Respiratory Muscle Function in a Large Cohort of Healthy Subjects: Can Strength Predict Endurance?

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Respiratory function depends on coordinated activity of the respiratory muscles which assure effective ventilation. Several conditions such as chronic obstructive pulmonary disease (COPD), neuromuscular diseases and congestive heart failure can impair respiratory muscle function, leading to reduced respiratory muscle strength and endurance [1]. Moreover, respiratory muscle training has been shown to significantly improve respiratory muscle strength and endurance in patients suffering from COPD [2]. Therefore, measuring respiratory muscle function may be clinically relevant in all disease states involving respiratory muscles. The maximum static inspiratory pressure (PI_{max}) and the maximum static expiratory pressure (PE_{max}) generated at the mouth are simple techniques to estimate inspiratory and expiratory muscle strength, respectively [3]. Inspiratory muscle endurance can be measured with different tests: the most common techniques use resistive and threshold loading devices. Whereas normal values for PI_{max} and PE_{max} have been reported in adults as well as in children and elderly [4, 5], normal values for inspiratory muscle endurance have not yet been developed. In the early 1980s, Nickerson and Knees [6] measured endurance as sustainable inspiratory pressure, using a threshold loading device, but the study

involved a small number of patients with a wide age range.

Although strength and endurance appear to be closely linked in many conditions, there are several circumstances such as COPD, asthma, and heart failure in which endurance cannot be accurately predicted from measurements of maximum respiratory pressures [3]. Thus, endurance measurement can be helpful to evaluate the respiratory muscle involvement in normal and pathological conditions in addition to measurement of muscle strength. The study by Reiter et al. [7], published in this issue of *Respiration*, is the first to evaluate inspiratory muscle endurance (TI_{im}) using a flow-dependent resistive loading device in a large population of 68 healthy Austrian individuals with an age range from 17 to 75 years. The authors divided the subjects into five age groups, and investigated TI_{im} and its relation to anthropometric, spirometric data and PI_{max} . They found a high interindividual but low intraindividual variability for both TI_{im} and PI_{max} .

In accordance with previous studies, PI_{max} was negatively related to age and positively related to weight and spirometric parameters. Interestingly, the authors found that TI_{im} was not related either to respiratory effort sen-

sation, or to $PI_{\max}$, spirometric and anthropometric data. Moreover, because of the great interindividual variability, they were not able to establish normal values for TI_{im} . The findings of this study [7] indicate that TI_{im} , evaluated with resistive loads, cannot be inferred by other physio-

logic factors and has to be measured in addition to $PI_{\max}$, when studying inspiratory muscle function. Further studies are necessary to assess the clinical significance of serial measurements of TI_{im} in the follow-up of patients with respiratory muscle impairment.

References

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