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LUNG FUNCTION TEST WITH BODY-PLETISMOGRAPH AND DIFFUSION MEASUREMENT IN DIAGNOSIS OF OCCUPATIONAL LUNG DISEASES

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ABSTRACT. Lung function test using the body-plethysmograph in a 17 patients study group from professional environment with exposure to irritant gases and vapours found significant changes in residual volume and airway resistance to flow. These changes are also accompanied by abnormal alveolo-capillary diffusion. Data obtained with the body-pletismograph Piston which is featured with the measurement of the gas diffusion capacity mode of the alveolo-capillary membrane, correlated with the results of simple spirometry performed during the periodical medical examination and with the clinical and paraclinical examinations obtained during the hospitalization at the Occupational Health Department, offers a correct and early diagnosis of the lung affections from the professional environment, which also involves a fair therapy and an efficient recovery of work capacity.
Keywords: body-pletismography, diffusion, COPD, asthma, irritant gases and vapours

INTRODUCTION

A certain diagnosis in pulmonary diseases from the professional environment is a cornerstone in the context of concern for health and safety in the workfield. Most of the times, the clinician has to establish a diagnosis of asthma or professional COPD without having access to the most modern exploration in this regard, namely body-plethysmography, also with the measurement of the gas transfer at the alveolo-capillaries membrane level.

MATERIALS AND METHODS

The study was performed on a number of 17 patients hospitalized in the Occupational Healt Department in Targu Mures during April to June 2010. The 17 patients were directed to the hospital after the periodical medical examination, when there were found different changes of the spirometry values.

RESULTS AND DISCUSSIONS

Besides the usual spirometry and normal clinical and laboratory examinations done in any respiratory disease, the patients had their airway resistance to flow, the residual volume and the alveolo-capillary diffusion measured.

The statistical data that were analyzed showed that patients' ages are between 17 and 61 years, with the following stratification (figure 1).

Regarding the vital capacity (FVC), only 35.29% of patients had normal values of vital capacity, the others showing various levels of low values, as follows (figure 2).

Analyzing the maximum expiratory volume per second (FEV 1) at the 17 hospitalized patients also like FVC, was noticed that only 35.29% had normal values, while the others showed various levels of obstruction, as follows (figure 3).

By analyzing the peak expiratory flow (PEF) was shown that only 17.65% of the patients had normal values of PEF, while the others showed decreased values, as follows (figure 4).

By analyzing the peak expiratory flow (PEF) was shown that only 17.65% of the patients had normal values of PEF, while the others showed decreased values, as follows (figure 4).

Looking at the obstruction level in the small airways by the most reliable indicator in this way, which is the interval expiratory flow FEF 25-75, is found that most patients have different levels of small airway obstruction, as it can be seen from the table and graph below (figure 5).

Using the body-plethysmograph it could be quantified the following parameters: TLV, TGV, RV, Raw, sRaw, and sGaw.

Analyzing TGV showed the following (figure 6).

Compared with TLC, TGV measurement shows the following results (figure 7).

There is noticed that there are some insignificant differences between TLC and TGV values, which is also expected.

Analyzing the residual volume (VR-PLETI) by pletismography method shows that most patients have increased values, which guides us to an emphysema component of COPD. VR-PLETI increases are generally significant, as follows (figure 8).

In a significant number of cases studied, there was an increase in airway flow resistance shown as follows (figure 9, figure 10 and figure 11).

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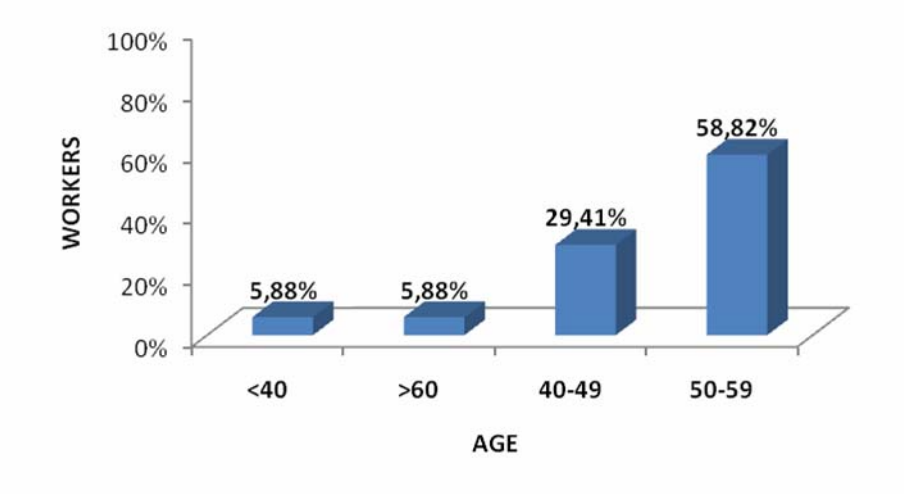

