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Title: Gas exchange abnormality during cardiopulmonary exercise test in patients with primary pulmonary hypertension

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Body: Background: Decline in ventilation and oxygen uptake efficiency is found in patients with primary pulmonary hypertension. Such reduction may sustain from rest to exercise. Our primary hypothesis was that ratio of ventilation to CO2 output (VE/VCO2) and ratio of O2 uptake / ventilation (VO2/VE) would differ between normal subjects and patients during cardiopulmonary exercise testing (CPET). Methods: We administered incremental cycle ergometry tests to 20 normal subjects and 20 patients. We compared ratio of ventilation to CO2 output (VE/VCO2) and ratio of O2 uptake / ventilation (VO2/VE) at rest, unloaded pedaling, anaerobic threshold, and peak exercise. Results: Patients had distinguished decreased peak O2 uptake ($P<0.001$). The levels and patterns of change for two groups for VE/VCO2 and VO2/VE were significantly distinctive. As hypothesized, the patients group always had markedly higher VE/VCO2 and lower VO2/VE than normal subjects group ($P<0.001$). In addition, the fall in VE/VCO2 between rest and peak exercise was slight for patients. In the contrast, the VE/VCO2 distinguishably decreased with exercise for normal subjects ($P<0.001$). At the same time, patients had slightly higher VO2/VE at anaerobic threshold than rest. Comparatively, the VO2/VE greatly increased at anaerobic threshold for normal subjects ($P<0.001$). Conclusions: The levels and changes in VE/VCO2 and VO2/VE during CPET are distinctive for patients with primary pulmonary hypertension. CPET provide valuable information for diagnosis and evaluation for primary pulmonary hypertension.