The Stair-climbing Test. The Quest for Much-needed Simplicity

La prueba de escaleras. En búsqueda de la necesaria simplicidad

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For several decades, exercise capacity has been an essential part of the evaluation of functionality in patients with lung cancer. Exercise tests are used in patients referred for lung resection surgery to more accurately select those capable of supplying tissues with enough oxygen to meet increased demand if a postoperative complication should occur. According, an exercise test is recommended for all patients referred for lung cancer surgery with an FEV₁ or DLCO less than 80% of reference values. Progressive formal cardiopulmonary exercise testing (CPET) is the procedure of choice, and maximal oxygen consumption (VO₂ max) is the single most important parameter. Planned resection is feasible when predicted post-operative VO₂ max is greater than 35% of the reference value, and 10 ml/kg/min.¹

However, compliance with these recommendations is limited. An evaluation of several Spanish hospitals carried out in 2009–2010, found that 26% of patients in whom CPET was indicated did not perform the test, mainly because of lack of availability.² This situation has led to greater interest in “low-tech” exercise testing that could replace CPET, or at least select patients in whom the test is essential.

The stair-climbing test is one of the most widely used alternatives, since it is simple, accessible, quick and cheap. Indeed, according to one classic approach, patients who can climb 3 floors without stopping are candidates for lobectomy, while those who can climb 5 floors may be considered for pneumonectomy.³ The ERS/ESTS consensus document identifies the stair-climbing test as the first-line evaluation in the selection of patients who can be safely accepted for surgery, or for identifying those who need a more precise functional evaluation with CPET, the cut-off point being an ascent of 22 m.³

However, a recent systematic review of 21 studies⁴ found several different stair-climbing procedures used during the test, and notable methodological limitations. The equipment used depends largely on the structural characteristics of the hospital in question. While the Brunelli group uses 8 floors with 16 flights of 11 steps, each measuring 15.5 cm, producing an ascent of 27 m,⁵ other authors limit the ascent to 20, 13.8 or 12 m, using steps measuring between 15 cm and 17.5 cm.⁶ Instructions given to patients also vary widely: some groups ask the patient to climb the most stairs possible, at their own speed, until they are exhausted,⁷,⁸ while others propose climbing a previously established number of stairs in the shortest time possible. Finally, no consensus exists on which variable should be recorded, with some clinicians using altitude, test duration, speed of ascent, change in oxyhemoglobin saturation or heart rate and power of work performed (body mass times ascent speed)—often estimated using different equations—have all be used.⁹

Hence, efforts aimed at achieving greater standardization of the procedure, such as those presented by Novoa et al.⁸ in this issue Archivos de Bronconeumología, are of great interest. They compared the estimated power between the stair-walking test limited to 27 m and to 12 m. They found that the power was similar in both protocols, although patients gained greater speed in the shorter test. It is also interesting to note that while the 33 study subjects completed the 12-m test, 21 were incapable of completing the 27-m test, and 17 did not manage to climb 22 m.

These data lead us to ask if the shorter stair-climbing test could be an acceptable alternative, and if so, what the best parameter to evaluate would be. Answers may vary, depending on the objective of the procedure. According to current information, height climbed, test duration and desaturation appear to be the most consistent variables for predicting post-operative complications.¹⁰ Specifically, an ascent of less than 12 m is identified as very high risk, while the cut-off point for low risk may be 14 m for lobectomy¹¹ and 22 m for pneumonectomy.¹² The principal variable for predicting mortality is height climbed: subjects who only climb 12 m have a 13-fold increase in risk of mortality than those who climb 22 m,¹³ with a cut-off point of probably 18 m.¹⁴ Height climbed is also related with post-operative hospital costs,¹⁵ while power and speed of ascent are related with length of hospital stay.¹⁶

These associations give the stair-climbing test robustness and consistency, compensating for a potential physiological limitation. Because of its short duration, this test probably provides a partial assessment of the patient’s aerobic capacity, since metabolism at the beginning of exercise is supported by oxidative phosphorylation, and as such, is not oxygen-dependent.¹⁶ For this reason, it is essential to identify variables for the stair-climbing test that are more closely related to VO₂ max, and to establish cut-off points.

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for clinical decision-making. To date, height climbed has shown a reasonable association with VO$_2$max.\textsuperscript{4}

International recommendations currently in force suggest that patients who climb less than 12 m should be refused surgery, and those who climb more than 22 m do not need further evaluation, while the remaining patients require CPET.\textsuperscript{5,6} Thus, a 12-m stair-climbing test would not be sufficient to distinguish between these 3 groups of patients. However, speed of ascent has also been proposed as a useful parameter for distinguishing between patients on the basis of VO$_2$max, with the recommendation that those who complete the ascent at a speed of less than 15 m/min should be referred for CPET.\textsuperscript{7} This would clearly facilitate the use of shorter stair-walking tests; however, there is still much work to be done on standardizing the procedure, and its usefulness in clinical decision-making algorithms needs to be validated.

References