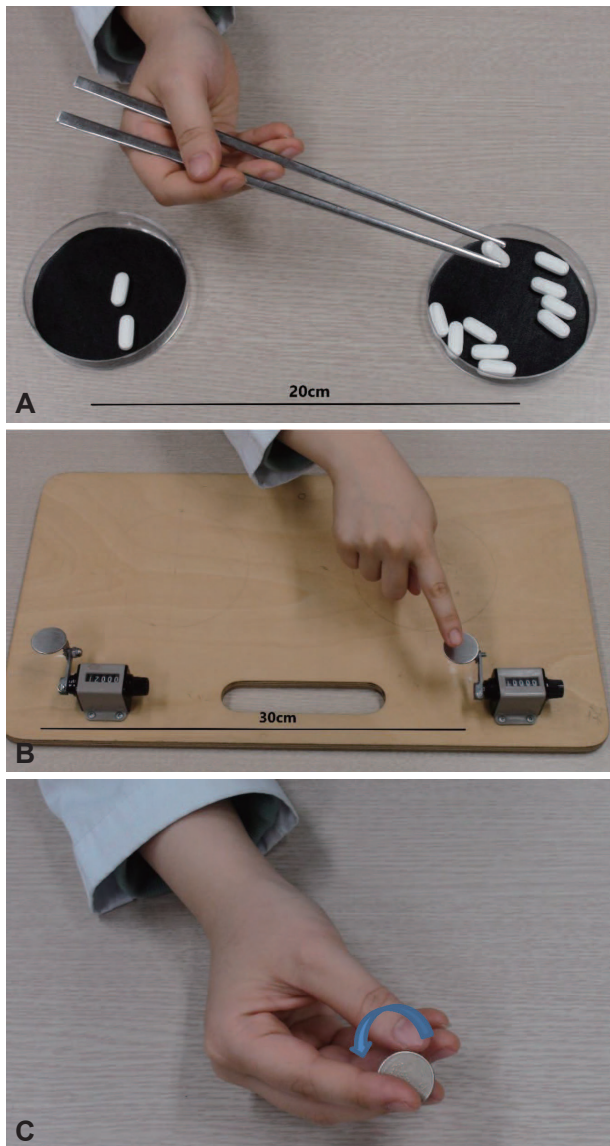
Fig. 1. Methods for evaluating chopsticks skills and hand dexterity. A: Chopsticks skills test counting the number of drug tablets carried using chopsticks within 20 seconds. B: Finger-tapping test counting the number of times two levers were alternately tapped for 20 seconds or one lever was tapped for 10 seconds. C: Coin-rotation test measuring the number of half turns performed within 10 seconds using the first, second, and third fingers.

test language, visuospatial, and memory functions, respectively. Frontal executive function was evaluated using the Controlled Oral Word Association Test (COWAT) to measure semantic and phonemic word fluency, Stroop color reading, and the go/no-go test. Ideomotor apraxia was evaluated based on the performance on the following five instrumental subsets for apraxia in the Western Aphasia Battery: key, knife, screwdriver, hammer, and scissors.[12] A correct performance was scored as 1 point, and so the highest score achievable was 5 points.

Statistical analysis

We used Pearson's chi-square test to compare two categorical variables and the *t*-test to the compare the mean values of two continuous variables. Pearson's correlation coefficient or Spearman's rank correlation coefficient were calculated to quantify the correlation between two variables. Analysis of covariance was used to compare chopsticks skills between groups while controlling for other distinguishing clinical factors. A *p* value of less than 0.05 was considered statistically significant. Statistical analyses were conducted using IBM SPSS software (version 24.0, IBM Corp., Armonk, NY, USA).

RESULTS

Patient age (66.77±10.78 years vs. 67.78±10.65 years, mean±SD) and age at disease onset (65.80±10.78 years vs. 66.77±10.29 years, mean±SD) did not differ significantly between patients with PD and AP. The H&Y stage and UPDRS scores were higher in the AP group than in the PD group ($p<0.05$). In the AP group, patients with PSP were older and had higher UPDRS scores than did patients with PD ($p<0.001$). Patients with MSA were younger than those with PD ($p<0.001$). Motor tasks as assessed using the UPDRS motor test, FTT-A, FTT-B, and CRT revealed worse performance in AP, more so in the PSP than in the PD group ($p<0.001$). Ideomotor apraxia was more severe in PSP and CBS than in PD, but the difference was statistically significant only in the comparison between PD and PSP, probably due to the smallness of the CBS sample (Table 1).