Fig. 1 Age analysis of the study group

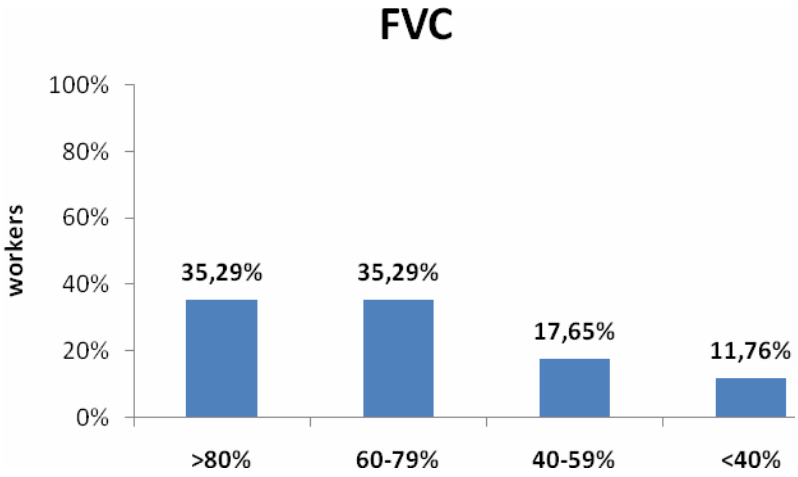

Fig. 2 FVC analysis

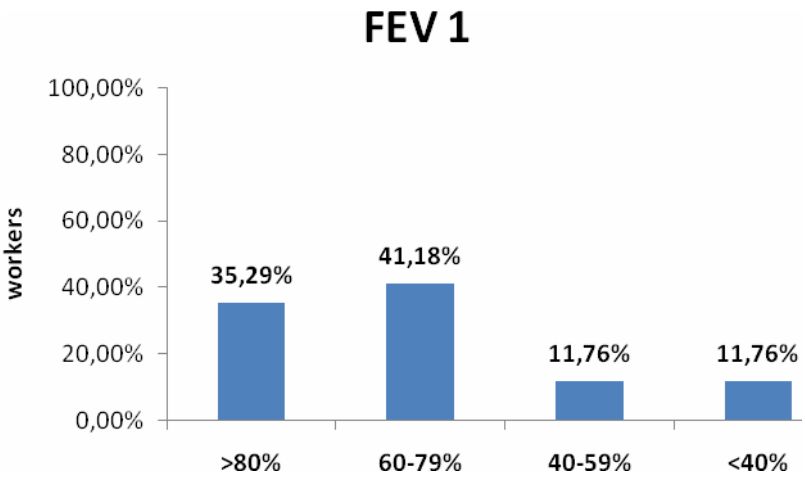

Fig. 3 FEV1 analysis

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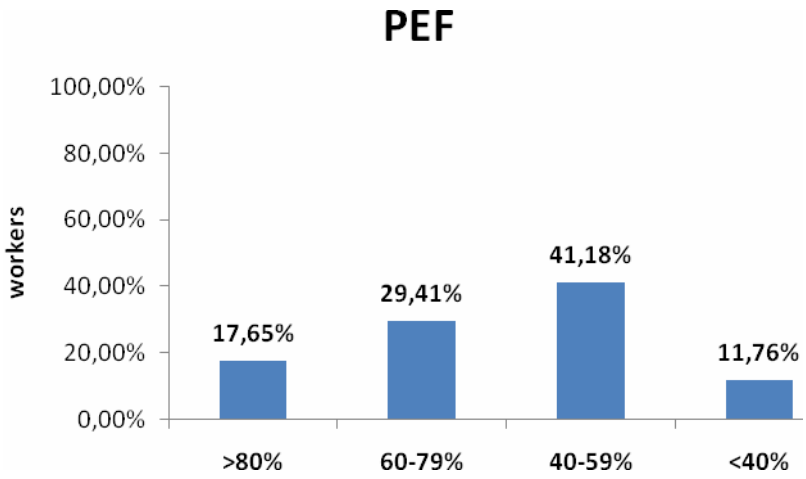

