A simple bedside test to assess the swallowing dysfunction in Parkinson’s disease

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Abstract

Background: Swallowing changes are common in Parkinson’s disease (PD). Early identification is essential to avoid complications of aspiration. Objectives: To evaluate the swallowing ability of the PD patients and to correlate it with the indicators of disease progression. Materials and Methods: A total of 100 PD patients (70 males and 30 females) aged between 50 years and 70 years with varying stage, duration, and severity were enrolled in a cross-sectional study carried out between January and May 2012. A simple bedside water swallowing test was performed using standard 150 ml of water. Swallowing process was assessed under three categories—swallowing speeds (ml/s), swallowing volume (ml/swallow) and swallowing duration (s/swallow). Equal number of age and sex matched controls were also evaluated. Results: All of them completed the task of swallowing. A mean swallowing speed (27.48 ml/s), swallowing volume (28.5 ml/swallow) and swallowing duration (1.05 s/swallow) was established by the control group. The PD patients showed decreased swallowing speed (7.15 ml/s in males and 6.61 ml/s in females), decreased swallowing volume (14.59 ml/swallow and 14 ml/swallow in females), and increased swallowing duration (2.37 s/swallow and 2.42 s/swallow) which are statistically significant. There was a significant positive correlation between the severity, duration, and staging of the disease with the swallowing performance and a poor correlation between the subjective reports of dysphagia and the objective performance on water swallow test. Conclusion: The water swallowing test is a simple bedside test to identify the swallowing changes early in PD. It is recommended to do the test in all PD Patients to detect dysphagia early and to intervene appropriately.

Key Words

Dysphagia in Parkinson’s disease, swallowing dysfunction, simple bedside test

Materials and Methods

A cross-sectional study was carried out in 100 PD patients (70 males and 30 females) undergoing treatment from Madras Institute of Neurology, Rajiv Gandhi Government General Hospital, Chennai between January and May 2012.

All the patients were between 50 years and 70 years age group with varying stage, duration, and severity of PD. Hoen and...
Yahr staging, Unified PD rating scale were used to assess the disease. Mini Mental State Examination was used to assess their cognition. They were clearly explained about the study and informed consent was obtained.

Swallowing test was performed in the Morning between 8 AM and 10 AM. In the water swallowing test, a plastic calibrated conical beaker with standard amount of 150 ml of water was used. The swallowing time was measured beginning from holding water in the mouth to avoid the effects of bradykinesia. The patients were instructed to swallow the water in their routine normal speed and to stop only after completing the act. It took hardly 5 min to finish and analyze the test. One patient had severe cough and he was excluded from the study. Five patients coughed on completion of the test and hence, their performance was not altered. Swallowing process was assessed under three categories-swallowing speeds (ml/s), swallowing volume (ml/swallow), and swallowing duration (s/swallow). Materials used were graduated beaker with 150 ml of drinking water and a digital camera.

Age and sex matched control group of 100 participants (70 males and 30 females) were selected and their swallowing ability were recorded.

**Statistical analysis**
Swallowing parameters between the patient and the controls were compared using Student t-test and the correlation analysis carried out to assess the relationship between the variables.

### Results

The control group was first evaluated to assess the normal performance and their mean swallowing speed, swallowing volume, and swallowing duration were established. The PD patients were then evaluated [Tables 1-4].

The mean swallowing speed in the control group was 27.48 ml/s and in the patient group was 6.99 ml/s. The mean swallowing volume in the patient group was 14.41 ml/swallow and the in the control group was 28.50 ml/swallow. 2.39 s/swallow was the mean swallowing duration among the PD patients and 1.05 s/swallow was the mean swallowing duration in the control population. There was a statistically significant difference \((P < 0.05)\) in the swallowing parameters between the patient and the control group as the PD patients had decreased swallowing speed, decreased swallowing volume, and increased swallowing duration [Table 1].

In the controls, there was a difference in the swallowing performance noted between the males and the females as the males swallow faster, took much less time to swallow and consume more water per swallow. Hence, we established a mean (swallowing speed, swallowing volume, swallowing duration) separately for males and females both in the control group as well as in the patient group. We then compared the swallowing parameters between the two groups.

The mean swallowing speed and the swallowing volume were low (7.15 ml/s and 14.59 ml/swallow) in PD patients when compared to the controls. The swallowing speed and

| **Parameters** | Patients \((n=100)\) | Controls \((n=100)\) | Significance \(P\) value |
|----------------|----------------------|----------------------|--------------------------|
| Swallowing speed (ml/s) | 6.99 \(\pm\) 3.23 | 27.48 \(\pm\) 4.33 | < 0.05 |
| Swallowing volume (ml/swallow) | 14.41 \(\pm\) 2.94 | 28.50 \(\pm\) 2.30 | < 0.05 |
| Swallowing duration (s/swallow) | 2.39 \(\pm\) 0.86 | 1.05 \(\pm\) 0.10 | < 0.05 |