In the interview using the CQ, only 1 (0.9%) of the 111 PD patients complained about being unable to use chopsticks anymore (CQ score=4), while 6 (8.1%) of the 74 patients with AP reported they were unable to do so [$p<0.05$, odd ratio (OR)=9.441, 95% CI=1.112−80.142]. Poor chopsticks skills—as represented by a CQ score of 3 or 4—were found in 17 (23.0%) of the 74 patients with AP but in only 6 (5.6%) of the 111 patients with PD ($p<0.001$, OR=5.07, 95% CI=1.89−13.58). In particular, 30% of the PSP patients showed poor chopsticks skills (OR=7.29, PD vs. PSP) (Table 2). The CQ scores were strongly correlated with quantitative parameters assessing motor tasks in parkinsonian disorders such as the CRT, FTT-A, and FTT-B that test finger dexterity or both proximal and distal movements of an upper extremity (Spearman's rank correlation coefficient=-0.487, -0.532, and -0.300, respectively; $p<0.001$) for all subjects in each disease group. The CQ score was also strongly correlated with CST—which simulates everyday chopsticks usage—in all subjects (Spearman's rank correlation coefficient=-0.626, $p<0.001$) as well as in each disease group. Comparing chopsticks skills as measured by the CST score among parkinsonian disorders, the

performance was significantly worse in the AP group than in the PD group. Notably, the mean number of drug tablets moved was lower and the mean number of errors (i.e., dropped tablets) was higher in PSP than in PD (*p*<0.001) (Table 2).

We next explored the mechanisms underlying the functional decline in chopsticks skills. CST scores were strongly correlated with the subtotal and hand scores of the UPDRS motor tests, FTT-A, FFT-B, and CRT in both PD and AP.

These results suggest that parkinsonian motor symptoms as well as finger dexterity contribute to the decline in chopsticks skills (Table 3). However, the action or postural tremor score only (UPDRS item 21) was not correlated with the CST score (*r*=-0.012, *p*=0.877), suggesting that impairment of chopsticks skills was not caused by this type of tremor. Analyzing the correlation between cognitive function and CST scores in the pooled data of all 185 patients revealed that the CST scores were correlated with global cognition, language, vi-

Table 1. Demographic features of 111 patients with PD and 74 patients with AP

	PD (*n*=111)	AP (*n*=74)	PSP (*n*=40)	MSA (*n*=30)	CBS (*n*=4)
Sex, male	53 (47.7)	35 (47.3)	18 (45.0)	15 (50.0)	2 (50.0)
Age, years	66.77±10.78	67.78±10.65	74.66±7.27**	59.17±8.00**	67.00±8.28
Age at onset, years	65.80±10.78	66.77±10.29	73.25±7.25**	58.27±7.60**	65.75±7.14
Disease duration, years	0.88±1.10	1.05±1.31	1.18±1.52	0.87±1.01	1.25±1.26
Clinical follow-up duration, years	3.18±1.55	2.85±1.30	2.815±1.29	2.91±1.36	2.73±1.28
H&Y stage	2.23±0.71	2.95±1.06**	3.21±0.94**	2.62±1.16	2.67±0.58
UPDRS parts I & II score	8.80±6.86	15.67±10.95**	18.33±11.19**	11.18±8.94	20.5±13.30*
UPDRS motor score	24.66±10.51	29.99±15.98*	36.18±15.35**	21.38±12.43	32.00±19.95
UPDRS motor hand score	14.36±4.94	14.51±7.44	16.35±7.59	11.58±5.65*	17.25±11.95
FTT-A, no. of taps	16.85±5.54	16.85±5.54*	12.31±7.27**	16.09±8.91	5.25±6.08*
FTT-B, no. of taps	31.04±19.16	31.04±24.47*	25.94±22.07	24.25±16.48	11.75±10.91*
CRT, no. of half turns	9.76±4.29	9.76±7.29**	6.44±4.22**	9.32±4.81	1.42±1.48*
MMSE score	26.24±3.90	24.43±5.00*	21.97±5.41**	27.27±2.60	26.00±2.65
Ideomotor apraxia score	4.42±1.16	3.95±1.52*	3.63±1.76*	4.42±1.07	3.33±1.53

