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Ocena spirometryczna populacji wiejskiej gminy Rejowiec

Spirometric assessment of the rural population of Rejowiec Commune

Streszczenie

Wstęp. Badania czynnościowe płuc pozwalające mierzyć składowe objętości i pojemności powietrza w płucach należą do najdawniej stosowanych prób czynnościowych. Umożliwiają diagnostykę schorzeń układu oddechowego, wstępną lokalizację zaburzeń, ich dynamikę, odwracalność, a także wysuwanie wniosków prognostycznych.

Cel. Celem badań było wykonanie przesiewowych badań spirometrycznych wybranej populacji, ukierunkowanie dalszego postępowania diagnostycznego oraz edukacja zdrowotna w zakresie przewlekłych schorzeń układu oddechowego.

Materiał i metoda. Badania objęły 273 dorosłych mieszkańców gminy Rejowiec. Przeprowadzone za pomocą przenośnego urządzenia MicroLab Spiro. Do oceny wyników spirometrycznych użyto wartości należnych wg American Thoracic Society (ATS).

Wyniki. Analizując wartości średnie parametrów spirometrycznych w zależności od płci stwierdzono nieco wyższe wartości u kobiet dla parametrów – FEV1, FVC, FEV1%FVC. Wskaźnikami, dla których większe wartości stwierdzano u mężczyzn, był PEF%, MEF50% oraz MEF25% ($p<0,05$). Wśród osób poniżej 50 r. ż. stwierdzono statystycznie niższe wartości PEF, FEV1, MEF75%, i MEF50% w porównaniu do osób powyżej tej granicy wieku. Zaburzenia o charakterze obturacyjnym stwierdzono u 2,56% osób, z restrykcją u 8,06%. Przeprowadzone badania wskaźnika BMI ujawniły u 84 osób otyłość I i II stopnia. Zanotowane wartości wskaźników spirometrycznych (FEV1, FVC, MEF50%, MEF25%) u tych osób były istotnie niższe ($p<0,05$) w porównaniu do osób z prawidłową masą ciała. Wśród osób palących tytoń stwierdzono istotnie niższe średnie wartości parametrów spirometrycznych w stosunku do osób niepalących (FEV1, FEV1% FVC, PEF; $p<0,05$).

Wnioski. Zarówno palenie tytoniu, narażenie na pył organiczny, jak i nadmierna masa ciała odgrywają istotną rolę w rozwoju przewlekłych schorzeń układu oddechowego, które wyrażają się w postępującym spadku wartości spirometrycznych.

Słowa kluczowe: spirometria, badania przesiewowe, nadwaga.

Abstract

Introduction. Lung function tests are the oldest methods used to measure the air volume and capacities of the lungs. Such tests make it possible to diagnose respiratory disorders, localize them, assess their dynamics and reversibility, as well as set forth the conclusive prognoses.

Aim. The aim of this study was to perform a screening spirometric examination among a chosen population with an indication for further diagnostic action and health education in the sphere of chronic diseases of the respiratory system.

Material and method. The examinations covered a group of 273 adult inhabitants of Rejowiec Commune. The measurements were taken with the use of a portable MicroLab Spiro apparatus. The reference values in accordance with the American Thoracic Society (ATS) were used for the evaluation of the spirometric results.

Results. The analysis of the mean values of individual spirometric parameters in relation to sex shows slightly higher values of FEV1, FVC, FEV1%FVC for women. For men, higher values were assessed for PEF%, MEF50%, and MEF25% ($p<0.05$). Statistically lower PEF, FEV1, MEF75%, and MEF50% values were observed in people under the age of 50 in comparison to people over this age limit. In 2.56% of the examined population, obstruction type impairments were observed (restriction type impairments - 8.06%). The results of the BMI calculation revealed I and II stage obesity in 84 people. The spirometric parameter values (FEV1, FVC, MEF50%, MEF25%) in this group were significantly lower ($p<0.05$) than in the group of people with proper body weight. Significantly lower mean values of spirometric parameters were observed in smokers, in comparison to non-smokers (FEV1, FEV1%FVC, PEF; $p<0.05$).