Fig. 4 PEF analysis

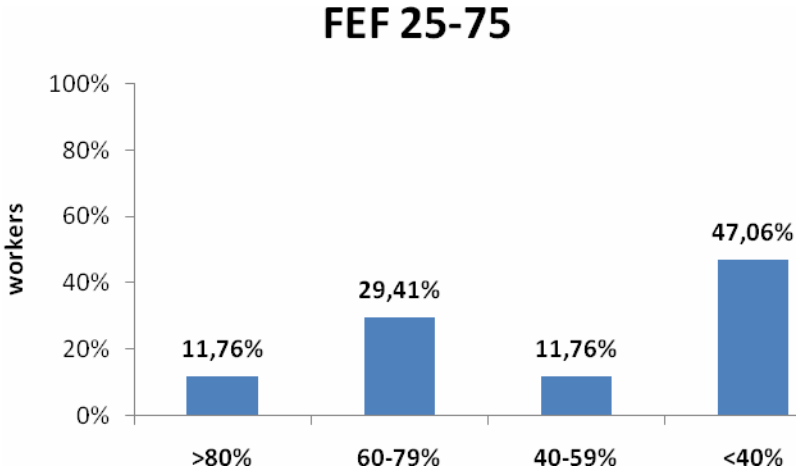

Fig. 5 FEF 25-75 analysis

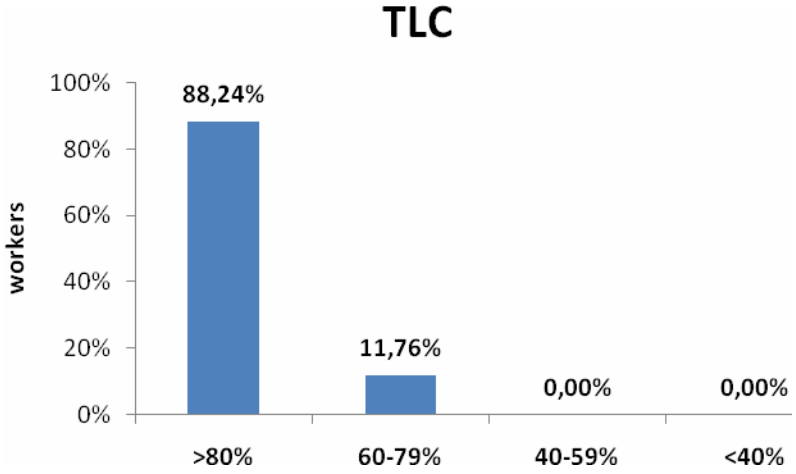

Fig. 6 TLC analysis

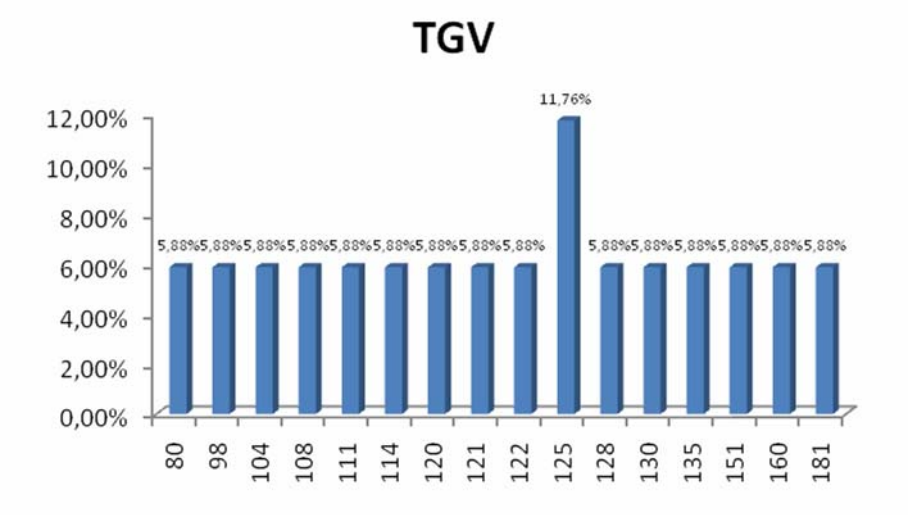

Fig. 7 TGV analysis

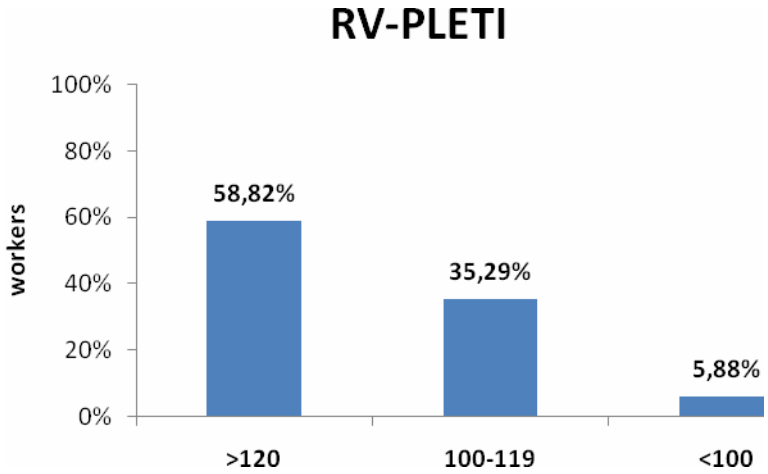

