Non-invasive assessment of swallowing and respiration in Parkinson’s disease

Introduction

Parkinson’s disease (PD) is a common disorder with an estimated prevalence of 140 per 100,000 [1, 2]. Difficulties with chewing and swallowing can present early in the course of the disease, and approximately one-third of patients regard them as a major problem [3]. These difficulties are associated with considerable nutritional and pulmonary morbidity [4–7]. A number of reports describe the type of swallowing difficulties encountered by patients with PD disease. These demonstrate that clinical symptoms are not correlated with examination findings, and that both the history and examination underestimate the frequency and severity of the dysphagia as assessed using videofluoroscopy. Videofluoroscopy demonstrates silent
aspiration occurring in 15%–20% of asymptomatic PD patients [8, 9] and 36% of symptomatic patients [10]. Some of these studies recommend videofluoroscopy as a screening technique [10] especially in symptomatic patients [9, 11], although other authors are more sceptical. Bushman and colleagues [8] state that ‘it would be premature, however, to recommend a modified barium swallow for every PD patient’.

Early identification of patients at risk therefore represents a significant problem. Self-reporting of symptoms and the clinical findings under-report the severity of risk. Repeated screening using videofluoroscopy is not feasible or safe. Once identified, however, those at risk patients can learn techniques that enhance swallow safety [8, 12].

The Exeter Dysphagia Assessment Technique (EDAT) is a reliable and simple method of studying swallowing difficulties non-invasively [13, 14]. The technique records simultaneously respiratory synchronisation with swallowing, the time fluid enters the mouth and the associated swallow sounds. From these features it is possible to calculate the oral and pharyngeal transit times. This has a number of advantages over videofluoroscopy. EDAT can be performed by the bedside and is easily repeated to measure the efficacy of an intervention. When compared with videofluoroscopy, the equipment is relatively cheap (UK £7600) and staff can learn simple interpretation of the charts in a few hours.

This study demonstrates the use of EDAT to detect subclinical abnormalities of swallowing in 12 patients with PD compared with 14 subjects. In addition, it illustrates that oro-pharyngeal transit times are reduced when verbal cues are provided, confirming the role of EDAT in repeat assessments.

**Participants and methods**

Twelve patients with a diagnosis of PD were recruited whilst attending a neurology clinic held at the Derbyshire Royal Infirmary. The sample included seven men and five women whose mean age was 68 years. All patients fulfilled the United Kingdom Parkinson’s Disease Brain Bank criteria for PD [15] and were assessed using the modified Hoehn and Yahr scale [6] and the Unified Parkinson’s Disease Rating Scale (UPDRS) [16]. Patients were studied while ‘on’, having received their normal dose of medication. Patients reports of speech and swallowing difficulties were also recorded. Control data (six men, eight women, mean age 78 years) were obtained in an associated study from 14 people admitted to an ortho-geriatric ward. These people were medically stable, had no history of dysphagia and no evidence of neurological or respiratory disease [14]. Informed consent was obtained from all participants and the methods used were approved by the local ethics committees.

Full technical details and procedures for carrying out EDAT assessments have been described elsewhere by Selley et al. [13]. Briefly, EDAT records nasal air-flow, contact of the lips or tongue with a spoon and sounds associated with swallowing. Bi-directional air-flow is recorded through nasal cannulae. Spoon contact is detected by completion of a circuit between an indifferent electrode (normally attached to the hand or leg using micropropore tape and a conductive gel) and an electrode incorporated in the insulated handle of a stainless steel teaspoon. Swallow sounds are recorded by a microphone held against the throat. The signals obtained from these three sources are recorded simultaneously by a chart recorder and analysed subsequently from a paper or disk record (Fig. 1).

All participants were assessed in an upright seated position. The PD group were assessed twice. In one assessment the spoon was presented under standard quiet conditions, and in the other presentation of the spoon was reinforced by a short verbal prompt. The patients were instructed that the spoon would be offered to the lips on a count of three, thus providing verbal as well as visual information about the timing of spoon presentation. The order of presentation was alternated between patients. Ten 5ml measures of liquid (water or orange squash) were given during each assessment with the spoon held level and central to the lips. Respiration was recorded throughout the assessment.

When analysing the chart record, the following information was noted for each feeding trial: (a) the direction of respiration immediately preceding and following each swallow, (b) number of swallows, (c) the duration of the ‘oral part’, defined here as the interval between cessation of spoon contact and the first swallow sound [13], and (d) the duration of the ‘pharyngeal part’ or ‘deglutition apnoea’ defined here as the period when no nasal airflow is recorded during the pharyngeal stage of swallowing [17].

The data were stored and analysed on an IBM-PC compatible computer using commercially available analysis packages (SPSS, Microsoft Excel). Differences between the timed variables were assessed using unrelated and related two-tailed Student’s t tests.

**Results**

The median UPDRS total score for the group was 65, and the mean disease duration was 11 years. All patients fell within stages II–V of the Hoehn and Yahr classification (5 stage II, 3 stage III, 3 stage IV, 1 stage V). Three patients reported mild speech difficulties, and five felt their speech impairments to be moderate or severe. Only one patient felt his swallowing was impaired.

**Oral-motor efficiency**

As shown in Table 1, the mean duration of the oral part was significantly slower in the PD patients \( P < 0.0001 \). Five of...