Abstract:
Background - Parkinsons disease (PD) is a chronic progressive neurodegenerative disorder characterised predominant motor symptoms. Non motor symptoms are also seen in PD patients. Pulmonary function abnormalities add to the morbidity of illness.

Aim - To analyse the characteristics of pulmonary function test abnormalities in patients with PD.

Methods - Pulmonary function testing was performed in 30 patients with PD during off state and 30 matched healthy controls.

Results - Among 30 patients, 28 (94) of them had pulmonary function abnormalities, 26 (87) had restrictive pattern of pulmonary dysfunction and remaining 2 patients had obstructive pattern. The forced vital capacity (FVC), maximum voluntary ventilation (MVV), maximum expiratory pressure (MEP), and maximum inspiratory pressure (MIP) were significantly reduced in patients with PD compared to controls.

Conclusions - Pulmonary function abnormalities were present in majority of patients with PD. The evaluation of respiratory disturbances and rehabilitation should be routinely included in the management of patients with Parkinson's disease.

Keyword: PARKINSON'S DISEASE, PULMONARY FUNCTION TEST

INTRODUCTION
Parkinson's disease (PD) is a chronic progressive neurodegenerative disorder, characterised by loss of dopamine producing cells in substantia nigra. The cardinal features of PD are rest tremors, bradykinesia, rigidity, loss of postural reflexes, flexed posture and freezing. Though it predominantly affects motor system, non motor manifestations like fatigue, depression, anxiety, sleep disturbances, constipation, bladder and other autonomic disturbances (sexual, gastrointestinal), and sensory complaints are also well documented.

Pulmonary function abnormalities in patients with PD have been noted since 1817. Respiratory distress such as dyspnea can occur as a symptom of PD in some patients, especially during the “off” period in some. It can also occur as a complication of dystonia, usually peak-dose dystonia, and with some dopamine agonists, particularly pergolide. Pulmonary function abnormalities have also been noted in asymptomatic PD patients.
Connolly et al studied pulmonary function abnormalities in patients with PD in 1967 and noted obstructive pattern in majority of them. Hovestadt et al in 1989 analysed pulmonary function abnormalities in 31 patients with PD and noted that 22 had upper airway obstruction. Another study by Vincken et al in 1984 noted the presence of upper airway obstruction in PD patients and also their reversibility after levodopa therapy. This was followed by several studies on pulmonary function abnormalities in patients with PD and the effect of levodopa in it. Obenour et al analysed the cause abnormal pulmonary function test in patients with PD. It was postulated that obstructive pattern was due to increased bronchial muscle tone caused by increased parasympathetic activity causing obstruction. Tremor of upper airway muscles, in coordination between upper airway & thoracic cage muscles also contributed to obstruction. While restrictive pattern was due to Low chest wall compliance due to chest wall muscle rigidity and difficulty in performing repetitive motor acts because of bradykinesia. The pulmonary function abnormalities, if undetected at early stage, results in pulmonary complications leading to increased morbidity and mortality in patients with PD. Thus, it is of great clinical interest to undertake more systematic studies to look into the various pulmonary function abnormalities in PD. In the present study, we describe the pulmonary function abnormalities in patients with PD with a history of smoking currently or in the past, lung disease, cardiovascular pathology, medication that might result in pulmonary dysfunction and those unable to perform PFT because of anatomical abnormalities or clinical signs of dementia were excluded from the study. Thirty healthy age and gender matched, non-smoker volunteers selected from the patients' relatives were included as controls. The severity of disability of the patients was assessed according to the scale of Hoehn and Yahr whereby stage -1 is mild unilateral Parkinsonism, stage -2 is mild bilateral Parkinsonism, stage -3 includes postural instability, stage-4 is marked incapacitation with the ability to walk still preserved and stage-5 is confinement to bed or wheelchair. None of them complained of respiratory symptoms and were able to perform satisfactorily. Spirometry was performed using the Spirometry Kit, RMS Helios (version 3.1.85) machine. All the patients had taken the drugs the previous day night and there was minimum time period of 12 hours between last dose of drug and time of testing (off state). Forced vital capacity (FVC), forced expiratory volume (FEV1) and the ratio of forced expiratory volume in the first second to vital capacity (FEV1/FVC) were calculated. From these measurements, peak expiratory flow rate (PEFR) and inspiratory reserve volume (IRV) were obtained. The methods used to evaluate respiratory muscle strength included the measurement of FVC, maximal inspiratory pressure (MIP), maximal expiratory pressure (MEP) and maximum voluntary ventilation (MVV). For inspiratory efforts the subject was asked to attempt to inspire as forcefully as possible at the end of a normal expiration and for expiratory efforts to expire as forcefully as possible after a full expiration.
inspiration. The MVV was performed with instructions to breathe out and breathe in as fast as possible. This test was performed for 12 seconds and later corrected for one minute. All patients had to do each maneuver three times with interval of two minutes between the test-sitting position. The best of three technically acceptable tests were considered. All lung volumes were expressed as percentages of the values predicted.

