

Spirometry at Home: Technology Within the Patient's Reach

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Spirometry is a basic lung function test useful both for measuring and for monitoring expiratory volume. For many years monitoring has been performed by means of a portable peak flow meter capable of measuring maximal expiratory flow. We present a portable spirometer (Spirotel, Medical International Research, Rome, Italy) capable of transmitting stored lung function data from the patient's home by telephone. The device is easy to use, presents information graphically and numerically, and allows degrees of change in lung function to be monitored on-line. It may be useful for controlling asthma and work-related respiratory diseases.

Key words: *Spirometry. Portable spirometer. Patient's home.*

La espirometría en el domicilio del paciente: una tecnología al alcance de la mano

La espirometría es una prueba básica de función pulmonar útil para medir la capacidad ventilatoria a la vez que para monitorizarla. La monitorización se ha realizado durante años mediante un medidor portátil de flujos capaz de determinar el flujo espiratorio máximo. Presentamos un espirómetro portátil (Spirotel, Medical International Research, Roma, Italia) capaz de evaluar la espirometría en el domicilio del paciente y transmitir la información almacenada por vía telefónica. El equipo es sencillo de manejar, obtiene datos numéricos y gráficos y permite controlar *on-line* el grado de alteración ventilatoria. Puede ser de utilidad para el control del asma y en enfermedades respiratorias relacionadas con el trabajo.

Palabras clave: *Espirometría. Espirómetro portátil. Domicilio del paciente*

Introduction

Spirometry is a basic lung function test that can be used not only to measure ventilatory capacity at a given moment but also to monitor that capacity in certain diseases. Portable peak flow meters are commonly used for day to day monitoring of certain respiratory variables, leading to widespread use of peak expiratory flow (PEF) for the follow up of asthma in outpatient and emergency settings and for the diagnosis of work-related asma.¹

The appearance of new portable spirometers that are easy to use, capable of storing a large number of signals, and more importantly, that allow data to be transmitted over phone lines to a reception center, from which the receiver can dialog with the sender, will change the conventional practice of spirometry in some cases.²

The Spirotel device (Medical International Research, Rome, Italy) is a portable spirometer that was created to fulfill a need for spirometric monitoring at home and to provide a new tool for the new field of telemedicine. The objective of our study was to assess its efficacy under normal working conditions in which an asthmatic patient required spirometric monitoring on a daily basis from home.

Case Description

The patient was a 25-year-old woman diagnosed with mild persistent asthma. She had been treated for her disease in our clinic for the previous 5 years and was following a conventional treatment regimen with corticosteroids and inhaled bronchodilators. She visited the clinic reporting that her symptoms had grown increasingly unstable over a period of several weeks, with intermittent episodes of wheezing and dyspnea related to effort which required rescue doses of fast-acting bronchodilators. The patient was accustomed to using her portable peak flow meter to monitor her symptoms and control them in accordance with her clinical state and PEF reading. On this visit she was given a Spirotel portable spirometer together with the usual instructions. She was also

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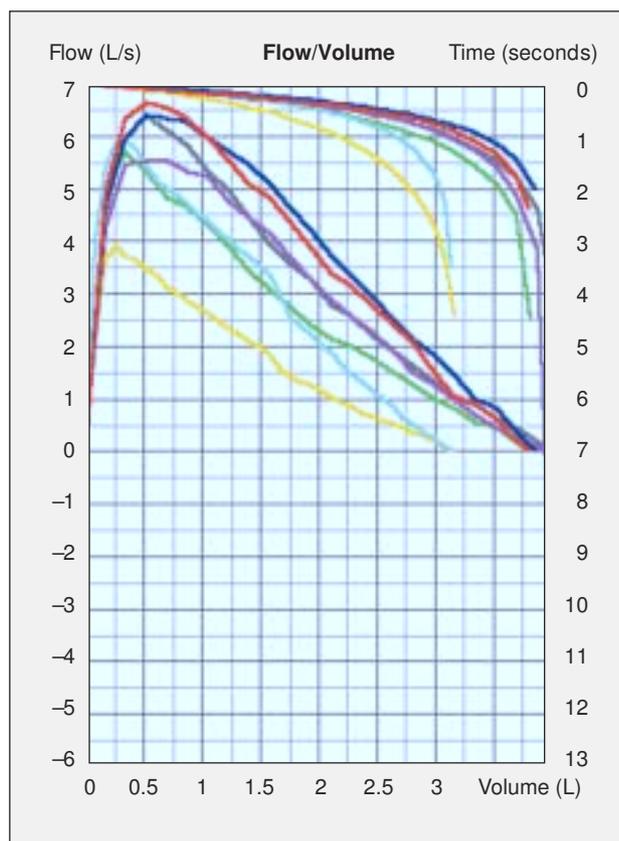


