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Prevalence and clinical correlates of drooling in Parkinson disease: A study on 518 Chinese patients

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ABSTRACT

Background: The prevalence and clinical correlates of drooling in Chinese patients with Parkinson disease (PD) are unknown.
Methods: A cross-sectional analysis of 518 Chinese patients with PD was conducted. Assessments included Unified PD Rating Scale (UPDRS), Non-Motor Symptoms Scale (NMSS), Hamilton Depression Scale (HAMD), Hamilton Anxiety Scale (HAMA), PD Questionnaire-39 (PDQ-39), Frontal assessment battery (FAB) and Montreal Cognitive Assessment (MoCA).
Results: Two hundred and seventy-three PD patients (52.7%) reported drooling (droolers). Drooling occurred more frequently in the late-onset PD patients than the early-onset PD patients ($p < 0.05$). Droolers had higher levodopa equivalent daily doses, higher incidences of dysarthria, dysphagia and fluctuation, higher scores for the UPDRS part III, NMSS, HAMD and HAMA, and higher scores for the mobility, activities of daily life, stigma and communication subdomains of the PDQ-39 than the non-droolers ($p < 0.05$). The percentage of benzhexol use in the non-droolers was significantly higher than the droolers ($p < 0.05$). The FAB and MoCA scores between the droolers and non-droolers were not different. The binary logistic regression analysis indicated that dysarthria, dysphagia, benzhexol use, and a lower score for the naming domain of the MoCA were associated with drooling.
Conclusions: Drooling is a relatively common disabling symptom in Chinese PD patients. Patients with dysarthria, dysphagia and naming disorder are likely to experience drooling. Drooling is not correlated with disease duration and motor severity of PD.

1. Introduction

Parkinson disease (PD) is a progressive neurodegenerative disorder, which is characterized by cardinal motor symptoms including bradykinesia, resting tremor, rigidity and postural instability as well as numerous non-motor symptoms (NMS), such as sleep disorders, and neuropsychiatric, autonomic and sensory symptoms.

Drooling (or sialorrhea) is one of the autonomic symptoms in PD. It is defined as the inability to control oral secretions, resulting in excessive saliva accumulation in the oropharynx. Drooling in PD is primarily considered resulting from impaired swallowing rather than hypersecretion of saliva [1]. It is one of the bothersome problems for PD patients, which can give rise to social embarrassment, isolation and worsening of depressive symptoms while also represents a potential cause of choking or aspiration pneumonia [2]. As a consequence, it is necessary to study this symptom more comprehensively.

Currently, studies focused on the prevalence and clinical correlates of drooling are limited. Epidemiological studies showed a high prevalence of drooling in PD [3–5]. Recently, a meta-analysis including eight previous epidemiological studies revealed that the prevalence of drooling in PD ranged from 32% to 74% [6]. A study on 123 Canadian patients found that male patients or patients with more severe motor symptoms were likely to experience drooling, but age and ethnicity had no relationship with developing drooling [7]. Another small case-control study on 58 American patients and 51 age-matched controls found that hallucination was the only correlated factor with drooling [8]. Some studies conducted on non-Asian populations found that drooling was related to oral symptoms (including dysphagia and dysarthria) [9,10] or dementia [11]. However, the relationships between

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drooling and other clinical factors, such as depression, anxiety and frontal lobe function remain unknown. The aim of this study is to explore the prevalence and clinical correlates of drooling in a large cohort of Chinese PD patients.

2. Patients and methods

This study was approved by the Ethics Committee of West China Hospital of Sichuan University. After obtaining informed consent, a total of 518 PD patients from the Department of Neurology, West China Hospital of Sichuan University, between May 2011 and July 2014 were consecutively recruited for this observational study. PD was diagnosed according to the United Kingdom PD Society Brain Bank Clinical Diagnostic Criteria for PD [12]. Patients with atypical and secondary parkinsonian syndromes were excluded from the current study. The demographic and clinical data including age, sex, age of onset, disease duration, diagnostic delay, family history of PD, history of hypertension and diabetes, dysarthria, dysphagia, years of education, handedness, anti-Parkinson's medication use, levodopa equivalent daily doses (LEDD), and motor complications were collected by neurologists majoring in movement disorders during face-to-face interviews. Unified PD Rating Scale (UPDRS) part III [13] and Hoehn and Yahr (H&Y) stage [14] were used to evaluate the severity of the motor symptoms. The quality of life (QoL) of PD patients was evaluated using the Chinese version of the PD Questionnaire 39 (PDQ-39) (8 domains) [15]. NMS were assessed using the Non-Motor Symptoms Scale (NMSS) (9 domains) [16], Hamilton Depression Rating Scale (HAMD) (24 items) [17] and Hamilton Anxiety Rating Scale (HAMA) [18]. Frontal lobe function was evaluated using the frontal assessment battery (FAB) [19], while cognitive function was evaluated using the Montreal Cognitive Assessment (MoCA) (7 domains) [20]. All of these assessments were conducted at “on” state.

