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EDITORIAL COMMENT

Has the ideal and universal prognostic index in cardiorespiratory exercise testing been identified?☆

Terá sido identificado nas provas de esforço cardiorrespiratórias o índice prognóstico ideal e universal?

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Cardiopulmonary exercise testing (CPET), although of limited availability in many countries, provides data on various parameters with clinical, diagnostic and prognostic implications that are of particular interest in heart failure.[1] These parameters include maximum oxygen consumption (VO_2max),[2,3] oxygen pulse curve (both absolute and adjusted for body weight),[4,5] the ventilatory anaerobic threshold (VAT),[6] ventilatory equivalent for CO_2 (VE/VCO_2) and VE/VCO_2 slope,[7,8] and oxygen uptake efficiency slope.[9]

The question is which of these are the most reliable, easiest to obtain and prognostically most useful for predicting overall mortality.

There are limitations in the assessment of these variables, including low reproducibility,[10] differences in methods of calculation and identification,[11] and the need in most cases to achieve maximal exercise to obtain results,[12] which depends on the motivation of patients, technicians and physicians alike. Exercise tests frequently do not reach maximal levels, particularly in patients with heart failure and most elderly people.

The study by Ramos et al.[13] in this issue of the *Journal* analyzes a new parameter, the cardiorespiratory optimal point (COP), calculated as the minimum oxygen ventilatory equivalent (VE/VO_2) obtained during CPET. The same group studied this parameter in 2012 and showed that it had modest associations with other ventilatory parameters, and suggested that COP could be an independent predictor of cardiorespiratory response. They also showed that COP values rose with age and were higher in females.[14]

COP has advantages over other cardiorespiratory parameters: it is easy to determine, at least as stable as conventional parameters, and free from observer error, since it can be obtained automatically from the lowest minute-by-minute VE/VO_2 value.[15] By contrast, VO_2max and particularly VE/VCO_2 are more prone to measurement error. As an index that quantifies the lowest ventilation required to extract 1 l of oxygen, COP characterizes the interplay between the circulatory and respiratory systems. It is a reliable parameter that is simple to identify and occurs at modest exercise levels, much earlier than VAT.[14] This new parameter can add prognostic value to submaximal CPET data, especially for adults unable or unwilling to achieve maximal exercise.

The aim of the present study was to assess the ability of COP, as an independent prognostic index and in combination with VO_2max, to predict all-cause mortality in middle-aged and older adults with and without chronic disease.

Despite the inherent limitations arising from its retrospective nature, the study has the merit of a large population sample. It should be noted that patients who did not achieve maximal exercise in CPET were excluded and that those included were of high socioeconomic status, were mostly healthy or only slightly unhealthy and were relatively fit, and the levels of exercise achieved indicate that

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these individuals were at low cardiovascular risk. Among this heterogeneous population, mostly of subjects with unspecified chronic disease (54%), but also including some coronary patients (28%) and healthy individuals (18%), none had been diagnosed with heart failure. It would have been interesting if other data had been provided, such as on left ventricular function and ejection fraction, ventricular volumes as determined by echocardiography, and brain natriuretic peptide levels, but the characterization of this large sample is sketchy. The study's conclusions – that COP >30, either independently or in combination with low VO_2max (which increases its predictive value), is a good prognostic indicator in healthy individuals and those with chronic disease, particularly with stable coronary disease but without heart failure, who are able to achieve maximal exercise – can only be applied to this particular population, and should not be extrapolated to patients with other characteristics, particularly those with heart failure or who are unable to complete maximal CPET.

Finally, it can be stated that this is without doubt an important study that underlines the utility of COP by demonstrating its prognostic value and emphasizing its ease of determination and low error rate. It also indirectly highlights the potential of CPET itself, an extremely valuable tool in clinical practice that is frequently underused because of the expectation that the patient will be unable to attain maximal exercise, which with the use of this new index may no longer be a reason for not performing it. With reference values available for specific populations and for patients undergoing submaximal CPET, COP may even lead to more widespread use of CPET in centers that have the necessary facilities.

Considering the demonstrated potential advantages of COP compared to other CPET parameters, it is now important to study the prognostic value of COP in a large sample of heart failure patients, with and without systolic dysfunction, most of whom should – by definition – be unable to complete maximal CPET. We look forward to the results of such studies.

Conflicts of interest

The author has no conflicts of interest to declare.

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