Figure. Spirometric curves (flow/volume and volume/time) obtained with a Spirotel device.

taught to send her spirometric data by telephone daily and keep a table of symptoms.

Results

The data correspond to the week from December 24-30, 2002. The Table summarizes the spirometric values (forced vital capacity, forced expiratory volume in 1 second (FEV_1), FEV_1 expressed as a percentage of predicted, and PEF), and the severity of the patient's symptoms (absent, moderate, or severe). On the third day, the patient reported that symptoms were moderate,

TABLE
Spirometric Variables and Patient symptoms During
the Week of Study*

Day	FVC	FEV_1	FEV_1 (%)	PEF (L/min)	Symptoms
12-24-2002	3.99	3.13	78	384	A
12-25-2002	3.82	2.86	75	344	A
12-26-2002	3.17	2.17	68	235	M
12-27-2002	3.14	2.66	85	356	M
12-28-2002	3.80	3.26	86	400	A
12-29-2002	3.97	3.10	78	332	A
12-30-2002	3.86	3.40	88	385	A

*FVC indicates forced vital capacity; FEV_1 , forced expiratory volume in 1 second; PEF, peak expiratory flow; A, absent; M, moderate.

coinciding with a significant decrease in spirometric variables. The figure shows the curve that allowed us to evaluate the correctness and quality of maneuvers. The rapid increase in medication allowed us to control the symptoms and the obstruction, thus avoiding a visit to the emergency room.

Discussion

The Spirotel portable spirometer has a turbine sensor that can be cleaned and sterilized. The device is powered by a long lasting battery and can perform all measurements available from conventional spirometers and store numerical and graphic data, such that the device is highly useful for monitoring the lung function of asthmatic patients. The data obtained can be easily sent by phone: the patient has to dial the receiver's phone number and draw the telephone near the spirometer while pressing the send button. The reception center must be equipped with a computer prepared to receive the telephone signal, although the data can also be input directly to the computer by connecting it to the spirometer with a RS232 cable. The apparatus is light (100 g) and can store data from more than 100 spirometric maneuvers.

In our patient, the presence of symptoms coincided with a worsening of bronchial obstruction and, logically, a decrease in PEF. The possibility of telephone contact during the period of the study gave the patient greater peace of mind, which in turn allowed her to celebrate Christmas as she wished.

Lung function in patients with asthma can be monitored adequately with a portable peak flow meter.³ However, complete spirometry allows the clinician to follow the evolution of FEV_1 , which is less susceptible to change due to effort. The graph allows the quality of a maneuver to be gauged. In our patient's case, we were able to detect errors (e.g. diminished forced vital capacity due to a defective ending to a maneuver).

In summary, the Spirotel device yields a full spirometric signal that can be transmitted over a simple telephone. Lung function data can be sent from the patient's home to a reception center where decisions are taken. The acceptability of this equipment, however, will depend on issues other than those discussed in this technical note. Trials with several types of patients in different circumstances with other diseases must be undertaken, as must studies aiming to assess the cost-effectiveness of this technology before it can be used widely.

REFERENCES

1. Cross D, Nelson HS. The role of the peak flow meter in the diagnosis and management of asthma. *J Allergy Clin Immunol* 1991; 87:120-8.
2. Cooper BG, Madsen F. Spirometry. *Eur Respir Buyers* 2000;3:40-3.
3. Powell H, Gibson PG. Options for self-management education for adults with asthma. *Cochrane Database Syst Rev* 2003;(1):CD004107.