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Title: A symptom-limited incremental step test determines maximal physiological responses in patients with COPD

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Body: Background: Step tests (StTs) have been used to evaluate exercise tolerance and effort-related hypoxaemia in different diseases. StTs can be classified as paced (fixed rate) or self-paced cadence. However, an incremental step test (IStT) has never been tested in COPD patients. Aim: To compare maximal physiological responses between an IStT and symptom-limited incremental cycle ergometry (CE), and to test the reliability of the IStT in patients with COPD on different days. Material and methods: Twenty-two patients (VEF_1 47±13 %) underwent two IStTs (IStT-1 and IStT-2, height of 20 cm) and a CE. For the IStT, the initial step rate was set at 10 steps/min and was increased by one step every 30 seconds. The stepping rate was dictated by an audio signal played on a CD. Results: Despite significant differences in peak VO_2 (1.18±0.36 L for 1.26±0.41 L and 1.26±0.43 L, respectively), no differences were observed for VE, L/min (42.0±13.9, 42.5±14.6, 41.2±13.7, respectively) and for heart rate expressed as a percentage of the predicted rate (89±12, 90±13, 88±11, respectively). The desaturation was significantly lower for CE compared to IStT-1 or IStT-2 (-3.4 ± 3.4 %, -6.3 ± 4.9 %, -6.3 ± 4.0%, respectively). Both IStTs showed highly reproducible VO_2 peaks (intraclasse correlation coefficient (ICC)=0.99) and number of steps (ICC=0.98). A strong correlation was found between the work performed on the IStT [step height (m) x number of steps x weight (kg) x 0.16357] and peak VO_2 on CE (r=0.93). Conclusion: A symptom-limited incremental step test, externally paced, elicits maximal cardiopulmonary and metabolic responses, and is well tolerated and reproducible in patients with COPD.