Data are mean±SD or *n* (%) values. *t*-test or Pearson's chi-square test for comparison of PD vs. AP, PSP, or MSA; Mann-Whitney U test for PD vs. CBS. **p*<0.05, ***p*<0.001.
AP: atypical parkinsonism, CBS: cortical basal syndrome, CRT: coin-rotation test, FTT-A: two-tapper test, FTT-B: one-tapper test, H&Y: Hoehn and Yahr, MMSE: Mini Mental State Examination, MSA: multiple system atrophy, PD: Parkinson's disease, PSP: progressive supranuclear palsy, UPDRS: Unified Parkinson's Disease Rating Scale.

Table 2. Comparison of chopsticks skills using a CQ and CST in PD and AP

Assessment of chopsticks skills	PD (*n*=111)	AP (*n*=74)	PSP (*n*=40)	MSA (*n*=30)	CBS (*n*=4)
CQ					
Poor chopsticks skills, score of 3 or 4	6 (5.6)	17 (23.0)* 5.07* [1.89–13.58]	12 (30.0) 7.29** [2.51–21.15]	p=2/c=2 (13.3) 2.62 [0.69–9.95]	1 (25) 5.67 [0.51–62.99]
0, normal	55 (50.9)	27 (36.5)*	11 (27.5)	16 (53.3)	0 (0)
1, slower and more clumsy than before but no difficulty eating a meal	37 (34.3)	22 (29.7)	13 (32.5)	8 (26.7)	1 (25)
2, slowness and clumsiness prolong the meal time but can still eat with chopsticks	10 (9.3)	8 (10.8)	4 (10.0)	2 (6.7)	2 (50)
3, cannot pick up some of the food items	5 (4.6)	11 (14.9)	9 (22.5)	2 (6.7)	0 (0)
4, cannot use chopsticks anymore	1 (0.9)	6 (8.1)	3 (7.5)	2 (6.7)	1 (25)
CST					
Number of pills moved within 20 seconds	10.05±3.09	7.84±3.32**	7.06±3.46**	9.11±2.53	6.50±4.69
Number of pills dropped during 20 seconds	0.49±0.81	0.71±0.88	0.86±1.02*	0.49±0.61	0.89±0.96

Data are mean±SD, *n* (%), or odd ratio [95% confidence interval] values.
*p<0.05, ***p*<0.001.
AP: atypical parkinsonism, CBS: cortical basal syndrome, CQ: chopsticks questionnaire, CST: chopsticks skills test, MSA: multiple system atrophy, MSA-c: multiple system atrophy-cerebellar type, MSA-p: multiple system atrophy-parkinsonism, PD: Parkinson's disease, PSP: progressive supranuclear palsy.

suospatial function, and frontal executive function. Among cognitive domains, visuospatial function showed the strongest association with chopsticks skills (i.e., CST) (Pearson's correlation coefficient=0.315, $p<0.001$). Contrary to our expectation, ideomotor apraxia scores were not correlated with CST scores in any of the parkinsonian groups (Table 3). In the analysis of AP subgroups, global cognition [as measured using the Mini Mental State Examination (MMSE)], visuospatial function, and frontal executive function (COWAT phonemic test) were significantly correlated with CST scores in PSP, while no cognitive domains were correlated with CST scores in PD (Table 3).

After correcting for several contributing factors related to chopsticks skills, we compared chopsticks skills (i.e., CST)

between PD and PSP. Irrespective of age, the CST score was significantly worse in PSP than in PD ($p<0.001$). After adjusting for age and either motor symptoms (UPDRS motor scores, FTT-A, or CRT) or global cognitive function (MMSE), the CST scores remained different between the two groups. However, the CST score did not differ significantly between the two groups after adjusting for the three factors of age, motor symptoms, and cognitive function (Table 4).

Finally, we checked whether the laterality of motor symptoms affects poor chopsticks skills. The 23 patients with poor chopsticks skills (CQ score of 3 or 4) comprised 21 right-handed and 2 ambidextrous patients, and all of these patients used chopsticks in their right hands. Among them, the motor symptoms were more affected on the right and left sides in nine and nine patients, respectively, while five patients showed symmetric motor involvement, which suggested that poor chopsticks skills was not biased by motor laterality.