Fig. 8 RV analysis (by pletismography)

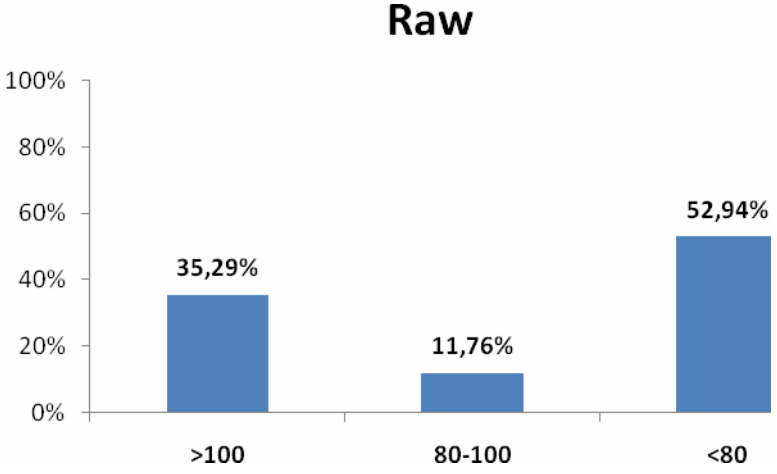

Fig. 9 RV analysis (by pletismography)

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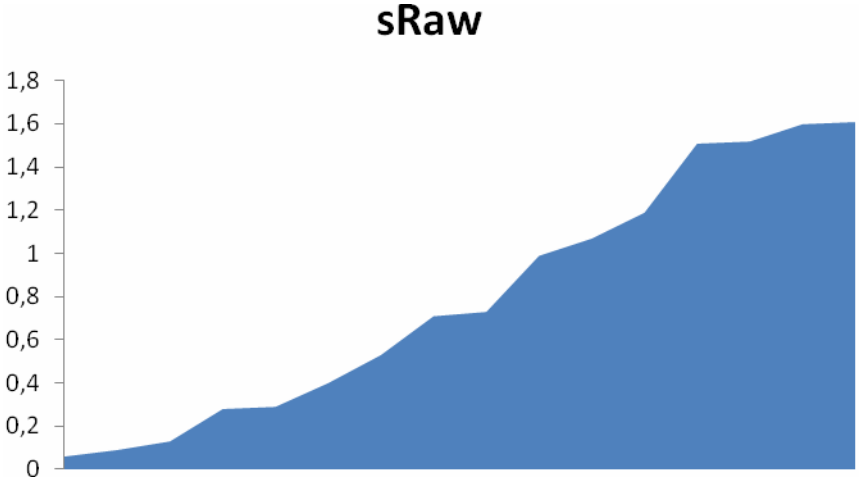

Fig. 10 sRaw analysis (by pletismography)

