

Pulmonary Function Tests Abnormalities In Parkinson Disease

H Mikaelee, M Yazdchi, K Ansarin, M Arami

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Abstract

Objective: In patients with Parkinson's disease (PD) and other extrapyramidal disorders, respiratory problems commonly contribute to morbidity and mortality. The aim of this study is to investigate the characteristics of pulmonary function tests (PFT) abnormalities in patients with PD.

Materials and Methods: PFTs performed in 25 patients suffered PD (19 male 69%, 6 Female 24 %) without known respiratory and cardiovascular disease and no history of smoking and 25 healthy individuals as an age and sex matched control group. We obtained Body plethysmographic measurements of lung volumes and respiratory determinations of PFT. PD severity was evaluated by Hoehn and Yahr staging.

Results: The mean age of PD onset was 58.8 ± 11.6 years. 44 % (n= 4) of patients in H-Y Group 1, and 75 % (n= 6) in group 2 and 3 and 75% (n=6) in group 4 and 5 had abnormal PFT values. Between various tests, the Residual Volume (RV>120 % of normal value); Forced Vital Capacity (FVC<80 % of normal value) and FEV1 / FVC Ratio<75 % of normal ratio, were significantly abnormal in patients with PD compared with the controls, ($p<0.05$). Also obstructive pulmonary function disorders were significantly common in patients, ($p<0.04$).

Conclusions: Obstructive pattern of respiratory abnormalities is the most common type of PFT impairment in PD patients. The evaluation and rehabilitation of pulmonary disorders should be routinely included in the management of PD patients.

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INTRODUCTION

The clinical features of Parkinson's disease (PD), also known as paralysis agiants, comprehensively described more than 175 years ago, consist primarily of rigidity, tremor, bradykinesia, gait impairment, postural instability and parasympathic hyperactivity.^(1,2,3,4,5)

James Parkinson described a patient "who fetched his breath rather hard". Since its initial description in 1817, respiratory abnormalities have been noted in PD patients^(6, 7). The spectrum of respiratory abnormalities associated with PD has broadened to include, not just restrictive defect but also obstructive defect, abnormal control of ventilation and pulmonary sequel attributed to the drugs used to treat the disorder. These abnormalities are thought to cause impairment in activities of daily living and increased

morbidity and mortality of them.^(8, 9, 10, 11, 12)

Thus it's of great clinical interest to undertake more studies to look into the various pulmonary function abnormalities in PD.

To investigate the characteristics and clinical significance of respiratory function in patients with PD, 25 PD patients and 25 healthy controls were studied.

MATERIAL AND METHODS

This descriptive and analytical case-control study was conducted at a neurology outpatient clinic and a well founded pulmonary function study laboratory.

Twenty five ambulatory patients clinically diagnosed on PD cases were recruited for this study. The diagnosis of PD was based on its diagnostic criteria⁽¹³⁾. Patients were screened with a careful clinical evaluation, chest radiographs, EKG, and routine laboratory blood testing. The study had ethical

approval and all patients and controls signed informed consents.

Patients with a history of smoking currently or in the past, lung disease, cardio-vascular pathology, drugs that might result in pulmonary dysfunction and those unable to perform PFT because of clinical sign of dementia or anatomical abnormalities were excluded.

Twenty non-smoker healthy age and sex matched individuals with no history of pulmonary disease were selected as "Control group".

The severity of disability of the patients was evaluated 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 in capitation with the ability to walk still preserved and stage 5 is confinement to bed or wheelchair.

The majority of these patients were receiving antiparkinson medications (usually Levodopa-Carbidopa combination in different doses) during the study. All patients and control subjects were measured for body plethysmographic measurements of lung volumes and spirometric determinations of: Expiratory Flow Rate (EFR), Forced Vital Capacity (FVC), Forced Expiratory Volume in 1 second before and after bronchodilator use (FEV₁), FEV₁ / FVC Ratio, Residual Volume (RV), Total Lung Capacity (TLC), Total conductance of airways, Effective conductance of airways, Functional Residual Capacity (FRC) and Maximum Mid-Expiratory Flow rate (MMEF). Normal ranges calculated according to American Thoracic Society. (www.thoracic.org)

Two basic types of lung dysfunction were defined by spirometry: obstructive patterns and restrictive patterns. The primary criterion for airflow obstruction was a reduced FEV₁/VC%. Other measurements of flow used to support conclusions based on this variable or to assist in making decisions when FEV₁/VC% is borderline. A restrictive pattern means that lung volumes are small. The primary criterion for this diagnosis was a reduced FVC and normal or above normal FEV₁/FVC ratio). a reduction in total lung capacity (TLC), the volume of air in the lungs at the end of a maximal inhalation. Also, all patients had to do each maneuver three times and the best of three technically acceptable tests were considered.

All continuous variables were expressed as mean \pm SD. Comparisons of PFT parameters between patients and

control subjects were performed using student's independent sample t test and P value of < 0.05 was considered statistically significant.

RESULTS

In this study, 25 PD patients (19 Male, 76%; 6 female, 24%) with PD of varying duration and on different therapeutic agents, have been assessed.

The mean age of PD patients was 63.8 ± 11.1 (Range 37 to 82 years). The mean age of male patients was 65.4 ± 11.1 years and mean age of female patients was 58.8 ± 10 years. The mean age of control group was 61.6 ± 7.5 years (Range 51 to 75 years) respectively.

The mean age of PD patients at the onset of disease was 58.8 ± 11.6 years (Range 31 to 80 years), that in male patients was 59.8 ± 12.4 and in female group was 54.3 ± 8.1 years.