Conclusions. Smoking tobacco, exposure to organic dust as well as overweight play an important role in the development of chronic respiratory diseases and are expressed in a decrease in spirometric values.

Key words: spirometry, screening, overweight.

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INTRODUCTION

The basic function of the respiratory system is gas exchange. Efficient functioning of that mechanism, together with the circulatory system action, is the most crucial factor making life possible.

Spirometry enables to measure lung volume and capacities during static conditions, independently of time lapse and dynamic conditions, through the time dependent tests [1,2]. Such tests make it possible to diagnose respiratory disorders, localize them, assess dynamics and reversibility, as well as set forth conclusive prognoses.

Lung volumes measured during calm respiration reflect the elasticity of the lungs and the chest. Vital capacity (VC) is the maximal capacity of air which can be removed from the lungs during slow expiration that follows the maximal deep inspiration [3]. The next often used parameter is the forced vital capacity (FVC). This value was introduced in the 1960s and it is a dynamic parameter which measures the maximal forced expiration preceded by the maximal inspiration [4].

The most important dynamic parameter is the forced expiratory volume (FEV). Its value may differ, as it depends strongly on the force of the respiratory maneuver. The differences are relatively small and range from 100ml to 200 ml, being smaller for the maximal expiratory force than for the sub-maximal force. It is caused by a slight bronchoconstriction during the maximal forced expiration [5]. FEV is most frequently measured in one second of expiration (FEV1), starting from the position of the total lung capacity (TLC) and it constitutes over 75% of FVC. FEV1 is a widespread parameter. The most important factor for the FEV1 value are VC and airways diameter. The FEV1 value is also defined as a percentage of VC (FEV1%VC) or FVC (FEV1%FVC) and, in this form, it is called the Tiffenau index. Because of the simplicity of the procedure and a very good repeatability, the FEV1 test is the most common and the most frequently quoted respiratory efficiency test both in clinical practice and in epidemiological type analysis [6].

The parameter that reflects air flow through the main bronchi is the peak expiratory flow (PEF) which depends mainly on the force of expiratory muscles and efficient cooperation with the patient.

An analysis of the parameters characterizing air flow through small bronchioles with a diameter below 2 mm (MEF25%, MEF50%, FEF25%-75%) is important because the changes in these parameters can precede the changes in FEV1, FEV1%VC [7,8].

Ventilation impairment that is obstructive in type can be explained as a disproportion in which the maximal respiratory air flow is reduced in comparison to the maximal lung capacity (VC). The reduction of FEV1, FEV1%VC and PEF – the parameters characterizing air flow through the large and medium bronchi – is most characteristic for this impairment. A secondary effect, which can also be observed, is a decrease of VC. It results from worse air provision by some of the pulmonary segments and the impairment of the airways potency and is connected with an existing inflammatory process or allergy [9,10]. A decrease in the parameters of the final expiration stage (MEF25%, MEF50%, FEF25%-75%) is caused by the obstruction of peripheral bronchi, which produces air flow reduction. These kinds of changes are significant for the small airways syndrome, which is common in smokers. Similar changes can be observed in the early stages of chronic obstructive pulmonary disease (COPD). The presence of this type of respiratory impairments can be the pre-stage of an irreversible and progressive respiratory obstruction syndrome [11].

Restrictive impairments can be physiologically characterized as the reduction of TLC. A decrease in this value is caused mainly by the VC reduction. The restriction can be caused primary by pulmonary diseases, e.g, interstitial fibrosis, inflammatory or neo-plastic infiltration of the pulmonary tissue. Functional loss of alveolar pulmonary tissue can be also caused by changes in pleura (fluid, pneumothorax, adhesion) or by the impairment of the chest which reduces its mobility, e.g, because of obesity or neuromuscular diseases.

