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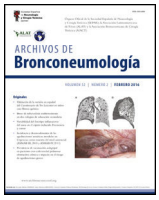

Editorial

The Future of Exercise Tolerance Testing☆

El futuro de las pruebas de esfuerzo

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Clinical data is generally obtained from 3 sources: the patient's subjective account of a perceived abnormality, the measurement of physiological or biological indicators, and the identification of anatomical changes, either by direct visualization or imaging techniques. The aim is threefold: to determine what is wrong with the patient, to predict the natural history of the disease, and to evaluate the efficacy of therapeutic interventions. One such physiological indicator is exercise tolerance testing. These tests can be used to measure a variety of physiological and biological indices when the systems involved are put under pressure to increase their function. A unique feature of these tests is that they are performed at a time when the systems are most likely to fail. Moreover, by reproducing the experience of individuals while performing activities, real, rather than reported, symptoms can be measured directly. This is important because dyspnea during exertion is both the major complaint of patients with chronic respiratory diseases and the most incapacitating consequence.

In diagnostics, exercise tolerance tests can reveal abnormalities, such as desaturation, bronchospasm, angina, and pulmonary or systemic hypertension that only appear during exertion.[1,2] Moreover, the sensitivity of these tests for detecting malfunctions of the systems involved in exercise makes them useful for accurately establishing the exercise capacity of an individual, and for determining whether the symptoms reported by the patient are due to a detectable alteration or occur in the context of mild, moderate or intense activities. Finally, if physiological measurements are made, the resulting patterns may be used to guide the differential diagnosis of the origin of the patient's intolerance to exercise.[1,2]

Exercise tolerance tests provide excellent information for determining prognoses. Exercise capacity has a universal predictive value that is systematically superior to standard risk markers obtained at rest.[3–5] Therefore, any intervention that might improve exercise tolerance would lead to a better prognosis. Studies consistently show that both aerobic capacity and distance walked on the 6-minute walk test are powerful prognostic factors for survival in patients with chronic respiratory diseases, and these parameters outperform all other tests for determining severity both in terms of life expectancy and symptoms.[3,5,6] Exercise tolerance also predicts the development of comorbidities such as hypertension, diabetes, and metabolic syndrome,[7] and the risk of comorbidity decreases or increases as exercise tolerance improves or worsens.[8]

Several studies have demonstrated the prognostic value of exercise testing in candidates for thoracotomy, and we know that patients with maximum oxygen consumption of less than 65% or 16 ml kg^{-1} min^{-1} have a significantly increased risk of complications, including death and respiratory failure.[9] The latest guidelines for the physiological assessment of lung cancer patients support the use of these tests in the evaluation of the peri- and post-operative risk.[10]

Any intervention that impacts positively on the cause of exercise limitation, whether pulmonary, cardiovascular or skeletal muscle function, will improve aerobic capacity, resistance to submaximal exercise and other variables, such as inspiratory capacity and dyspnea. Exercise tolerance tests are thus an essential component in the clinical follow-up of treatment for chronic respiratory diseases.[4] In clinical practice, they also provide the most sensitive indication of the efficacy of treatments for diseases in which the expected changes in lung function (except in asthma) and symptoms are of limited use (at least if we continue using a scale as insensitive as the mMRC).

Despite their considerable advantages, exercise tolerance tests are seldom used due to their relatively high cost, and also to a more insidious problem: no-one believes in them. The attitude of many practitioners toward the abstract physical and physiological concepts needed to understand these tests is lukewarm at best, and training in this area is neglected. Symptoms, which are often not even quantified in a standardized way in clinical practice, are given preference over objective measurements as the sole yardstick needed for diagnosis. We stick by this belief, even though we know that certain populations (men and women, patients with greater or lesser health literacy, patients with anxiety, etc.) have different perceptions of their symptoms, and no clinical trials have been performed to analyze the effects of treatment on symptoms in groups who perceive their symptoms differently. Moreover, it is not uncommon for patients to react to their symptoms, and in particular dyspnea, by limiting their activity to reduce the impact of

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the disease on their quality of life. This, however, will not help their prognosis, as it can cause clinicians to underestimate the severity of the disease.

The future of exercise tolerance testing depends, in our opinion, on several factors:

- Pulmonologists must understand how to use and promote their physiology laboratories (in many cases in order to avoid losing them); the core services they offer, including cardiopulmonary exercise testing and other tests of exertion, must be considered essential procedures, and they must be able to meet all the demands of other departments, including cardiologists. Their usefulness must be recognized and indications must be extended to apparently healthy or asymptomatic populations and to patients scheduled for intensive physical rehabilitation programs, in order to avoid the direct risks of exercise as well as to assess general life-long risk. To achieve this, more evidence must be generated to show that identifying high-risk individuals via exercise tolerance testing is cost-effective and optimizes physical activity programs, increases patient motivation, and provides a basis for designing a personalized exercise program. These procedures are also ideal for monitoring the effectiveness of such programs.
- Exercise tolerance testing will not become standard practice unless we develop courses and qualifications in exercise physiology in order to train other health professionals to perform these tests in patients at low risk of complications.
- Finally, the formats and patient reporting system must be simplified where possible, and users should be trained in the interpretation of the most relevant variables, making them more accessible to health professionals, and even to patients with no training in physiology.

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