Based on Hoehn and Yahr Severity Score, 9 patients (36%) of PD patients were in H-Y group 1; i.e. Mild unilateral parkinsonism, 8 cases (32%) were in H-Y group 2 and 3 and remaining 8 patients (32%) had severe PD (H-Y Group 4 and 5) respectively.

Eighteen PD patients (72%) hadn't any pulmonary complaint (Dyspnea, Cough and etc.) in first evaluation.

In subgroup analysis of PD patients, four of 9 patients (44.4%) in H.Y Group 1, 6 cases (75%) in H-Y Group 2 and 3 and 6 patients (75%) of H-Y group 4 and 5 had abnormal PFT values. Pulmonary function tests parameters of the patients and controls are compared in table 1. No significant correlation was found between severity of PD and pulmonary dysfunction ($p=ns$).

Figure 1

Table 1: Comparison of Pulmonary Function Tests (PFT) results between patients with Parkinson's disease (PD) and normal subjects.

PFT	case n= 25	control n= 35	P. value
RV > 120% of normal†	56% (14)	20% (5)	< 0.05
TLC < 80% of normal	8% (2)	4% (1)	NS
FVC< 80 % of normal	16% (4)	4% (1)	< 0.05
MMEF< 65% of normal	28% (7)	16 % (4)	< 0.05
TCAW< 80% of normal	24% (6)	28 % (7)	NS
ECAW< 80% of normal	20% (5)	20% (5)	NS
FRC< 80% of normal	4% (1)	8% (2)	NS
FEV ₁ < 80% of normal	8% (2)	0	NS
FEV ₁ > 120% of normal	20% (5)	8% (2)	NS
FEV ₁ /FVC<75% of normal	24% (6)	12% (3)	< 0.05

TCAW: Total Conductance of Airways; ECAW: Effective Conductance of Airways; PFT: Pulmonary Function Tests.

†Based on normal value of American Thoracic Society. **

According our findings the RV of more than 120% of normal value, FVC of less than 80% of normal ranges, FEV₁ < FVC ratio of less than 75 % of normal values were statistically significant in patients with PD compared with the controls.

Obstructive pattern respiratory dysfunction was noted in 13 PD patients (52%). This pattern found only in 6 (24%) healthy subjects. Statistically obstructive disorders were significantly higher in PD patients (p<0.04), though MMEF (Air flow limitation) of less than 65% of normal limits was detected in 6 (28%) of PD patients and 4 (16%) controls, p>0.05, not significant.

Airtrpment was fund in 14 PD patients (56%) that was not significantly higher compared with control group in which only 5 patients (20%) had airtapment, (p =0.09).

Just one of our patients showed upper airway obstruction, as judged by abnormal values of peak inspiratory flow, the ratio of Forced Expiratory Volume in 1 Second and Peak Expiratory Flow. We didn't detect restrictive pattern in PD patients.

DISCUSSION

The frequency of respiratory system involvement in Parkinson's disease is more than what is perceived usually and respiratory dysfunction remains one of the most causes of death in these patients.(1,11,13)

However dyspnea is not a frequent complaint among Parkinson patients, it's well documented that pulmonary

function abnormalities are very common. (14,16).Probably pulmonary status of patients remains unnoticed , while the disease develops , because physical disability in Parkinson's disease often makes a patient lead a sedentary life and limiting the activities , where respiratory problems can became manifest.

Our study shows that abnormalities of pulmonary function exist in PD patients, even in the absence of respiratory symptoms.

In this study, we found obstructive pattern of ventilatory abnormalities in 52% of patients, that consist of obstructive ventilatory defect (FEV₁/FVC<75% of normal value), air flow limitation (MMEF <65% of normal value) , airtrpment as evidenced by RV>120% of normal value. These findings are consistent with previous studies which have indicated that pulmonary function abnormalities are have caused by an increase in parasympathic activity (10, 11).

Although some reports have demonstrated pulmonary restriction because of abnormally low chest wall compliance, secondary to chest wall rigidity, as most common cause of PFT impairment in PD patients (17,18) , we didn't detect restrictive pattern in PD Patients. However this may be to our low sample size.

More patients with severe disease i.e. group 4 and 5 H.Y staging had abnormal PFT values than patients with mild unilateral Parkinsonism. However these observations need to be verified in more studies.

The present data support the hypothesis that Parkinson disease patients present a high risk for pneumologic disturbances (14,15).

Our results demonstrated that spirometric values may serve as a useful indicator of assessment of pulmonary function status in patients with parkinson's isease.

As many of Parkinson patients may have no pulmonary symptoms, therefore pulmonary function test are well worth considering in anticipating and thus preventing pulmonary complications in parkinson's disease patients.

On the other hand pulmonary testes could be a useful tool for monitoring the effects of pulmonary rehabilitation programs on the respiratory dysfunctions and motor performance and life quality in this group of patients.

So we suggest the routinely evaluation of respiratory disturbances must be included in the management of patients

with parkinson's disease.

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Author Information

H. Mikaelee, M.D.

Assistant Professor of Internal Medicine, Tuberculosis and Lung Diseases Research Center of Tabriz University of Medical Sciences

M. Yazdchi, MD

Assistant Professor of Neurology, Imam Hospital, Neurology Department, Tabriz University of Medical Sciences

K. Ansarin, MD

Professor of Internal Medicine, Imam Hospital, Department of Internal Medicine, Pulmonology Laboratory, Tabriz University of Medical Sciences

MA Arami, MD

Consultant Neurologist, Milad Hospital, Neurology Department, Social Security Organization