To diagnose the restrictive syndrome, spirometric parameters characterizing air flow through the airways are required, similarly to the process of diagnosing the obstruction. It results from the ability of VC values reduction in the obstructive syndrome. The main difference between restriction and obstruction is the right value of FEV1%VC in restriction. The secondary impairments resulting from a reduced VC value are the expiratory flow parameters (FEV1, PEF, and FEF – all of them below normal values).

Functional disorders of obstructive and respiratory types very often coexist and form a mixed type [12].

The respiratory system, much like any other organ in the human body, undergoes involuntary processes, which is purely a physiological phenomenon. Such changes are caused by ageing of pulmonary tissues, an increase in the rigidity of the chest, and a decrease in the efficiency of the respiratory muscles.

What is more, physiological ageing of the lungs reinforces the harmful influence of other environmental conditions, such as the exposure to atmospheric pollution, harsh work surroundings and, above all, tobacco smoking, which inflicts the most considerable changes. The biggest danger for the farmers, who constitute the most numerous group among the examined people, is organic dust that is widespread in farmers' workplace.

Another significant factor that influences the values of ventilation parameter is the body weight. Excessive accumulation of fatty tissue in the body becomes an essential problem which can, in consequence, lead to many chronic and ventilation diseases. Overweight and obesity do not have homogeneous etiopathogenesis. The most frequent causes are inadequate nutrition and lack of physical activity, but metabolic disorders, genetic predispositions, impairments in the nervous system function (dysfunction of the hypothalamus, disorders of the hypothalamic-pituitary axis), hormonal impairments and taking great amounts of medications, very often without a physician's supervision, are also important. Moreover, the reduction of immunological resistance of pulmonary tissue that progresses together with ageing and the probable infective complications are the additional factors that decrease the efficiency of lung ventilation.

AIM

The aim of this study was to perform a screening spirometric examination among a chosen population with an indication for further diagnostic action and health education in the sphere of chronic diseases of the respiratory system.

MATERIAL AND METHOD

The examination covered the rural population of Rejowiec Commune. The patients were the volunteers recruited during a social-scientific camp organized by the Medical University of Lublin. The examined were informed of the possibility of taking part in the spirometric examination by physicians and through the advertisements placed around the communal area.

The measurements were taken with the use of a portable MicroLab Spiro apparatus. Each person was informed about the character, the aim, and the non-invasiveness of the performed tests. The patient history and personal data were written down in a standard survey.

The spirometry test was performed three times in each patient, with 30-second breaks in-between to allow people to take a few calm breaths.

The tests that were carried out enable us to measure some of the ventilation efficiency parameters: FEV1, FVC, FEV1%FVC, PEF, MEF50%, MEF75%, FEF25%-75%.

The reference values in accordance with the American Thoracic Society (ATS) were used for the evaluation of the spirometric results. The Quetelet Index (BMI – Body Mass Index), which is a simple method of body mass assessment (current body weight (kg) /height^2 (m)), was calculated for each participant. The assessment of the body mass, depending on the BMI value, with accordance to WHO, is presented below: norm 18.5 – 24.9; overweight 25.0 – 29.9; obesity 30.0 – 39.9; heavy obesity > 40.0.

RESULTS

The population examined in the project consisted of the residents of Rejowiec Commune. The examinations covered a group of 273 people, including 85 men (68.86%) and 188 women (31.14%). The most numerous group consisted of people aged 50–70, constituting a total of 41.03% persons.

Tobacco smoking is listed among the environmental factors that cause impairments of lung ventilatory reserves most frequently. Connected to this subject was a survey carried out before the proper examination. It was verified that 62 people were current tobacco smokers (22.71%). Smoking was observed more frequently in men (25.88%) than in women (21.27%). It was estimated, based on the collected data, that, in the past, smoking was attributed to 23.44% of the respondents. People who had never smoked tobacco constituted a total of 53.85%.

Overweight or obesity was also observed, based on BMI value, in 65.2% of patients. Overweight concerned a total of 94% of the patients, while obesity was observed in 84 people.

