



Editorial

The Stair-climbing Test. The Quest for Much-needed Simplicity[☆]

La prueba de escaleras. En búsqueda de la necesaria simplicidad

Francisco García-Río^{a,b}^a Servicio de Neumología, Hospital Universitario La Paz, IdiPAZ, Madrid, Spain^b Facultad de Medicina, Universidad Autónoma de Madrid, Madrid, Spain

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.¹ Progressive formal cardiopulmonary exercise testing (CPET) is the procedure of choice, and maximal oxygen consumption (VO₂max) is the single most important parameter. Planned resection is feasible when predicted post-operative VO₂max 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.¹

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,^{5,6} other authors limit the ascent to 20, 13.8 or 12 m, using steps measur-

ing between 15 cm and 17.5 cm.⁴ 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,^{4,5} while others propose climbing a previously established number of stairs in the shortest time possible.⁷ 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 been used.⁴

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.⁴ 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 lobectomy⁴ and 22 m for pneumonectomy.⁶ 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,⁶ with a cut-off point of probably 18 m.⁵ Height climbed is also related with post-operative hospital costs,⁶ while power and speed of ascent are related with length of hospital stay.⁴

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.⁹ For this reason, it is essential to identify variables for the stair-climbing test that are more closely related to VO₂max, and to establish cut-off points

[☆] Please cite this article as: García-Río F. La prueba de escaleras. En búsqueda de la necesaria simplicidad. Arch Bronconeumol. 2015;51:259–260.

E-mail address: fgr01m@gmail.com

for clinical decision-making. To date, height climbed has shown a reasonable association with $VO_2\text{max}$.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.^{5,10} 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 $VO_2\text{max}$, with the recommendation that those who complete the ascent at a speed of less than 15 m/min should be referred for CPET.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

- Brunelli A, Charloux A, Bolliger CT, Rocco G, Sculier JP, Varela G, et al. ERS/ESTS clinical guidelines on fitness for radical therapy in lung cancer patients (surgery and chemo-radiotherapy). *Eur Respir J*. 2009;34:17–41.
- Novoa NM, Ramos J, Jiménez MF, González-Ruiz JM, Varela G. Primera fase de validación del algoritmo europeo de evaluación funcional previa a la resección pulmonar: cuantificación del cumplimiento de las recomendaciones en la práctica clínica real. *Arch Bronconeumol*. 2012;48:229–33.
- Colice GL, Shafazand S, Griffin JP, Keenan R, Bolliger CT. Physiologic evaluation of the patient with lung cancer being considered for resectional surgery. *Chest*. 2007;132:161S–77S.
- Ganger CL, McDonald C, Parry SM, Oliveira CC, Denehy L. Functional capacity, physical activity and muscle strength assessment of individuals with non-small cell lung cancer: a systematic review of instruments and their measurement properties. *BMC Cancer*. 2013;13:135.
- Brunelli A, Pompili C, Berardi R, Mazzanti P, Onofri A, Salati M, et al. Performance at preoperative stair-climbing test is associated with prognosis after pulmonary resection in stage I non-small cell lung cancer. *Ann Thorac Surg*. 2012;93:1796–801.
- Brunelli A, Refai M, Xiumé F, Salati M, Sciarra V, Socci L, et al. Performance at symptom-limited stair-climbing test is associated with increased cardiopulmonary complications, mortality, and costs after major lung resection. *Ann Thorac Surg*. 2008;86:240–8.
- Bernasconi M, Koegelenberg CFN, von Groote-Bidlingmaier F, Maree D, Barnard BJ, Diacon AH, et al. Speed of ascent during stair climbing identifies operable lung resection candidates. *Respiration*. 2012;84:117–22.
- Novoa NM, Rodríguez M, Gómez MT, Jiménez MF, Varela G. La prueba de escaleras limitada por altura podría sustituir a la prueba estándar en la evaluación funcional previa a la resección pulmonar. Estudio piloto. *Arch Bronconeumol*. 2015;51:268–72.
- Biccard BM. Relationship between the inability to climb two flights of stairs and outcome after major non-cardiac surgery: implications for the pre-operative assessment of functional capacity. *Anaesthesia*. 2005;60:588–93.
- Brunelli A, Kim AW, Berger KI, Addrizzo-Harris DJ. Physiologic evaluation of the patient with lung cancer being consideration for resectional surgery. *Chest*. 2013;143:166S–90S.