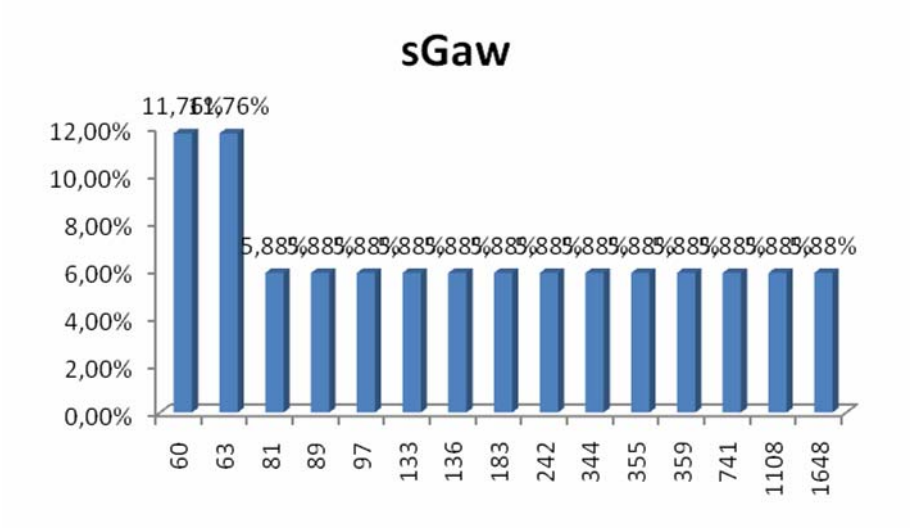

Fig. 11 sGaw analysis (by pletismography)

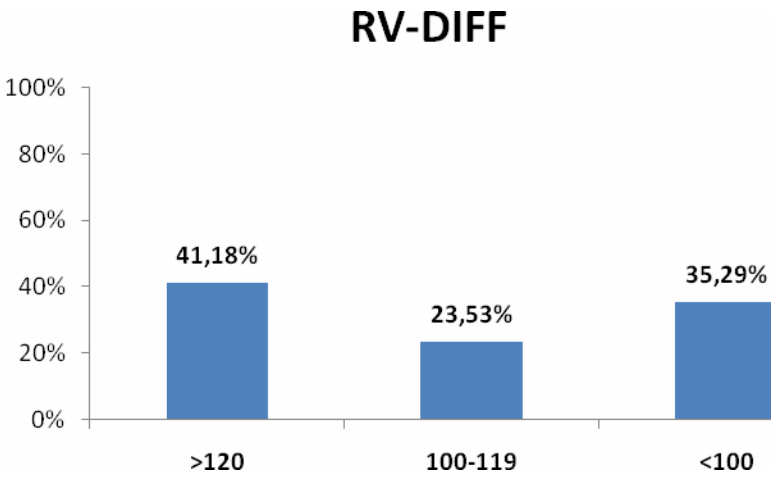

Fig. 12 RV analysis (by diffusion)

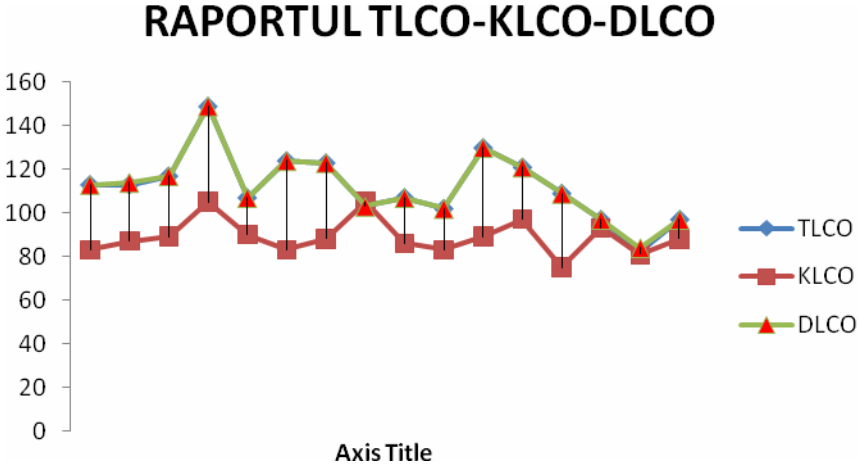

Fig. 13 TLCO/KLCO/DLCO analysis (by diffusion)

