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Case Report

Internal Medicine Section

Effect of Levodopa Treatment on Respiratory Muscle Power in a Patient with Newly Diagnosed Parkinson's Disease

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ABSTRACT

Parkinson's Disease (PD) is a common neurodegenerative, progressive motor disease. The condition is often accompanied by tremor, stiffness, bradykinesia, postural imbalance, and subsequent respiratory problems. In many patients with PD, the aspiration and respiratory problems that develop after difficulty in swallowing and loss of mouth and throat muscle control are the main causes of morbidity and mortality. A 62-year-old non-smoker male was admitted because of progressive dyspnea, unconsciousness, slowing of movement, and respiratory failure. The patient was diagnosed with Parkinson's disease after neurological consultation. After two weeks of levodopa treatment, the patient showed a significant improvement in pulmonary function and respiratory muscle strength parameters. This case demonstrates the effect of levodopa treatment on respiratory muscle strength and emphasises the importance of respiratory muscle strength parameters in special pulmonary function test.

Keywords: Bodyplethysmography, Pulmonary function test, Respiratory alkalosis

CASE REPORT

A 62-year-old non-smoker male was admitted to the clinic because of progressive dyspnea, unconsciousness, and slowing of movement. Complaints of the patient started within the last 1-2 years, and he had been suffering from dyspnea for the last few months. The family members stated that there was a decrease in the exercise capacity of the patient, that shortness of breath would develop even with a little effort and clouding of consciousness had started in recent days. There was no significant family history.

Signs of respiratory alkalosis were detected in the blood gas. Brain Magnetic Resonance Imaging (BMI), electroencephalography, echocardiography, and chest X-ray findings were normal. Lung function measurements were performed with body plethysmography (Ganshorn PowerCube SR2 and ResPImax) and showed restrictive and obstructive type dysfunction. The mouth occlusion pressure measured at 100 m seconds (P0.1) was 0.24 kPa-84%, and the effective impedance of the respiratory system {P0.1/(VT/TI) was 3.28 kPa/(l/s)}–656%. These results showed that the patient had a significant reduction in inspiratory muscle strength.

Neurological consultation, with a pre-diagnosis of neuromuscular disease, resulted in a diagnosis of PD. Levodopa/benserazide treatment (2×100/25 mg) was subsequently started. After two weeks of treatment, the patient showed a significant improvement in pulmonary function and respiratory muscle strength. During the treatment, a significant improvement was seen in FEV1 and FVC as well as an improvement in P0.1/(VT/TI) with 0.33 kPa/(l/s) - 65% [Table/Fig-1]. The patient regained consciousness and began to fulfill his daily needs (toilet, washing, feeding, dressing etc.,). In addition, significant improvement in exercise capacity was noted.

Features		Predicted	Before levodopa	After two week
FEV1	L	3.19	0.92-31%	1.67-52%
FVC	L	4.06	1.24-29%	2.44-60%
FEV1/FVC	%	76	92	90
RV	L	2.41	4.95-205%	1.82-75%
TLC	L	6.83	4.36-64%	6.00-88%
VC.Insp.	L	4.23	1.32-31%	2.43-58%
Special results for neuromuscular diseases				
P0.1	kPa	<0.30	0.24	0.14
Pi max	kPa	9.95	1.74	3.27
P0.1 / Pi max		<0.05	0.14-312%	0.04-92%
P0.1 / (VT/ti)	kPa/(L/s)	<0.50	3.28-656%	0.33-65%

[Table/Fig-1]: The pulmonary function and body plethysmography test results. FEV1: Forced expiratory volume in one second; FVC: Forced vital capacity; RV: Residual volume; TLC: Total lung capacity; VC: Vital capacity; PO1: mouth occlusion pressure measured at 1 second; ti: time of inspiration; Pi max: maximal inspiratory mouth pressures; P01/Pi max: respiratory capacity index; P0.1/VT/ti: effective impedance of the respiratory system

DISCUSSION

Parkinson's disease is a common progressive motor disease and first described by James Parkinson in 1817 [1]. This disease often presents with bradykinesia, postural instability, stiffness, tremor, and subsequent respiratory symptoms [2]. In addition, non-motor symptoms such as anosmia or hyposmia, constipation, daytime somnolence, depression, erectile dysfunction and urinary dysfunction may be observed [3].

