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ARTICLES

The preflight evaluation. A comparison of the hypoxia inhalation test with hypobaric exposure

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STUDY OBJECTIVES: We sought to compare arterial oxygen partial pressure (PaO2) relationships between a 15.1% hypoxia inhalation test (HIT) at sea level and a hypobaric chamber exposure equivalent to 2,438 m (8,000 feet) of altitude above sea level in patients with chronic obstructive pulmonary disease (COPD) and healthy subjects. DESIGN: Comparison of physiologic variables before and during intervention. SETTING: A referral-based pulmonary disease clinic at a US Army medical center in a metropolitan area. SUBJECTS: The study included three groups: group 1, 15 patients, 3 women and 12 men, with COPD (forced expiratory volume in the first second [FEV1, mean +/- SD], 41 +/- 14% of predicted); group 2, 9 healthy men; and group 3, 18 men with COPD (FEV1, 31 +/- 10% of predicted) previously reported in detail. INTERVENTIONS: We evaluated each group at sea level followed by one of two different types of hypoxic exposures. Group 1 received exposure to 15.1% oxygen at sea level, the HIT. Groups 2 and 3 received hypobaric chamber exposure equivalent to 2,438 m (8,000 feet) above sea level. MEASUREMENTS AND MAIN RESULTS: For all three groups combined, the arterial oxygen tension at sea level (PaO2SL) explained significant variability in PaO2 during hypoxic exposure according to the following formula: PaO2 during exposure = 0.417 (PaO2SL)] + 17.802 ($n = 42$; $r = 0.756$; $p < 0.001$). Neither the type of hypoxic exposure (HIT vs hypobaric), status as patient vs control, sex, nor age explained significant variability in PaO2 during hypoxia exposure after inclusion of PaO2SL as a covariate in analysis of variance. Subsequent analysis revealed that forced expiratory spirometric variables FEV1 and FEV1 to FVC ratio served as second order covariates with PaO2SL to improve description of PaO2 during hypoxia exposure for the combined samples ($n = 42$; $p < 0.05$). Analysis of residuals from regression analysis revealed approximately normal distribution. CONCLUSIONS: The PaO2 relationships did not differ between the 15.1% HIT at sea level and hypobaric exposures of 2,438 m (8,000 feet) above sea level. Normal subjects and patients with COPD formed a single relationship. The present study extends descriptive models to a larger range of subjects. Regression models have definable accuracy in predicting PaO2 during hypoxia exposure that increases with inclusion of spirometric variables.