**STATISTICAL ANALYSIS**

All continuous variables were expressed as mean values. Comparisons of PFT parameters between patients and control subjects were performed by student’s independent sample t-test using SPSS 17.0 Software. p value <0.05 was considered statistically significant.

**RESULTS:**

During the study period, 30 patients (22 males & 8 females) with PD were evaluated (fig.1). The demographic details of the cases and the controls are shown in table 1. The mean age of the patients was 54.1 years. Their mean body mass index (BMI) was 24.4 kg/m2. The mean age and BMI of control group were 52.8 years and 25.2 kg/m2, respectively. The total duration of the disease was 3.2 years (range 1 to 5 years). There was no statistically significant correlation between the duration of the disease and the severity of pulmonary dysfunction. Pulmonary function parameters of the patients and controls are compared in table 2. The mean FVC (% predicted) (p<0.001) and the mean FEV1 (<0.001) were significantly lower in patients with PD compared with the controls. Restrictive type of respiratory abnormality was noted in 26 patients. However two patients had obstructive pattern with FEV1/FVC values of 66.1% and 68.0 percent and 2 had normal PFT values (fig.2). The IRV (l/btps) was also reduced significantly (p=0.002) in PD group compared to the control group. Furthermore, patients with PD had lower PEFR (p<0.001), MVV (p<0.001), MIP (p<0.05) and MEP (p<0.001) compared with the controls. Based on Hoehn and Yahr severity score, majority of PD patients had stage-2, i.e. bilateral Parkinsonism (n=24, 80 %) and remaining six patients (n=6, 20% ) had stage-1, i.e. mild unilateral Parkinsonism. On sub group analysis of PD patients, stage-2 PD patients were found to have more respiratory dysfunction as evident by lowered PFT values (statistically not significant) Among 30 patients, 28(94%) of them had pulmonary function abnormalities, 26 (87%) had restrictive pattern of pulmonary dysfunction and remaining 2 patients had obstructive pattern.In this study we analysed the pulmonary function of 30 PD patients and 30 controls. None of the patients had respiratory symptoms during the study. Restriction of daily activities because of the disease process might have masked subtle or early clinical features of pulmonary function abnormalities. All the patients were grouped in stage 2 or 3 in Hoehn & Yahr staging. Analysis revealed significant reduction in pulmonary function parameters. We report that abnormalities of pulmonary function exist in PD patients, as evidenced by reduction in lung volumes, capacities, and flow rates and also by decrease in respiratory muscle strength. These findings are consistent with previous studies, which have indicated that patients with PD have respiratory dysfunction In this study, we found that 28 (94%) of patients had pulmonary function abnormalities, 26 (87%) had restrictive pattern of pulmonary dysfunction and remaining obstructive pattern. This correlates with previous studies which shows similar
Identification of sub clinical pulmonary abnormality is essential to prevent mortality and morbidity due respiratory problems. All patients with Parkinson’s disease should be screened for pulmonary function abnormality using spirometry during routine clinical evaluation and if detected, early pulmonary rehabilitation to be started to reduce morbidity and mortality due to pulmonary complications.

REFERENCE:


Table 1

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<th>VARIABLE</th>
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<th>CONTROL</th>
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<td>AGE (yrs)</td>
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<td>HEIGHT (cm)</td>
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<td>WEIGHT (kg)</td>
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<td>BMI (Kg/m2)</td>
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<tr>
<td>BSA (m2)</td>
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*BMI - Body Mass Index, BSA – Body Surface Area

Table 2

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