In many patients with PD, the aspiration and respiratory problems that develop after difficulty in swallowing and loss of mouth and throat muscle control are the main causes of morbidity and mortality [4]. Respiratory function tests and respiratory muscle function measurements has found that obstructive, restrictive, or mixed ventilation dysfunction may develop, even in the early stages of the disease; this is believed to contribute to the impairment of daily life activities in patients with PD [5].

This case was presented to show the body plethysmographic results of a patient with newly diagnosed PD, before and after levodopa treatment. The findings suggest that respiratory muscle power increases significantly after levodopa therapy in patients with PD. Levodopa, developed in the early 60s has been accepted as the gold standard in the treatment of PD [6]. This treatment improves cardinal motor symptoms such as bradykinesia, stiffness, and tremors. In contrast, the efficacy of levodopa in patients with autonomic dysfunction, including respiratory disorders, is still controversial [7]. In a systematic review conducted in 2012, it was observed that levodopa treatment improved FVC and PEF, whereas

FEV1 and FEV1/FVC did not change [8]. In the present case, both FEV1 and FVC were improved, and FEV1/FVC did not change. In one study, it was found that, patients with restrictive type pulmonary dysfunction and subclinical findings, partially responded to levodopa treatment, suggesting the use of routine pulmonary function tests at all times, regardless of the severity of the disease [9].

In patients with neuromuscular disease, the early measurement of respiratory muscle function is important. It is necessary to evaluate the parameters of inspiratory mouth occlusion pressure at 100 ms (P0.1) and maximal inspiratory mouth pressure (Plmax), respiratory capacity index (P0.1/Plmax), and effective impedance of the respiratory system (P0.1/VT/TI).

P0.1 is an important marker of neuromuscular ventilatory drive and can be measured independently of the patient's effort. P0.1 values are found to be slightly elevated in patients with neuromuscular disease, as opposed to chronic obstructive pulmonary disease, chest wall disease, or interstitial lung disease. It is thought that a significant respiratory muscle weakness in these patients may affect the assessment of P0.1 [10,11]. Plmax is the most important indicator of ventilatory capacity. One study suggests that P0.1 should be assessed with Plmax in order to measure the ability of respiratory muscles in respiratory failure. It has been reported that P0.1/Plmax index is more effective and useful [12]. Increased P0.1/Plmax indicates inspiratory muscle dysfunction, mechanical limitation and a strain of the respiratory system.

In the index patient, Plmax values were found to be quite low, although P0.1 levels were normal. Respiratory capacity is calculated as the quotient of P0.1 and Plmax. It allows an estimation of the momentary stress of the respiratory muscles during inhalation. In present case, P0.1/Plmax came out to be 312%, a significantly high value that decreased to 94% after treatment. This showed that the patient made considerable effort to perform inspiration prior to treatment. The effective impedance of the respiratory system (P0.1/VT/TI) is dependent on inspiratory drive and mechanical load. It has been shown that the index increases linearly with respiratory workload [13]. This index was 3.28 kPa/(l/s) - 656% in the patient. After levodopa treatment, this index became 0.33 kPa/(l/s) - 65%. In the index case, levodopa therapy was started immediately after the diagnosis of PD, and improvement of obstructive and restrictive type ventilation dysfunction was observed. In addition, the importance of P0.1 values for early diagnosis of pulmonary dysfunction was emphasised in recent studies [14].

CONCLUSION(S)

It can be stated that there is a positive effect of levodopa treatment on respiratory muscle strength in patients with dyspnea in Parkinson's disease.

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