CORRESPONDENCE

(almost linearly) as the child grows. This does not involve invoking theories regarding sequential emptying, diffusive pendelluft, or the cross-sectional area of the FRC:V
 interface. I do not wish to speculate as to which of the many hypothetical models pertain, but my point is that any experimental evidence that claims to support one theory while supporting another equally well cannot be regarded as supporting either definitively.

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In Reply.—It was unfortunate that typographic errors on our part resulted in the regression coefficients published for x (Table 1) in the body weight versus phase III slope regression analysis being 10 times too large. The correct coefficients are 0.061 and 0.051 for the 8.5 and 12.5 ml·kg
5 tidal volumes, respectively (also 0.058 for the 8.5 ml·kg
5 V in the body length regression). Using the correct coefficients, the equations are not linear.

The model of normalized phase III washout slope versus age proposed by Farmery is based on the mechanism of continuous carbon dioxide evolution into a well mixed and ventilated total alveolar volume that increases with age. This mechanism is included in the pediatric single path model (SPM) along with several others not included in Farmery’s model. In particular, the SPM includes the effects of gas phase convection and diffusion, airway length and diameter variations, and acinar blood flow distribution, along with blood carbon dioxide evolution and alveolar volume variation. That these other parameters are sometimes important in determining the slope of phase III of washout curves can be seen from human and animal experiments in which gas diffusivity and acinar blood flow distribution were varied while other parameters were held constant.

In the case of carbon dioxide washout curves recorded from patients with severe COPD, the sum FRC + V
5/2 either is increased or remains normal, and the normalized slope is greatly increased in comparison to normal. Equation 5 of Farmery’s model would predict either no change in the normalized slopes for this case (COPD) or a decrease, whereas the SPM, with reduced acinar cross-sectional area to simulate the anatomic changes of COPD, predicts increases in phase III slope in agreement with the experimental data.

All the parameters included in the SPM may not be equally important in any given application, however the model allows simulations of the effect of airway and/or vascular pathology that are not possible in a single-compartment alveolar model. The SPM is the simplest possible theoretical model that combines the physiology of airway gas exchange, a reasonable model of airway anatomy, and the physics of gas convection, diffusion, and continued evolution from pulmonary blood

References


In summary, the model of Farmery is not an alternative explanation of the pediatric normalized slope versus age data but rather an insightful demonstration of what probably is, for the developing healthy human lung, the most relevant mechanism of several contained within the SPM.

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