DISCUSSION

To our knowledge, this is the first study to systemically evaluate chopsticks skills in Asian patients with PD or AP. We found that poor chopsticks skills were more common in AP (especially in PSP) than in PD, as assessed by the CQ and CST, which reflect everyday chopsticks skills. The CQ and CST scores were strongly correlated with parkinsonian motor scores. In addition, impairment of chopsticks skills was correlated with visuospatial dysfunction and frontal executive dysfunction in PSP but not in PD.

We developed a new questionnaire specifically to evaluate chopsticks skills for the following reasons: in the original ver-

Table 3. Results of a correlation analysis of the CST with motor and cognitive parameters

Types of clinical assessment	CST (r)			
	Total	PD	PSP	MSA
Motor symptoms including finger dexterity				
UPDRS motor score	-0.476**	-0.476**	-0.300	-0.496*
UPDRS motor hand score	-0.372*	-0.302*	-0.340*	-0.353
FTT-A	0.569**	0.542**	0.567**	0.509*
FTT-B	0.334**	0.240*	0.570**	-0.063
CRT	0.518**	0.350*	0.684**	0.588*
Global cognition				
MMSE	0.278*	0.051	0.468*	0.401
Attention				
Digit span backward	0.125	-0.046	0.204	0.331
Language				
K-BNT	0.199*	0.060	0.225	0.207
Praxis				
Ideomotor apraxia	0.109	-0.083	0.277	0.081
Visuospatial				
RCFT copy	0.315**	0.123	0.470*	0.134
Memory				
SVLT delayed recall	0.136	0.016	0.096	0.128
Frontal executive				
Contrasting program	0.005	-0.012	0.065	-0.054
Go/no-go test	0.197*	0.015	0.293	0.117
COWAT semantic	0.180*	0.027	0.125	0.129
COWAT phonemic	0.258*	0.102	0.505*	0.170
Stroop color reading	0.229*	0.065	0.396	0.159

Values are partial correlation coefficients adjusted by age. The 'total' column is for all subjects (PD, PSP, and MSA).
*$p<0.05$, **$p<0.001$.
COWAT: Controlled Oral Word Association Test, CRT: coin-rotation test, CST: chopsticks skills test, FTT-A: two-tapper test, FTT-B: one-tapper test, K-BNT: Korean version of the Boston Naming Test, MMSE: Mini Mental State Examination, MSA: multiple system atrophy, PD: Parkinson's disease, PSP: progressive supranuclear palsy, RCFT: Rey Complex Figure Test, SVLT: Seoul Verbal Learning Test, UPDRS: Unified Parkinson's Disease Rating Scale.

Table 4. Comparison of chopsticks skills adjusted by age, motor function, and MMSE score between PD and PSP

Parameters adjusted in CST score comparisons	PD (n=111)	PSP (n=40)	p
Age	9.85±0.32	7.37±0.54	<0.001
Age and UPDRS motor score	9.53±0.29	7.89±0.51	0.008
Age and FTT-A score	9.36±0.27	8.06±0.46	0.020
Age and CRT score	9.51±0.28	7.95±0.49	0.009
Age and MMSE score	9.88±0.34	8.20±0.62	0.024
Age, UPDRS motor score, and MMSE score	9.73±0.31	8.50±0.59	0.082
Age, FTT-A score, and MMSE score	9.48±0.28	8.77±0.49	0.237
Age, CRT score, and MMSE score	9.58±0.30	8.81±0.54	0.240

Independent variables were compared using the t-test. Values adjusted by age and other scores (CRT, FTT-A, and MMSE) were calculated by analysis of covariance.
CST: chopsticks skills test, CRT: coin-rotation test, FTT-A: two-tapper test, MMSE: Mini Mental State Examination, PD: Parkinson's disease, PSP: progressive supranuclear palsy, UPDRS: Unified Parkinson's Disease Rating Scale.

sion of the UPDRS, the 'cutting food and handling utensils' item cannot be applied directly to skills used to pick up food with chopsticks. In the 'eating task' item of the MDS-UPDRS, the questions probe slowness, need for help, spillage of food, and cutting. In contrast, our questionnaire focused more on the ability of a patient to use chopsticks and pick up food, as well as slowness, clumsiness, and prolongation of meal time. Although our CQ is not a validated questionnaire, the strong correlation of our CQ scores with CST scores suggests that our CQ appropriately reflects the chopsticks skills of a patient. Other advantages of our CQ are its simplicity, its focus on chopsticks skills, and its ease of translation to other languages. Moreover, our CST involves a simple task and accurately simulates how chopsticks are used in daily life.