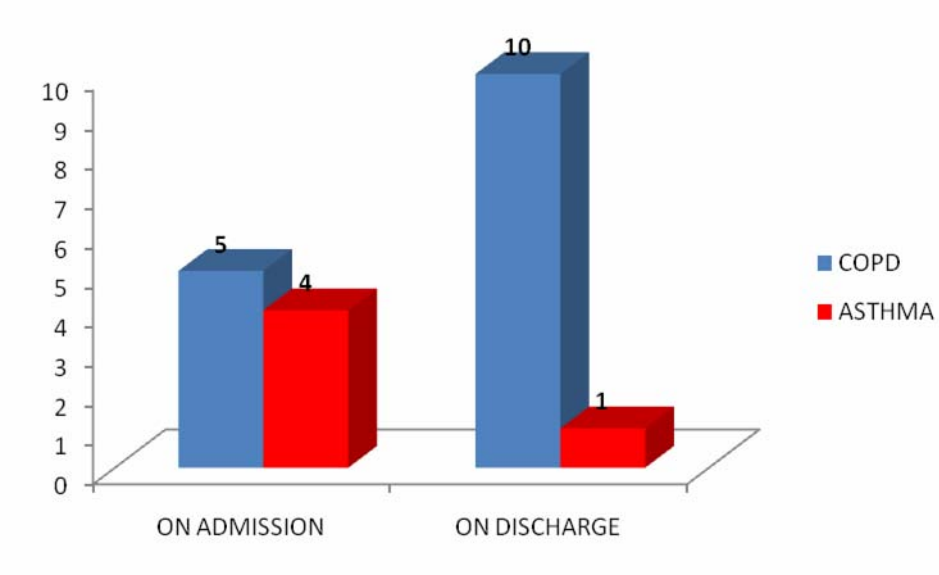

Fig. 14 The differences between admission and final diagnoses

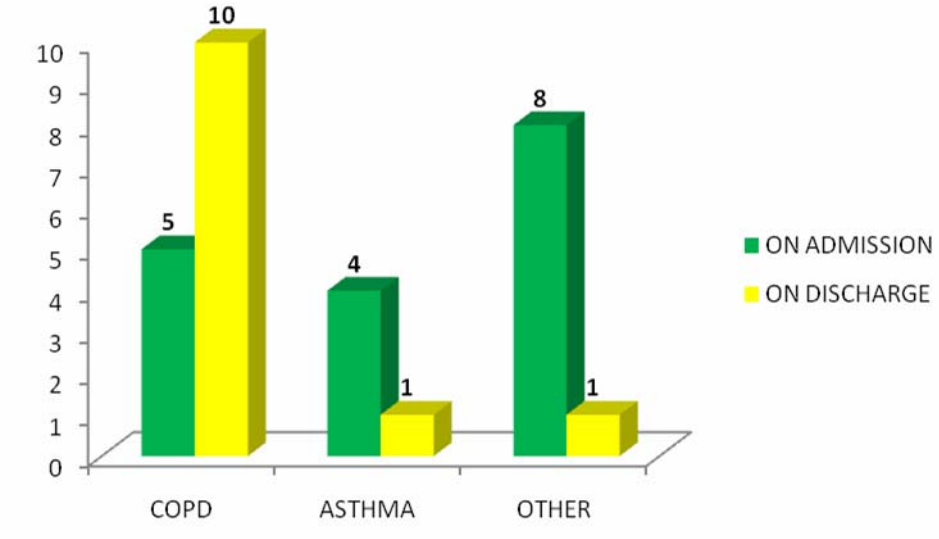

Fig. 15 The differences between admission and final diagnoses

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The residual volume was also measured by gas dilution method (RV-DIFF), achieving comparable results with those obtained by plethysmography method, but still with some differences, which we expected to have as it can be seen from the charts (figure 12).

RV and Raw changes just like the usual spirometry parameter changes were accompanied in some cases by the alveolo-capillary diffusion capacity adjustment, which signifies an advanced stage of lung disease caused by irritating gases and vapors but in a lower proportion, which justifies the use of these modern methods in early diagnosis of lung diseases in the work environment and may guide the clinician in managing the most appropriate treatment.

The analysis of the alveolo-capillary diffusion capacity is presented in the following chart (figure 13).

As a crowning of using these modern methods of diagnosis in lung diseases from the work environment it can be showed the significant difference between suspicion of the disease on admission to hospital and confirmation of lung disease on discharging from the hospital by the correct interpretation of data obtained with body-plethysmograph.

The differences between correct admission and final diagnoses, on discharge, are illustrated in the following table (table I) and graphs (figure 14 and figure 15).

Table 1

The differences between admission and final diagnoses

Diagnosis	On admission	On discharge
COPD	5	10
ASTHMA	4	1
OTHERS	8	1

CONCLUSIONS

The full body-pletismography can be considered the best method for proper diagnosis of pulmonary disease in occupational environments.

Most workers exposed to irritant gases and vapors who were hospitalized for various respiratory complaints have had varying degrees of emphysema.

The changes occurred in regular spirometry values at periodic medical checks are accompanied by increases in airway resistance to flow.

Body-pletismography together with alveolo-capillary diffusion measurement eliminates errors in diagnosis or inaccurate diagnosis of patients with occupational respiratory diseases.

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