Changes of respiratory function with diabetes and/or with the aging process

Variaciones de la función respiratoria con la diabetes y/o con la edad

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Abstract

Alterations in the pulmonary microcirculation and the possible changes in the parenchyma lead certain authors to consider the lung as yet another “target organ” in diabetes. Studies assessing the effects of chronic hyperglycemia on the spirometry have found changes in the cross-sectional measurements and longitudinal follow-up of the forced vital capacity and the forced expiratory volume in the first second. However, certain flaws in the method, the fact that the values fell within the limits of normality and their lack of clinical repercussions, question the continuing relevance of these findings.

Introduction

The spirometry is a procedure that assesses the lung function from measurements of the air volumes blown out after a maximum inspiration. The indexes derived from this maneuvering of forced expiration are the first tools that have to be used in order to study the repercussion of some diseases on the bronchial permeability and the lung volume. When comparing the obtained real values with the theoretical values of reference estimated as regards to age, weight, sex and ethnic, the level of affectation of the studied subjects can be determined. A spirometry is considered normal when the values of the forced vital capacity (FVC) (the basic measurement of dynamic lung volumes) and the values of the forced expiratory volume in one second (FEV$_1$) (the basic measurement of bronchial permeability) are over the 80% of the expected values and besides, the FEV$_1$/FVC coefficient is over 0.7.'

The changes that might appear in the explorations of one individual throughout time provide valuable information, but its real importance does not depend only on the magnitude of the variation in the values, but also on the relevance of the associated clinical findings. The accuracy that characterizes the spirometry depends on the strict respect to the rules of the procedure. The close collaboration of the studied subject (as it is a measurement that depends on the effort) are essential in order to obtain reliable results as well as regards to the training of the person who undertakes the exploration, the interpretation of a spirometry should be started revising and evaluating the quality of the manoeuvrings. It is a potential mistake to leave this step out and focus only on the numeral results which might generate incorrect diagnosis or inadequate therapeutic actions.

Diabetes and lung function

Observing the results collected since 1976 about the repercussion of the diabetes in the spirometry, it can be realized the frequency in which literature data appear clearly contradictory and the persistence with such changes of the function are discussed, that being even statistically relevant, are kept within the limits of normality and do not have a clinical repercussion. It is surprising to see how the speculative opinions are repeated in the “discussion” sections, referring one and again to the common resource of the possible thickening in the alveolar epithelium and in the centrilobular emphysema areas after the accumulation of collagen in the lung connective tissue.

This lack of consistency in the literature could be explained by several reasons: 1) though in a first moment the n of the functio-
nal studies was very small and (beyond the verification of the diabetic micro-angiopathy) and the relevant obtained pathological findings were scarce in human beings and animals, when providing these new and unexpected data, its weight in the medical opinion was notorious; 2) in some later studies with big size samples, the evaluation of the lung function was a secondary objective, and the procedures of exploration lacked of the adequate levels of specificity, sensitivity and accuracy; 3) occasionally, the information provided by the performed explorations was not enough in order to explain the nature of the findings, and 4) there are still no relevant studies available about the nature of the possible pathological changes in the lungs of the diabetic patients. The hypothesis that are arising about the general effects of the inflammation are, at least for the time being, not too consistent. 12