The findings of this study indicate that both parkinsonian motor symptoms and cognitive dysfunction are involved in the decline of chopsticks skills in parkinsonian disorders. The chopsticks skills were strongly correlated with the motor status of parkinsonism, as assessed by the UPDRS motor score and FTT scores across all parkinsonian disorders. Given that Asians learn to use chopsticks as eating utensils in early childhood, motor tasks using chopsticks may represent praxis. Our results showed that scores for chopsticks skills were correlated with CRT scores, which are used to assess limb kinetic apraxia, but not with ideomotor apraxia scores. The absence of correlations between CST and ideomotor apraxia scores may be due to the insensitivity of our ideomotor apraxia test, which only employed a 5-point scoring system, with a simple summation of binary results. However, the baseline scores for ideomotor apraxia were lower in the PSP and CBS groups than in the PD group, which is compatible with the current understanding of ideomotor apraxia in parkinsonian disorders. Given that our patients were at an early stage of PD or AP, we suggest that ideomotor apraxia is not a major cause of dysfunction in chopsticks skills, at least during the early stage of PD or AP. Further research exploring chopsticks skills in the advanced stages of PD and AP is needed.

We found that a decline in chopsticks skills was associated with cognitive dysfunction as well as parkinsonian motor signs in PSP. This finding implies that good chopsticks skills require good cognitive function, such as visuospatial function and frontal executive function, as well as finger dexterity. Grasping a piece of food using the tips of two chopsticks requires the individual to plan how to grasp the item at a certain angle and position depending on the type of food. We suggest that the absence of correlations between the decline in chopsticks skills and cognitive dysfunction in PD groups was due to the subjects being at an early stage of PD during which cognitive function is relatively spared compared to PSP. This means that the present results cannot be used to con-

clude whether the correlation between cognitive function and chopsticks skills is specific to PSP.

Our results showed that differences in chopsticks skills between PD and PSP disappeared after adjusting for age, motor symptoms, and cognitive function. This further suggests that the decline of chopsticks skills in parkinsonian disorders is due to the complex interplay of motor symptoms and cognitive function rather than to a specific disease entity. Nevertheless, we consider that early impairment of chopsticks skills has important clinical implications. Aerts et al.[13] argued that the loss of the ability to cycle after disease onset (called the 'bicycle sign') is a warning sign of the presence of AP. Bicycling, like chopsticks skills, represents complex praxis that requires cognitive planning as well as motor skills. Bicycling and chopsticks skills are ordinary learned movements in different cultures. Considering our findings that chopsticks skills were relatively impaired even in the early stage of AP, especially in PSP, but well preserved in early PD, we suggest that an early failure of a drug-naïve parkinsonian patient to use chopsticks represents a useful warning sign of AP, and especially PSP.

This study was subject to several limitations. Although a large number of patients with PD or AP were recruited, the number of patients in each disease subgroup (e.g., MSA or CBS) was insufficient to detect the effects on chopsticks skills. MSA-p and MSA-c may exhibit different impairments in chopsticks skills between groups, but the number of subjects available for analysis was insufficient. Only four patients with CBS were enrolled, and half of them showed significant impairments of chopsticks skills. However, interpreting this observation is complicated in CBS since it depends on the dominancy of the asymmetrically involved hemisphere.

In conclusion, a decline in chopsticks skills in parkinsonian disorders is associated with cognitive dysfunction as well as parkinsonian motor symptoms. Among parkinsonian disorders, poor chopsticks skills are more common in PSP than in PD. These findings suggest that an early functional impairment of chopsticks skills can be utilized as a warning sign for PSP. Replication studies in other Asian parkinsonian patients who use chopsticks as a primary utensil are warranted.

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Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

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