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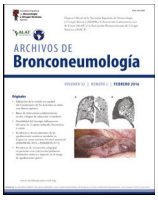

Editorial

Relevance of Respiratory Muscle Function Assessment in Respiratory Disease

Relevancia de evaluar la función de los músculos respiratorios en la enfermedad respiratoria

Dear Editor:

Assessing respiratory muscle function is crucial for clinicians, physiologists and researchers. Several methodological developments over the past twenty years have increased our understanding of respiratory muscle function and responses to interventions in health and disease. Substantial research has been done over the past two decades, since the publication of the 2002 American Thoracic Society (ATS)/European Respiratory Society (ERS) statement on respiratory muscle testing,[1] in the field of breathing mechanics, respiratory muscle neurophysiology and imaging, in adults and in children and critically ill patients in the intensive care unit (ICU).

A recently published ERS task force statement assessed the field of respiratory muscle testing in health and disease.[2] This statement critically evaluated the most recent scientific and methodological developments regarding respiratory mechanics and muscle assessment. A An original and novel approach was applied which allowed to address several characteristics of various methods: (1) the validity (i.e. the extent to which a test or variable is related to the function of a physiological system or to patient-meaningful variables, such as symptoms or exercise), (2) precision, (3) reproducibility, (4) prognostic information (i.e. relationship with the natural history of the disease), (5) discrimination (i.e. whether a variable can differentiate the severity of the disease as conventionally measured), (6) clinical meaningful difference (i.e. the minimal difference in a tested variable that is considered to be functionally worthwhile or clinically important) and (7) responsiveness to interventions.[2] A particular emphasis was given to evaluation during exercise, which is a useful condition to stress the respiratory system.

This editorial aims at spreading out this statement[2] with the purpose of stressing the relevance and promoting the culture of respiratory muscle function assessment in respiratory disease. In this regard diverse methods are now available[2] for the assessment of the respiratory muscles; however it should be born in mind that the technique used should be tailored to the question raised, as they are especially useful in diagnosing, phenotyping and evaluating treatment efficacy in patients with respiratory symptoms and neuromuscular diseases (NMDs). This could be a major problem: having requested the specific test, the clinician has then to decide what to do with the result, and here the process becomes much more difficult. Several reasons may be recalled here: (1) the difficulty for some patients to perform the test; this requires good technique from both the physiologist and the patient, and this also applies for tests considered as routine evaluations such as maximal static inspiratory and expiratory mouth pressure (PImax and PEmax, respectively); (2) the obtained values can be affected by factors such age, comorbid disease, ethnic differences and so on; (3) the normal range could be quite wide, and sometimes several normal ranges have been reported; (4) the technique of performing the tests may vary from laboratory to laboratory. This statement responds to each and every question raised before and tries to answer in a coherent and logical manner, by stressing the importance of the Lower Limit of Normal (LLN) because in medical practice mean normal population values are of very little interest, the relevance of the technique being used, and last but not least the specific clinical question posed by the clinician.

In this ERS statement[2] remarkable advances in respiratory muscle and lung mechanics assessment in the past few decades have come up, and three of them merit to be highlighted here.

First, the noninvasive and readily available measurements of upright and supine vital capacity (VC) in the evaluation of respiratory muscle function,[3] especially the diaphragm, and the novelty is that a 15% decrease in the supine position (15% represents twice the coefficient of variation of the measure and could be considered the LLN) may orient towards a unilateral diaphragm weakness, which is usually associated with a modest decrease in VC, to approximately 75% of predicted, while FRC and TLC are usually preserved.[2] In many neuromuscular disorders, such as amyotrophic lateral sclerosis (ALS), significant reduction of VC at diagnosis and its rate of decline over time are recognised as criteria for initiating noninvasive ventilation.[2] Reduction in VC is also predictive of sleep disordered breathing, respiratory failure, worse prognosis and response to treatment, to a lesser extent, with good sensitivity (80–95%) but quite variable specificity (50–90%).[2]

Second, indices of respiratory muscle effort during exercise such as the oesophageal pressure tidal swings (Poes,tid) can serve as an index of global respiratory muscle effort during exercise[4–6] and can identify differences in disease severity in patients with COPD (i.e. by Global Initiative for Chronic Obstructive Lung Disease stages). Those indices are sensitive to changes over time and to interventions and are related to the perception of dyspnoea during exercise.

Poes,tid has been successfully applied as a bedside monitoring tool in sleep studies, and during weaning trials. Although it is difficult to establish a minimal clinically important difference of these indices of respiratory muscle effort, given the paucity and heterogeneity of the studies, a clinically meaningful difference of 14–16% from baseline condition has been shown to correlate with a clinically meaningful reduction of exertional dyspnoea after pharmacological intervention such as bronchodilators.[5,7,8]

Third, the increasing availability of new and novel respiratory muscle imaging techniques such as the ultrasound to assess diaphragm dimensions and activity, in terms of static measurement of end-expiratory diaphragm thickness, dynamic evaluation of the ratio of inspiratory to expiratory diaphragm thickness, reported as thickening ratio, and diaphragmatic excursion.[9] This technique is readily available at the bedside and allows a simple, rapid and direct evaluation of the diaphragm that is more sensitive than fluoroscopy for the identification of muscle activity.[10] Ultrasound-related indices of diaphragmatic dimensions and activity have recently been associated with diaphragm dysfunction in critically ill patients receiving mechanical ventilation and have also been reported as possible predictors of weaning outcome and duration of mechanical ventilation.[11–13] Other imaging tools such as optoelectronic plethysmography (OEP) and structured light plethysmography (SLP) can be considered as emerging, non-contact, noninvasive method to assess breathing pattern and diaphragm (dys)function either in healthy or in patients with respiratory diseases.[14,15]

This ERS statement is meant to launch new attitudes for clinicians, physiologists and researchers and encourages them to apply and fully translate it to the clinical care of individual patients. This requires a huge effort especially in this era in which less and less time is dedicated to training in the practical realisation and interpretation of the more advanced tests of respiratory muscle function worldwide. A great effort is required to dedicate, learn, practice, interpret, decide, and apply actions in response to the results obtained. There is no sufficient time for all this, because of the hectic daily work, the insufficient time dedicated to learning, the scant possibilities of acting accordingly once the results of these tests are obtained, other higher priorities. This contributes to a vicious circle in which only a bunch of pulmonologists know and perfectly handle these tests that are available only in specialised centres. How to fight this disappointing and unfortunate situation? It is critical that new generations of pulmonologists must be intensively exposed to clinical physiology concepts and practices.

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