The Copenhagen City Heart Study13 was the first study with an adequate size sample. Though the main objective of this project was not to evaluate the lung function, the authors of the article, motivated by the findings of some small previous studies and by the interest generated by the possible incorporation of the inhalation route for the administration of insulin, analyzed the transversal results and the longitudinal changes of the FVC and the FEV1 in 280 diabetic patients. They found a light reduction in both measurements compared to the non-diabetic subjects, more marked in the subjects treated with insulin than in those administered with oral hypoglycemicant or than those who underwent a diet. However, the values were within the normal limits. The longitudinal follow-up14 of the functional values of these patients during an observation period of 5 years did not show a higher reduction compared to the non-diabetic subjects. However, the 126 participants who developed diabetes during the follow-up period showed (after adjusting for the age, sex, weight, and smoking) a significantly superior reduction than the non-diabetic patients. For the authors, these results suggest that, at the beginning, the diabetes is associated with a faster reduction of the lung function than when it is already established during several years. Fifteen years later,15 the results showed that the diabetic patients of the study had lower FV and FEV1 than the non-diabetic subjects, but with values within the normal limit. There have not been differences among the persons with diabetes and the non-diabetic ones as regards to the magnitude of the reduction of the values with the passage of the years. The care for the spirometry procedures and for the statistical analysis is a strong point of this article, but the authors themselves stress that the probable infraestimation of the number of diagnosed diabetic patients is a clear limitation, though they consider that the effect of such method mistake does not invalidate the consistency of their conclusions. They provide a valuable information about the transversal and longitudinal relation between the diabetes and the basic functional parameters and reject that among the complications at long term of the diabetes the respiratory functional alteration can be included, but they do not provide relevant information regarding to the responsible mechanism of the association between the initial reduction of the function and the diabetes. Through a reasoning that they qualify as “highly speculative”, due to the fact that the functional differences do not increase with duration of the diabetes, they assume the possibility that they might be related to a pre-existing factor. For example, the low weight at birth might be the link between the T2D and the reduction of the lung function in the adult.16,17

Walter et al.18 analyzed the data obtained from the Framingham Heart Study, another clinical project with a big sample size (n= 3,254), though it was not designed to study the lung function with priority and concluded that the diabetic patients had lower FVC and FEV1 than the non-diabetic subjects. Though the tables do not depict which was the percentage of the expected theoretical values of FVC and FEV1 that the study subjects had, the quotient FEV1/FVC of the two groups is within normality. Therefore, and in the absence of the total lung capacity (TLC) measurement—that the authors did not perform—there are no arguments in order to qualify as abnormal the observed changes. In another study19 published also in 2003, though the mean value of TLC of the group of diabetic patients (n= 16) was lower than the values of the control groups (n= 26), it was within the limits of normality. The TLC is the addition of the FVC and the residual value (RV); this last parameter is not obtained from a simple spirometry, and it is the reference measurement in order to evaluate a possible restrictive alteration.

A study was published in 200420 with an initial sample of 495 subjects with T2D, which passed to be 125 after a follow-up of 7 years. They belonged to a care observational, metabolic control and complications project developed in west Australia and included only European descendants. According to a self-administered questionnaire, they do not have lung diseases nor were they undergoing treatment with breathing profile. The authors concluded that the reduction of the lung volumes and the limitation of the airflow were, for sure, chronic complications of the diabetes, and that the reduction of the FEV1 percentage over the expected value was an independent predictor of mortality by all the cause. However, the study has important limitations: 1) serious doubts arise when reading it as regards to the adequacy of the procedures in order to obtain the spirometries and the interpretation of the results; 2) there is no information available about the smoking habits of the participants; 3) an important part of them had overweight/obesity (20/68%), and 4) once more, the measurements of the spirometry values were within the scientific limits, the consistency of the tests that support the conclusions are clearly insufficient.

In the study of Yeh et al. published in 2008,21 with a follow-up of 3 years of 1,100 diabetic patients and 10,162 non-diabetic subjects, some of these limitations are repeated. Though the quality of the functional exploration procedures was specifically supervised, the body mass index (BMI) diabetic patients was of 30.9 ± 5.7, a 52% of them were smokers or ex-smokers with a higher smoking habit (28 packages/years) and both the FVC (96% of the expected value) and the FEV1 (92.5%) values were normal. Finally, in a recent study of Berclaz et al.,22 though the differences in the initial measurement of the FVC and the FEV1 among the diabetic patients (n= 471) and the non-diabetic subjects (n=...
The Values of forced spirometry are lower in diabetic than in non-diabetic patients, although values remain within normality.

There are no consistent data available to suggest that the decrease with time of sphyrometric values might have clinical relevance or that it may be linked to hyperglycemia as a unique independent factor.

Although the decrease in lung function just after the diagnosis of diabetes is been described the pathogenic mechanisms involved are unknown.

References