### Table 2: Comparing swallowing parameters in males

| **Parameters** | Male patients \((n=70)\) | Controls males \((n=70)\) | Significance \(P\) value |
|----------------|-------------------------|---------------------------|--------------------------|
| Swallowing speed (ml/s) | 7.15 \(\pm\) 3.41 | 30.03 \(\pm\) 1.97 | < 0.05 |
| Swallowing volume (ml/swallow) | 14.59 \(\pm\) 3.06 | 30.00 \(\pm\) 0.25 | < 0.05 |
| Swallowing duration (s/swallow) | 2.37 \(\pm\) 0.92 | 1.00 \(\pm\) 0.08 | < 0.05 |

| **Parameters** | Female patients \((n=30)\) | Female controls \((n=30)\) | Significance \(P\) value |
|----------------|------------------------|-----------------------------|--------------------------|
| Swallowing speed (ml/s) | 6.61 \(\pm\) 2.76 | 21.54 \(\pm\) 1.65 | < 0.05 |
| Swallowing volume (ml/swallow) | 14.00 \(\pm\) 2.64 | 25.00 \(\pm\) 0.33 | < 0.05 |
| Swallowing duration (s/swallow) | 2.42 \(\pm\) 0.85 | 1.16 \(\pm\) 0.63 | < 0.05 |

### Table 4: Correlation analysis

| **Parameters** | MMSE | Duration \(Y\) stage | UPDRS part II | UPDRS part III | H and Y stage |
|----------------|------|----------------------|--------------|---------------|--------------|
| Swallowing speed \((ml/s)\) \(n=100\) | 0.270 | 0.524 | 0.746 | 0.830 | 0.635 |
| Peareson | Correlation | Significance | | | |
| Swallowing volume \((ml/swallow)\) \(n=100\) | 0.272 | 0.542 | 0.769 | 0.839 | 0.615 |
| Peareson | Correlation | Significance | | | |
| Swallowing duration \((s/swallow)\) \(n=100\) | 0.360 | 0.626 | 0.831 | 0.892 | 0.627 |
| Peareson | Correlation | Significance | | | |

MMSE =Mini mental state examination, UPDRS =Unified parkinson’s disease rating scale
Changes in the swallowing function occur from the earlier stages of PD, even in cases asymptomatic for dysphagia. Eating and drinking are social activities and physical changes affecting these simple manual skills cause profound psychosocial impact upon the individual. Studies indicate objective changes, including, silent aspiration precede subjective complaints of dysphagia, so it is essential to identify the swallowing changes early in the asymptomatic stage and initiate corrective measures to avoid aspiration.

The mean swallowing parameters among our control group (males and females) were similar to that by Nathadwarawala KM et al. (JNNP 1992). Our study revealed, significant swallowing dysfunction on objective assessment of the people with PD as they have decreased swallowing speed (7.15 ml/s in males and 6.61 ml/s in females), decreased swallowing volume (14.59 ml/swallow and 14 ml/swallow in females), and increased swallowing duration (2.37 s/swallow and 2.42 s/swallow) when compared to their age matched controls.

Completion of the water test alone does not exclude swallowing difficulty.

Most of the PD patients were not aware of their swallowing problem as they made adjustments by themselves in the form of drinking frequent small sips, adopting particular posture during swallowing to avoid choking, taking frequent small meals. Our study strongly revealed subjective self-report of “no difficulty” is not at all a reliable indicator of swallowing ability as their objective assessment (95%) showed significant changes in the swallowing parameters.

This study clearly showed that the duration of the disease, severity, and staging of the disease correlate positively with the swallowing difficulties. Our results of these variables influencing the swallowing performance were similar to that of the findings in the studies done by Clarke, Coates, Gullaksen, Macdonald and Lowe.

Studies using invasive methods like barium swallow showed abnormal oropharyngeal swallowing in 75% to 97% of the persons with PD (Pfeiffer et al, 2003). Studies using esophageal manometry demonstrated esophageal dysfunction in 63% to 73% of PD patients. Videofluoroscopy showed a broader range of abnormality noted in 5% to 86% of individuals (Pfeiffer et al, 2003). Another Invasive method called swallowing provocation test in which swallowing is induced and Electromyography of the submandibular muscle, tracheal sound, and breathing movements are continuously recorded. These procedures are done only in specialized centers and need much expertise.

The water swallowing test is a simple bedside test to assess the swallowing ability in PD patients. It does not require any specific apparatus and it can be easily administered and analyzed within 5 min.

We often overlook the swallowing aspect of PD patients as their complaints are predominantly motor and moreover, most of the PD patients are clinically asymptomatic and unaware of the swallowing difficulty until later in the disease course, so objective clinical assessment of swallowing is mandatory.

A glass of water which equals 150 ml is available everywhere. Asking the patient to drink a glass of water after completing the clinical assessment, improves the rapport and also helps in assessing the swallowing changes in PD. If the patient has objective changes but clinically asymptomatic, repeat this test in the subsequent visits and if worsening is noted, patient
needs specialist referral for detailed objective assessment and management.

**Conclusion**

Water swallowing test is a simple bed side test which can be done within 5 min and is very useful in identifying the swallowing disturbance early in PD. Hence, it is recommended that this test should be administered in all the PD patients to identify dysphagia early and to take appropriate steps to prevent the complications.

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