The analysis of the mean value of individual spirometric parameters in relation to sex shows slightly higher values of FEV1, FVC, FEV1%FVC for women. For men, higher values were assessed for PEF%, MEF50%, and MEF25% ($p<0.05$). All the mean values of the examined parameters were within the normal range. Statistically lower PEF, FEV1, MEF75%, and MEF50% values were observed in people under the age of 50 in comparison to people over this age limit.

The results of the carried out tests revealed disorders in 29 people (10.62%).

In 2.56% of the examined population, predominantly among men, obstruction type impairments were observed. Restriction was observed more often than obstruction, as it was found in 22 people (8.06% of the all examined), with slight predominance of women. Each case of restriction was accompanied by overweight or obesity. Mixed type obstructive–restrictive impairments were not found. Among the obstructive patients severe and moderately severe types were predominant, while mild and moderate types were characteristic for people with the diagnosed restriction (according to the GOLD criterion). The results of the BMI calculation revealed stage I and II obesity in 84 people. The spirometric parameter values (FEV1, FVC, MEF50%, MEF25%) in this group were significantly lower ($p<0.05$) than in the group of people with a proper body weight. Significantly lower mean values of spirometric parameters were observed in smokers, in comparison to non-smokers (FEV1, FEV1%FVC, PEF; $p<0.05$).

DISCUSSION

COPD is diagnosed in different countries and concerns from 8% to 15% men and from 3% to 5% women. In Poland this percentage equals 8.5% and 4.9%, respectively [13]. In highly developed countries, COPD causes death of one in four people [14]. There are reports on the equalization of COPD morbidity among women and men [15], and the most probable reason for this is the changing characteristics of exposure to tobacco smoke for both sexes. Only until recently it was men who were more exposed to it. The results of our examination reveal equalization of the percentage of smokers in both sexes. COPD concerns mostly tobacco smokers, but people who breathe in tobacco smoke passively are also exposed to it [16]. However, to associate this disease only with smoking is too much of a simplification. Nevertheless, it is a fact that smoking is the most important cause of respiratory obstruction that can be eliminated.

The spirometric examination carried out by Zieliński and op. cit. in the Bydgoszcz area showed disorder of ventilatory lung reserve in 21.4% people [17]. The objective of the examination was an environmental early stage diagnosis of the ventilatory impairment of the respiratory system. Obstruction constituted 18.7% and 2.7% was interpreted as a restriction syndrome. A lower frequency of obstructive disorders showed in the research seems surprising, but this can be explained if we take into consideration the prevalence of the smoking habit among young people (under 30) and a small number of collective years of smoking. It may also be

the result of the differences in the selection of patients. The number of active smokers and past smokers, who took part in the Bydgoszcz research, constituted a total of 80%, while the percentage of current smokers in the Rejowiec Commune residents, who took part in the examination, was twice as low.

Among the examined people from Rejowiec Commune, there were patients who represented different occupations, i.e, farmers and foresters. In such workplaces, there is exposure to harmful factors and huge organic dust concentration that act on the respiratory system. What is more, the results of our research showed that a big percentage of people with excess weight had significantly lower values of FVC and FEV1, which confirms the observations of Chinn and opp. cit.– who reported that one kilogram increase in body weight causes the decrease of FEV1 by 17.6 ± 2 ml and of FVC by 21.1 ± 2.5 ml [18]. These results are in agreement with Jones's results [19].

It is possible that such factors (organic dust concentration in the place of work in particular) [20, 21] could affect the occurrence of a higher percentage of airways ventilatory impairment of a restriction type (8.06%).

Our results suggest that there is considerable demand for this type of screening. There is hope that if such preventive examinations were combined with broadly understood education and anti-nicotinic consultancy, it would cause reduction of morbidity from chronic respiratory diseases.

CONCLUSIONS

1. An impairment of the lung ventilation reserves was observed in over 10% of the examined residents of Rejowiec Commune.
2. Smoking is one of the most important causes behind the development of obstructive airways disorder.
3. Along with age, overweight and exposition to organic dusts cause faster reduction of spirometric parameters.
4. The results of our spirometric tests show a need for performing similar preventive examinations, particularly among residents of small villages and in rural regions.

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