

Chapter 12

Remote Electronic Monitoring in Chronic Pulmonary Diseases

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ABSTRACT

In this chapter the main aspects of telemonitoring are described and discussed in the field of chronic respiratory diseases. The authors describe the various challenges they faced, in the order in which they did. First, they face the problem of effectiveness of the method, then, the problems related to the economic viability, and finally, the problems related to the operating method. The authors conclude that remote monitoring is a promising method in terms of effectiveness of follow-up that must be performed under well controlled conditions. They still require further validation studies to improve the effectiveness and reduce the effects of new issues that arise.

1. CLINICAL ASPECTS

Background

Innovative technologies and informatics applied to medicine offer both health operators and patients a wide range of services that have changed the traditional concept of health care. In the last few years, the availability of handy equipment, easy to transport and use, and suitable to collect and transmit various clinical data, have resulted in a fast development of Homecare. The earliest application of Telemonitoring has involved the follow-up

of acute patients affected by arrhythmia or heart failure, diabetes, acute respiratory insufficiency as bronchial asthma, the control of breast-feeding mothers during lactation and the assessment of post surgery patients (Scalvini, 2004).

Only recently Telehomecare (THC) became an opportunity for the follow-up of chronic diseases such as cardiopulmonary, bronchial asthma and heart failure (Meystre, 2005), although the impact of Telemonitoring on patients' conditions still remains uncertain (Paré, 2007).

The natural course of Cystic Fibrosis (CF) is characterized by a progressive lung destruc-

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tion, caused by obstruction of the airways due to dehydrated thickened secretions, resultant endobronchial infection and an exaggerated inflammatory response leading to development of bronchiectasis and progressive obstructive airways disease (Flume, 2006).

Prevention and control of lung infections is one of the main objectives of therapy in CF patients with the aim to slow down the progressive decline of the pulmonary function (Que, 2006).

Many researchers demonstrated that, in case of infectious relapse, pulmonary function modifications often precede the clinical symptoms and that monitoring variations in pulmonary function can be useful in children and in adults (Davis, 2001) (Mohon, 1993).

Early recognition of infectious relapse allows to promptly administer an antibiotic therapy, to prevent serious complications, and to use less aggressive therapies (Rajan, 2002).

Since 2001 distance monitoring of lung parameters has been used in the follow-up of patients with CF in the Cystic Fibrosis Centre of the Bambino Gesù Children's Hospital - IRCCS - in Rome.

In 2009 we have published data from the first years of this activity (Bella, 2009).

Purpose of this study was to assess the effect of THC in the follow-up of CF patients, by systematically monitoring respiratory parameters (O₂ saturation during the night and spirometry), to early detect pulmonary infectious relapses, and to measure the impact on respiratory function over time.

Materials and Methods

Study Design

We performed an open label trial in a population of CF patients followed in our reference centre for CF from 2001 to 2005.

Patients were considered eligible to enter the study if they presented multiple infectious lung relapses (more than 3-4 episodes in a year) and/

or significant decrease of mean FEV₁ (more than 10% in a year).

The intervention consisted in administering THC in addition to standard therapy. THC was assigned to the first patient seen in the week, who satisfied the eligibility criteria. A group of controls was chosen among patients visited on the same week, matching for respiratory function, bacterial colonization, sex, age and complications. The main outcome parameter measured considered in the study was the FEV₁ values over time. To standardize for individual characteristics, FEV₁ Zscores were calculated considering average FEV₁ and standard deviation measured in the 12 months before entering the study. FEV₁ was then measured during follow up, and Zscores calculated and compared in the two groups. To all patients, regardless of intervention assignment, were provided antibiotic treatment and therapies according to current treatment guidelines (Cystic Fibrosis Foundation, 1997).

Intervention

Telemonitoring was performed using Vivisol OXITEL M32 (www.vivisol.com), a digital multi-parametric recorder with integrated saturimeter. Oxitel M32 is a multi-channel recorder, which is able to receive data from external devices, such as spirometers. Spirometries were obtained using a Vivisol One Flow Spirometer linked to Oxitel by cable. Both patients and parents were trained by the physicians centre, being part of the multi-disciplinary CF care team, using the equipment. OXITEL can record and store overnight SaO₂ and pulse rate. Home recording of SaO₂ was carried out through the night. Spirometer measurements were performed in the morning, after chest physiotherapy for mucous drainage. The collected data were automatically sent by a modem via the public telephone line to a dedicated Personal Computer located in the CF Unit, and decrypted by a dedicated software. Data were collected and interpreted by the CF Unit medical team during

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