The item number 6 of the UPDRS II was used to evaluate drooling in PD. Patients with the score ≥ 1 were considered to be as “droolers” (with the presence of drooling), <1 as “non-droolers” (with an absence of drooling). Early-onset PD (EOPD) in the current study was defined as an onset age of PD younger than 50 years, while late-onset PD (LOPD) was defined as older than 50 years. PD patients were grouped into three subtypes including tremor-dominant, akinetic-rigid and mixed types based on the criteria described in a previous study [21].

3. Statistical analyses

All analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 19.0 for Windows. All of the continuous data, including age, age of onset, disease duration, diagnostic delay, years of education, LEDD, UPDRS part III score, the total scores and each domain score for the PDQ-39, NMSS and MoCA, and the total scores for the HAMD, HAMA and FAB, are presented as the mean ± standard deviation (SD). The discontinuous data, including H&Y stage, is presented as the median value (quartile). Student's *T* test was used for the comparisons of the continuous data between the droolers and non-droolers. The Chi-square test was used to evaluate the differences in the categorical variables between the droolers and non-droolers. The Wilcoxon rank sum test was performed to compare the discontinuous data between the droolers and non-droolers. Analyses of covariance (ANCOVA) adjusted for confounding factors, including age, H&Y stage and benzhexol use, were performed to compare the total scores for the PDQ-39, NMSS, FAB, MoCA, HAMD and HAMA, as well as the scores of each domain from the PDQ-39, NMSS and MoCA between the droolers and non-droolers. In order to eliminate the influence of benzhexol on the cognitive function, the ANCOVA adjusted for age and H&Y stage were performed to compare the differences in the total scores for FAB and MoCA, and each domain score for MoCA of benzhexol-naive PD patients. A binary logistic regression model was used to explore the potential factors related to drooling. The presence or absence of drooling was used as a dependent variable in the analysis to identify potential related factors. The parameters, including age, age of onset, dysarthria, dysphagia, LEDD, use of benzhexol, H&Y stage, fluctuation, the total scores of HAMD and HAMA, the scores for the sleep/fatigue, attention/memory, gastrointestinal and urinary subdomains in the NMSS, and the scores for the naming subdomain in the MoCA, were used as covariables. A factor was considered to be significantly related to drooling when $p < 0.05$ or if the 95% confidence interval (CI) of the odds ratio (OR) did not include 1.000. All statistical tests were two-tailed, and *p*-values < 0.05 were considered statistically significant (for multiple comparison of Chi-square test, *p*-values < 0.0125 were considered statistically significant, Table 1).

4. Results

The prevalence of drooling is presented in Table 1. From the overall 518 patients, 273 PD patients (52.7%) reported drooling. The prevalence of drooling in the LOPD patients was significantly higher than in the EOPD patients ($p = 0.004$), whereas no differences were observed between the male and female patients, or among the three subtypes of PD patients (Table 1).

The demographic and clinical features of the PD patients are listed in Table 2. The mean age, age of onset, LEDD, mean UPDRS part III score and median H&Y stage in the droolers were significantly greater than the non-droolers ($p < 0.05$). The percentage of patients receiving benzhexol treatment in the non-droolers was significantly higher than the droolers ($p < 0.05$). The frequencies of dysarthria, dysphagia, and motor fluctuation in the droolers were significantly higher than the non-droolers ($p < 0.05$). The disease duration and diagnostic delay, the percentages of patients treated with levodopa, dopamine receptor agonist, amantadine and entacapone, as well as the incidence of dyskinesia were not different between the droolers and non-droolers (Table 2).

The NMS and PDQ-39 results for the PD patients with and without drooling are listed in Table 3. After adjusting for age, H&Y stage and benzhexol use, the droolers had significantly higher total scores for the NMSS, HAMD and HAMA, as well as higher scores for the sleep/fatigue, mood/apathy, attention/memory, gastrointestinal and urinary domains of the NMSS compared with the non-droolers ($p < 0.05$). A significantly lower score for the naming domain of the MoCA scale was observed in the droolers compared with the non-droolers ($p < 0.05$), whereas no differences in the total score of FAB and MoCA as well as the scores for the remaining domains of the MoCA were observed between the droolers and non-droolers. In order to eliminate the influence of benzhexol on the cognitive function, the findings were consistent after the patients who used benzhexol were excluded (Table 4). The scores for the mobility, activities of daily life, stigma and communication subdomains of the PDQ-39 in the droolers were significantly higher than the non-droolers ($p < 0.05$), whereas no significant differences in the total score for the PDQ-39, as well as the scores for the remaining domains of the PDQ-39 were observed between the droolers and non-droolers (Table 3).

Table 1
Prevalence of drooling in patients with PD.

Groups	Drooling		*p*-value[a]
	n	%	
Total	273	52.7	
Gender			
Male	160	55.9	0.101
Female	113	48.7	
Onset age			
EOPD	54	41.9	0.004[b]
LOPD	219	56.3	
Type of motor symptom			
Tremor-dominant	3	25.0	0.058
Akinetic-rigid	184	55.6	
Mixed	86	49.1	

PD: Parkinson Disease. EOPD: early-onset PD. LOPD: late-onset PD.
[a] *p*-value is calculated from chi-square test.
[b] Significant difference.

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